Strengthening innovation-driven inclusive and sustainable development

Asia-Pacific Tech Monitor

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Sustainable Energy Technologies
Challenges and opportunities for the Asia-Pacific

Plus

- Technology News and Events
- Tech Ventures & Opportunities
- Business Coach

APCTT
Asian and Pacific Centre for Transfer of Technology

UNITED NATIONS ESCAP
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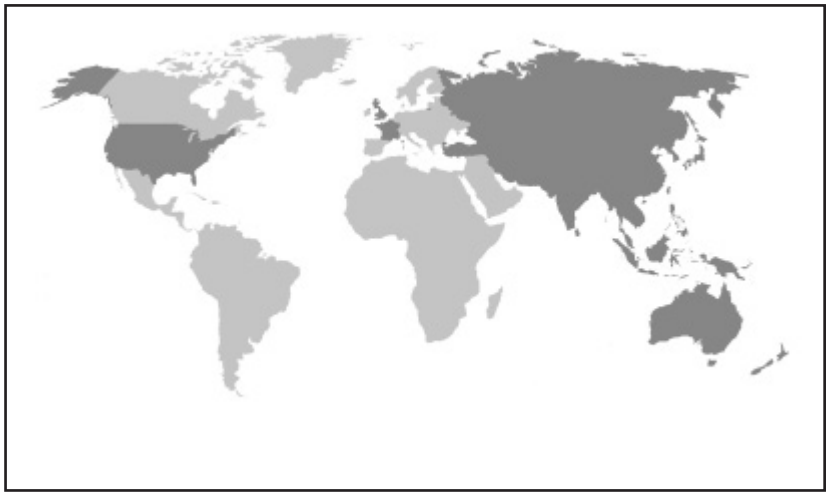
The **Asian and Pacific Centre for Transfer of Technology** (APCTT), a subsidiary body of ESCAP, was established on 16 July 1977 with the objectives to: assist the members and associate members of ESCAP through strengthening their capabilities to develop and manage national innovation systems; develop, transfer, adapt and apply technology; improve the terms of transfer of technology; and identify and promote the development and transfer of technologies relevant to the region.

The Centre will achieve the above objectives by undertaking such functions as:

- Research and analysis of trends, conditions and opportunities;
- Advisory services;
- Dissemination of information and good practices;
- Networking and partnership with international organizations and key stakeholders; and
- Training of national personnel, particularly national scientists and policy analysts.



The shaded areas of the map indicate ESCAP members and associate members

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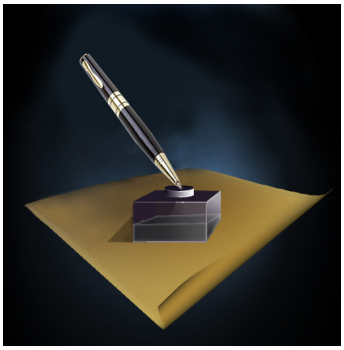

Introductory note

In the recent years, sustainable energy options have demonstrated potential to reduce the environmental impacts of energy use, provide access to affordable energy and thus play a significant role in the transition to sustainable development. For the sustainable energy sector, two developments are of great significance in the 2030 sustainable development agenda: the Sustainable Development Goal 7 – Ensure access to affordable, reliable, sustainable and modern energy for all; and the Paris Agreement on climate change under the United Nations Framework Convention on Climate Change (UNFCCC).

Towards achieving the global objectives, countries across the world need to not only expand the reach of sustainable energy but also increase affordability and access to sustainable energy in the areas of biomass, solar, wind, small hydro and others. The Asia Pacific region with its rapidly growing energy demand and its rich renewable energy resource base is well placed to utilize these resources in order to move away from heavy dependence on fossil fuels.

Two important dimensions of sustainable energy growth include (a) grid-connected renewable energy systems, and (b) decentralized and distributed generation of renewable energy. Both strategies require sustained policy commitment by the national governments. Some innovative policy instruments and initiatives to promote renewable energy expansion and utilization are net metering, feed-in tariffs (FiTs), renewable energy certificates (RECs), renewable portfolio standards (RPS) including quota systems and power purchase agreements and renewable energy resource mapping. These policy tools may have their own limitations and advantages when applied in different situations and therefore the national policy makers and practitioners need to take informed decisions considering all the related economic, social and environmental factors.

There are also many successful case studies and models of renewable and sustainable energy options around the world that have demonstrated their economic viability, linkages to social development as well as their sustainability. These models can be successfully replicated in different geographical locations and socio-economic settings. The strategy will require policymakers and practitioners to identify success criteria for various key aspects. They are technology choice and viability, policy and regulatory framework for technology transfer, availability of raw materials, skill, equipment and finance and socio-economic setting of target beneficiaries.

This issue of *Asia-Pacific Tech Monitor* examines the issues and challenges, as well as exploring strategies and opportunities to enhance accessibility and affordability of sustainable energy options in the Asia-Pacific countries.

Michiko Enomoto
Head, APCTT-ESCAP

INTERNATIONAL

World study on future R&D spending

Pressure on the public purse means research investment is slowing, according to the OECD. Government R&D budgets are in decline following 30 years of growth. A decline in public-backed science and technology research in a number of countries could pose a threat to innovation at a time when global challenges like climate change and ageing populations demand solutions, according to new OECD data.

The OECD Science, Technology and Innovation Outlook 2016 shows that spending on R&D in government and higher education institutions in OECD countries fell in 2014 for the first time since data collection began in 1981. R&D spending in government and higher education labs, most of which is provided by governments, began flattening out in 2010 following three decades of growth. While countries like Germany, Japan and Korea are spending more now on R&D than in 2000, as a share of total expenses, others including Australia, Finland, France, Italy, Spain, the UK and the US have reduced their R&D efforts.

Total government spending on R&D in the OECD area has been declining since 2009, following the global financial crisis. The "warning signs" for an even bigger fall off in government-backed science are there, the report says, with competing policy priorities such as state pensions, health and social care absorbing a growing share of public resources. On average across the OECD, public social expenditure rose from just over 15 per cent of GDP to almost 22 per cent of GDP between 1980 and 2014. At the same time, governments are taking in less money, with multinational enterprises taking advantage of opportunities to greatly reduce the taxes they pay. The use of legal arrangements that allow profits to be artificially shifted to low or no-tax locations "result in annual tax revenue losses conservatively estimated at between $100 billion and $240 billion," the report says.

With public spending squeezed, governments are focussing more on policy tools that do not require additional public spending in the short term, particularly public procurement and tax incentives for R&D and innovation. Between 2006 and 2013, the amount of tax revenues foregone for R&D has increased. In Belgium, France and the Netherlands, for instance, the share of government funds going to corporate R&D has increased faster than the share going to public research. Also partially making up for a drop off in government investment are charities, foundations and philanthropists, which funnel often-large donations from wealthy individuals into science. This spending boost is typically concentrated in fundamental and translational research areas, and is estimated to provide almost 30 per cent of annual research funds in leading US universities.

In labs, falling public investment and growing automation, is reducing the demand for new researchers. Job security in science is decreasing. Almost 90 per cent of PhD researchers in an EU survey, "Were in precarious working conditions with no or less-than-two-year contractual horizons," the report says. "Training new researchers through the PhD and postdoc process will therefore need to broaden because many are discontinuing public R&D careers and moving into other parts of the economy." Following gradual improvements in recent years, the public R&D workforce is becoming more female however, and the OECD sees more women gaining senior positions in the future.

The report notes a general shift in national research policy agendas towards environmental and societal challenges since the late 2000s. It also finds that countries are beginning to specialise more. The US has a clear policy orientation towards health R&D, which gets 24 per cent of its public R&D allocation in 2016.

The UK (22%), Luxembourg (18%), and Canada (17%), devote around a fifth of their R&D budgets to health issues, while Mexico (19%), Japan (11%) and Korea (9%) have prioritised energy R&D. While militaries have for many years been among the biggest investors in scientific research, the proportion of government R&D expenditure devoted to defence in most OECD countries has fallen substantially since the end of the Cold War and is currently at historical lows. This trend is slowly changing in the EU, with Brussels recently unveiling a range of new defence R&D schemes.

http://sciencebusiness.net

ASIA-PACIFIC

CHINA

One million domestic patents registered

China's central government is making moves to improve protection and use of intellectual property (IP), with figures showing that China has become the third country in the world to register one million active domestic patents, following only the United States and Japan. The State Council, China's cabinet, issued new guidelines on the development of IP in the country, laying out the goals and major tasks for intellectual property rights (IPR) protection and usage as part of the current Five-Year Plan, which covers the period between last year and 2020.

Among the highlights, the guidelines call for the improvement of rules and regulations related to IPR in newly emerging fields, including e-commerce and big data. "The plan has set out a number of goals we are aiming to achieve in the development of IP by 2020, including an overall improvement to its protection, practical application and competiveness," said Gan Shaoning, Deputy Director of the State Intellectual Property Office. It is also expected that patent ownership will increase from 6.3 per 10,000 people in 2015 to 12 per 10,000 in 2020. Additionally, IP royalties earned abroad are expected to rise from 4.4 billion US dollars in 2015 to 10 billion dollars in 2020.

"China received 1.1 million patent applications in 2015, making us the first country in the world to surpass the one-million mark. We had one million active domestic patents last year, only after the United States and Japan. Our current IP regulations are providing the basic protection of innovation, but we still face two major challenges – we need more patents on core technologies and more diversified allocation of patents," said Gong Yalin, another official with the State Intellectual Property Office.

China's IP authorities say the country has established a complete and internation-

ally recognized legal system for IPR protection with Chinese characteristics, which incorporates both administrative and judicial protection. However, Gan admitted that there is room for improvement, noting that China has a short history with IPR. "China is willing to enhance IPR cooperation and share our experiences of development with our counterparts across the world. At the same time, we oppose unfounded accusations and abuse of IPR to exercise trade protectionism," said Gan.

Over the past five years, Chinese authorities have launched 14 sets of laws and regulations involving IPR, in addition to investigating 87,000 cases of patent infringement. During that same period, China has entered IPR-related agreements with 63 other countries.

http://english.cctv.com

R&D spending

China's investment in research and development (R&D) is expected to reach 1.54 trillion yuan (around 223 billion U.S. dollars) in 2016, accounting for 2.1 percent of GDP, according to Science and Technology Minister Wan Gang. Last year's R&D expenditure was estimated to increase by 9 percent from 2015, with over 78 percent of the spending coming from enterprises, Wan announced at a national work conference on science and technology. Wan said initial figures showed the value of technology transactions in China was anticipated to amount to more than 1.14 trillion yuan, and the scientific and technological progress contribution to the country's economic growth in 2016 had increased to 56.2 percent. He said that China was a world leader in invention patent applications, ranking third place, with over one million invention patents.

At the conference, Wan also announced that China had begun working on implementation plans of key projects that involved quantum communication and computers, brain science and brain-like research, deep sea stations, as well as space-ground integrated technology. Wang said more projects, including ones on deep earth exploration and artificial intelligence, were in the pipeline.

http://news.xinhuanet.com

INDIA

MSMEs to boost exports with policy support

India is one of the largest importers of conventional defence equipment and spends about 31.1% of its total defence budget on capital acquisitions and about 60% of its defence requirements being import dependent. Between 2006-10 and 2011-15 India's defence imports increased by almost 90 per cent and now India tops the global arms import list with14% global share.

New Defence Procurement Procedure (DPP) 2016 has a focus on achieving the "Make in India" vision by according topmost priority to 'Buy Indian - IDDM (Indian Designed, Developed and Manufactured)' and 'Buy (Indian)' categories. India's Defence Minister Manohar Parrikar has set a target to raise India's defence exports to $ 2 billion in the next two years which is currently over $ 330 million. India's export vision in defence depends on the encouragement to MSMEs.

With world economy still reeling under slowdown, major international players in the defence sector are looking to cut costs. The time is ripe for the MSME sector to fill the gap not just in India but also globally with exports. MSMEs & SMEs already contribute significantly to defence manufacturing with around 10,000 quality products along in defence sector. Despite having reasonable resource capability, know-how and technical expertise, lack of clear policy had prevented their full exploitation in terms of defence exports. Separate defence exports incentives with increased budgetary allocations along with special subsidies in the Foreign Trade Policy can enthuse the industry with more MSMEs participating in the manufacturing of defence exports items from India.

The revised DPP has already stipulated giving desired thrust to the make in India initiative advocating for the strong alliance with MSMEs. However, this is not enough to fulfil India's export dream. The need of hour is working for the delivery of quality products matching the global defence requirements; the policy must encourage innovations along with the increased budget for R&D. The policy of maximizing indigenous production without well supported R&D policy back-up will not bring tangible results.

Transfer of technology along with the knowledge transfer will also play a huge role in optimization of defence exports. Export strategy has to clearly address the cause of transfer of technology and IPR concerns for seamless long term association with the partnering company or country. There is a need for greater coordination between different departments for streamlining the permissions and making it single window for smoother execution. Along with it there is also greater need for smoothening the window for exports. A successful interlocking set of relationships between the military, private sector, universities, and the political will is also needed.

Defence offset policy will contribute to enhanced defence exports. Offsets are also seen as a mechanism to develop indigenous manufacturing capability. They create jobs, enhance scientific and engineering skills, promote small local manufacturers, and will lead to enhanced exports. There are 193 countries which are member of UN and clearly we need to put serious marketing efforts to showcase our capabilities and strengths to attract more overseas customers and participants for co-manufacturing and buying of our products. Therefore, essentially we need to identify the potential markets for exports that would be most attractive and where we would have a definite edge, keeping in view our present capabilities and ability to deliver.

The good news is that opening of the defence sector for private sector participation is motivating foreign original equipment manufacturers to enter into strategic partnerships with Indian companies and develop the domestic industry for global competiveness. Many big companies like Airbus (France), BAE India Systems (UK), Pilatus (Switzerland), Lockheed Martin (USA), Boeing India (USA), Raytheon (USA), Israel Aerospace Industries (Israel), Rafael Advanced Defence Systems Ltd. (Israel), Dassault Aviation SA (France) are ready to invest in India through strategic partnerships.

For boosting manufacturing and export of defence products from India, real time identification and work on the following

area is needed; high cost and higher risk projects, high value and low volume products, international collaboration in design and development, high barrier to entry, issues of safety, long service life and criticality in terms of security concerns. The defence export policy at the base level must identify such products, markets and address pressing policy issues towards indigenous sustainable defence led exports.

http://economictimes.indiatimes.com

National research foundation to be set up

The Human Resources Development (HRD) Ministry sources said the National Research Foundation (NRF) will leverage more resources from the industry to support 500 collaborative research projects between Indian institutions and universities abroad. The HRD Ministry is working on a proposal to establish an agency with a seed grant of Rs 500 crore to bolster the country's weak research output. According to ministry sources, the National Research Foundation (NRF), in addition to its own seed grant, will leverage more resources from the industry to support 500 collaborative research projects between Indian institutions such as IITs, NITs, IISERs and reputed universities abroad.

India lags way behind internationally in terms of its spending on research. The country spends just 0.85 per cent of its Gross Domestic Product (GDP) on research as opposed to China which spends 2.10 per cent, USA 2.74 per cent, Japan 3.58 per cent and Israel, which contributes 4.11 per of its GDP to this cause.

As a result, only four patents are filed per million population in India. China files 396 patents per million people, South Korea files 2,962 and Japan files 2,250 patents."NRF will be an umbrella body which will establish research priorities and provide 50 per cent of the funds required for research projects that fit the bill. The NRF will work with Science and Engineering Research Board and Indian Council of Medical Research and finance some of their research. It will also help the IMPRINT programme, which is facing financial problems at this moment," said a ministry official, who did not wish to identified.

IMPRINT is a single window mechanism for funding India-specific research across IITs and other prestigious institutes, which was launched by the ministry with much fanfare last year. Of the 250-odd MoUs that were signed by different ministries with centrally funded educational institutions, only 60 have taken off. Many ministries haven't honoured their commitment of pitching half the funds required for research and technology development.

The NRF proposal was also pitched to the Prime Minister during the presentation made on January 13 by the group of secretaries working on education. The HRD Ministry is keen that the NRF is announced in the Union Budget that will be presented on February 1. Last year, Finance Minister Arun Jaitley had announced announced creation of a Higher Education Financing Agency (HEFA) with an initial capital base of Rs 1,000 crore which will leverage funds from the market and work to create infrastructure in top institutions like the IITs.

http://indianexpress.com

India Innovation Index launched

India's NITI Aayog CEO Amitabh Kant launched "India Innovation Index", the nation's first online innovation index portal which will rank states based on their innovations. Inaugurating the portal, he said that it will be a «first-of-its-kind online platform» where Global Innovation Index (GII) indicators and India-centric data from various states will be updated periodically. «This will be a one-stop data warehouse and will track progress on each indicator at the National level and the State level on real-time basis,» he said.

The access to the portal will be hosted on the NITI Aayog website. "Data collated on this portal will not only be used to ameliorate current data gaps with respect to the GII, but be the prime source for the India Innovation Index," a government statement said. The index was launched in collaboration with Department of Industrial Policy and Promotion (DIPP) and Confederation of Indian Industry (CII).

http://economictimes.indiatimes.com

MALAYSIA

Govt to create innovation and creativity guide index

Prime Minister Datuk Seri Najib Razak said the government will create a creativity and innovation index as a guide to achieve National Transformation 2050 (TN50). He said the index would become one of the thrusts to empower Malaysia as one of the top 20 nations in the world in the long term. He pointed out that innovation and creativity were important for any organisation, company or nation so that it would not lag behind in the increasingly competitive world.

Giving an example, he said a giant telephone company at one time, Nokia had been overtaken and the telecommunication market was now being dominated by smartphones such as Apple, Samsung and Huawei. "This shows that only companies that adopt innovation will succeed in the increasingly competitive market. "The same goes for a government, we have to deliver government service in a good and more effective manner in the interest and prosperity of the people.

"In the present situation of financial constraints due to external factors, we have to accept the fact. We must not complain and point fingers, on the contrary, we should consider it as a challenge. How we can do more with less. Here lies our capability to enculture innovation in our organisation, I am confident we can do more with less," he said. He said this at the Prime Minister's Award for Innovation (AIPM) and Public Sector Innovation Award (AISA) night here. Also present was the Chief Secretary to the Government, Tan Sri Dr Ali Hamsa. Najib said the AIPM and AISA had encouraged the public sector to continue to develop innovation as a culture.

The Malacca State Government was announced as the AIPM winner and received a cash prize of RM1 million and a trophy, while second place went to the Social Security Organisation (Socso) which received a cash prize of RM300,000 and a certificate, and in third place was the Malaysian Armed Forces (ATM) which received RM200,000 and a certificate. At the event, Najib handed over the trophy and cheque to Melaka Chief Minister Datuk Seri Idris Haron.

For AISA 2016, the Public Service Department won the Information and Communication Technology Innovation Award while the Ampang Jaya Municipal Council won the Local Authorities Innovation Award. Meanwhile, the Kemaman District and Land Office was the sole winner of the District and Land Administration Innovation Award. Each winner for the AISA category wins a cash prize of RM150,000 for the first place, RM100,000 for second place and RM50,000 for the third place together with a trophy and certificate of appreciation each.

http://www.themalaymailonline.com

ICT usage by SMEs

Information Communications Technology (ICT) usage among Small Medium Enterprises (SMEs) reached 89 per cent last year. Deputy Minister of International Trade and Industry (Miti) Datuk Ahmad Maslan said the jump from just 27 per cent in 2010 was a positive development towards the full use of the digital economy by the 645,136 SMEs by 2019. "The digitisation of SMEs will make the industry more resilient through the enhancing of online trade, e-commerce and implementation of e-payment activities, a practice in line with the expansion of ICT at present," he added. Ahmad said this at a press conference after visiting IX Telecom Sdn Bhd, the top listed company among 50 SMEs in the Enterprise Award 50 (E50) organised by SME Corp Malaysia, last month.

The E50 is a prestigious award programme which recognises the achievements of Malaysian SMEs which are well positioned for the future. The 50 winners from among 1,355 companies are accorded four and five star ratings based on financial capabilities, operations and management competencies. Ahmad said Miti would continue to lead and assist SMEs in adopting the digital agenda through agencies as SME Corp and the Malaysian Digital Economy Malaysia (MDEC).

Ahmad said Miti also targets to increase the ICT use among SMEs to 95 per cent in 2017 before achieving full digitisation next year. He said this is possible through various initiatives and new incentives to be introduced, among them, alternative funding such as equity crowdfunding loans, SME Investment Partner, namely the High Impact Programme 3 by SME Corp and Leading Entrepreneur Accelerator Platform with Bursa Malaysia. It includes enforcement of the SME Act apart from reducing the corporate tax rate to 18 per cent from 19 per cent for the first RM500,000 taxable income for SMEs, he added.

Meanwhile, IX Telecom Chief Executive Officer Noor Mohd Helmi Nong Hadzmi said the company, established in 2006, had promoted the digital economy early in its startup and even before being recognised and promoted last year. As a company that makes available Internet and ICT solutions, IX Telecom hopes to move concurrently with SME Corp in respect of government initiatives to assist SMEs in digitising the Malaysian economy," he added.

http://www.bernama.com.my

PHILIPPINES

Bill seeks to boost innovations, inventions, R&D

Albay Rep. Joey S. Salceda has filed in Congress House Bill 4581, which aims to boost the country's scientific innovations and inventions, research and development (R&D) toward social progress and global competitiveness. The measure projects a budget that could reach P672 billion by 2022. Salceda said the measure, titled Science for Change Program (S4CP) Act, gives special focus on "science- and-technology education, training, and services," and supports "indigenous, appropriate and self-reliant scientific and technological capabilities, and their application to the country's productive systems and national life."

S4CP is Salceda's fourth bill that seeks to pursue a strong science and technology (S&T) drive in the country, as an "essential tool for national development and progress". The three other bills involve the creation of a nuclear commission, revival of the Balik Scientist Program and the creation of metrology institute, to modernizes and standardize the country's measurement system. He had also filed an earlier bill that seeks to create the country's space agency.

Salceda said S4CP seeks to enhance and achieve a higher standard of S&T in the country to "contribute to the development of the economy and society and toward the improvement of the nation's welfare by prescribing the basic policy requirements for the promotion of S&T, and comprehensively and systematically promoting policies for progress." He said S4CP consists of four components: Program Expansion in seven areas; New Programs in six areas; Grand Plan for Science and Technology; Human Resource Development; and Accelerated R&D Program for Capacity Building of Research and Development Institutions and Industrial Competitiveness.

The projected total R&D budget for 2017 is P5.8 billion. The bill proposes and estimates the R&D budget starting at P21 billion this year, doubling yearly over the five-year period, and will reach P672 billion in 2022. In the last six years, Salceda pointed out, the Philippines's scientific and technological indicators have improved significantly, based on the benchmark of the United Nations Educational, Scientific and Cultural Organization (Unesco).

The Unesco prescribes that for a developing country, there should be 380 researchers, scientists and engineers (RSEs) per million population, and the percentage of the GDP expenditure on research and development (GERD) should be 1 percent at least. The number of RSEs in the country has increased from 180 in 2009 to 270 in 2013, while the budget of the Department of Science and Technology (DOST) has increased from P5.7 billion in 2009 to P20.8 billion in 2017, with R&D budget allocation increasing from P1 billion in 2009 to P5.8 billion in 2017. Salceda noted that for the DOST HRD, the Philippine Science High School (PSHS) and the Science Education Institute (SEI) have significantly contributed to the RSEs. The PSHS increased the number of regional campuses from 11 in 2010 to 16 in 2016, with now one PSHS campus per region.

The number of students in PSHS has increased from 1,840 in 2009 to 8,083 in 2017, and is projected to hit 9,500 in 2021. The SEIs have, likewise, increased its freshman scholars intake, from 1,250 in 2010 to 5,590 in 2015. It has crafted the Grand Plan for S&T Human Resource Development that aims to enable the Philippines to achieve

380 RSEs by 2022, he added. The DOST, Salceda said, must endeavor to significantly accelerate S&T and Innovation in the country through massive increase in investment on S&T HRD and R&D through the S4CP.

The program, he stressed, must be provided sufficient budget to underwrite all R&D efforts for the five-year period, as follows: 1) Niche Centers in the Regions for R&D (NICER), P3.2 billion; 2) R&D Leadership Program (RDLead), P6 billion; 3) Collaborative R&D to Leverage PH Economy (CRADLE) for RDIs and Industry, P3.2 billion; 4) Business Innovation through S&T (BIST) for Industry, P14.25 billion (25 industry sectors, at P50 million to P100 million per sector x 75); and 5) S&T HRD (STRAND, STAR, SRCUR).

http://www.businessmirror.com.ph

REPUBLIC OF KOREA

Gov't focuses R&D on emerging industries

The government will scale back overall spending on research and development in technology next year, the Ministry of Trade, Industry and Energy said, but the portion taken up by research into emerging industries with growth potential will increase. The ministry plans to cut R&D expenditure from 3.45 trillion won ($2.96 billion) in 2016 to 3.34 trillion in 2017, a 3.1 percent decrease. The budget cut is the result of restructuring that the ministry underwent this year to minimize spending on certain projects that it considered more customary than innovative.

The ministry's investment in the country's overall R&D spending continues to occupy a smaller piece of the pie, going from 18.3 percent in 2015 to 17.8 percent in 2016 and now falling to 17.2 percent next year. Even though the ministry's R&D spending has shrunk, it will be more focused. About 90 percent will go toward research meant to raise the nation's competitive edge in emerging industries, including robots, automated cars and renewable energy, while the rest will go toward legacy projects. The spending on innovative technology, around 3.06 trillion won, will be a 2.5 percent increase from this year. "We are looking for industry prospects that can lead Republic of Korea into the 'fourth industrial revolution,'" a ministry official said. "The ministry also plans to extend support to companies with high-value technologies in the information services and design sectors, as they are expected to enhance the nation's competitiveness in exports."

The ministry has allocated 211.7 billion won to research in smart cars, robots and semiconductors, a 43.4 percent increase from this year's budget of 147.6 billion won. "Developing cutting-edge technology in these industries is vital since they will be growth engines for us in the near future," the official said. In renewable energy, the ministry has raised spending from 228.4 billion won to 243.2 billion, a 6.5 percent increase. The official said the industry will be key to abiding by the climate change accord that Korea signed in Paris earlier this year. A total of 39.9 billion won will be spent on R&D in smart grid technology. Six new sectors were added to the ministry's list for 2017. Most notably, it allocated 43.7 billion won to energy storage systems for the first time and set aside 27.3 billion won for experimental fusion reactors.

The Republic of Korea has made huge leaps in R&D spending in the past few years, according to OECD data. In 2000, the country spent just 2.18 percent of GDP on R&D, about 1.8 percent lower than the leader at the time, Israel. By 2014, Korea's R&D spending to GDP had jumped to 4.2 percent, outperforming runner-up Israel by 0.1 percent.

http://mengnews.joins.com

Commercialized SME technologies

According to Korea Institute for Industrial Economics & Trade (KIET), 96 percent of the SMEs that received government funding on research and development between 2012 and 2014 succeeded in technology development. However, only 48 percent of these technologies were actually applied to products that were sold on the market. This is far below other advanced economies, including Japan with 54 percent, the United States with 69 percent and the United Kingdom with 70 percent.

The KIET study said one of the biggest reasons was because of lack of government funding. The Korean government allocates 95 percent of its R&D budgets in technology development while only 5 percent is spent on commercializing the technologies into actual products.

The government R&D budget allocated for SMEs as of 2014 amounted to 2.4 trillion won ($2.04 billion). But the Ministry of Trade, Industry and Energy only spends 63 billion won on commercializing the technologies including marketing and promotion. The situation is the same with the financial support provided by the Small Business Administration, which spends 800 billion won on technology development but only allocates 10 billion won on the commercialization.

The Korean government's spending on R&D has been increasing in recent years. In 2013 that budget amounted to 1.05 percent of the country's GDP, which is higher than the U.S. with 0.79 percent or Japan with 0.75 percent. But even without the government funding SMEs struggled in commercializing their products.

Among products that were sold in the market between 2012 and 2014 only 17.1 percent were new products or those that saw improvement through technological innovation. Of such products, 28.1 percent were by conglomerates. Midsize companies only accounted for 11.5 percent while small companies only accounted for 6.6 percent; indicating that the smaller the companies were the less new products or newly improved products were actually able to be sold on the market.

Other than the funding, the immature development of markets that could help such innovative products to be reached to consumers was another major obstacle that resulted in SMEs failing to apply their technologies to actual products. Also, the high costs of newly developed products were another reason technologies developed by SMEs failed to attract consumers, as well as the lack of experts to help market the products. The report noted a need for the government to come up with policies that could diversify the R&D budget so that it could also help create experts who can commercialize the products, create sales networks and even help these products launch overseas.

"The government, although it is aware of the importance in commercializing the technologies developed by SMEs, it has failed to implement the voices in the fields in its policies," said Yang Hyun-bong, senior researcher at KIET. "[The government] needs to create policies that would help convert technologies that could actually be implemented in business through systematical field researches." The researcher said even if the technology developed by SMEs is outstanding, it becomes a waste unless it actually commercializes.

http://koreajoongangdaily.joins.com

SRI LANKA

Innovation portfolio measuring

Work on Sri Lanka's long awaited national Innovation Index which is set to measure the islands innovation portfolio, began in Colombo. The World Intellectual Property Organization (WIPO) tasked with world Intellectual Property (IP) development says in a statement that many new IP projects have been earmarked for Colombo in future.

"In view of the rapidly expanding knowledge–driven global trade and economic activities, Intellectual Property (IP) has acquired a very important status," said Rishad Bathiudeen, minister of Industry and Commerce. He was addressing the inauguration of high profile National Level Innovation and Intellectual Property Policy Conference.

Among the International panellists at the event were Andrew Michael Ong, WIPO Asia Pacific regional director, Dr Richard S Cahoon, Cornell University visiting fellow, Dr. J.M. Swaminathan, Julius & Creasy senior partner , Yumiko Hamano, Columbia Maryland's ET Cube's intellectual property commercialisation specialist and Dr Sacha Wunsch-Vincent, WIPO senior economist.

Bathiudeen said, the IP System of a country greatly contributes to its various development activities such as promotion of national creativity, research, technology transfer, licensing, commercialization of goods and services, and proper implementation of industrial policies. "If we look at many developed economies practicing high level of innovation such as Japan and Korea, we can see that intellectual property has become a key growth driver for them."

Their strong research and development are transformed into innovations and then patents are obtained. This trend is never more important at present times, he added. The applications received by the European Patent Office (EPO) in 2015 increased by a strong 5 percent from 2014. Filings under the Patent Cooperation Treaty (PCT) of the World Intellectual Property Organisation (WIPO) increased by 1.7 percent in 2015.

The statement says that Asia contributed significantly to these growth taking a strong 43 percent of 2015 global total. In 2014, Sri Lanka filed a total of 516 'Article 50' Patent applications. Costa Rica, Tunisia and Uzbekistan are the only countries that filed Article 50 Patent applications in a somewhat similar range to Sri Lanka.

WIPO Asia Pacific Regional Director Andrew Michael Ong said that innovation thrives in an environment of collaboration. "I see today a big gathering of players and actors of innovation systems in Sri Lanka. WIPO congratulates Sri Lanka for preparing this session. As a UN Agency, WIPO's mandate is to provide info and support IP policy. We have been working with Sri Lanka's NIPO and looking forward to take up key development projects in future as well."

http://www.lankabusinessonline.com

VIET NAM

Technology transfer law on debate

The eighth session of 14th National Assembly Standing Committee has turned its agenda toward discussing amendments to the Technology Transfer Law. Phan Xuan Dung, chairman of the National Assembly Committee for Science, Technology and Environment, proposed major draft law amendments to the committee. The amendments pertain to State policies on transfer technology, technology assessment in investment projects and solutions to encourage technology transfer and develop technology markets. According to Dung, Article 34 of the draft law gives priority to those using machines and equipment that Viet Nam manufactured through public purchase. NA deputies argue that the article conflicts with World Trade Organisation regulations, banning protection of domestic products and those of Investment Law. The regulation is also said to discourage research, innovation and development of domestically-manufactured technology.

NA Chairwoman Nguyen Thi Kim Ngan demanded a reconsideration of Article 34, wanting to assure that it is "in accordance with Viet Nam's integration context and Competition Law". State assets given to scientific technology researchers must be presented to management agencies after research is finished. These agencies must responsibly managing them as State assets, Ngan said. Dung also called it necessary to assess and control imported technology to put an end to obsolete technology that causes pollution and affects human health. The move also aims to prevent impacts on Viet Nam's investment and business climate.

The committee agreed that technology assessment is a complicated process, especially the assessment of technology transferred from overseas. The assessment time of imported technology must be in accordance with the Investment Law and requires longer time. However, it must reduce unnecessary administrative procedures that cause obstacles for enterprises. The draft law also proposes the establishment of National Technology Innovation Fund which supports small and medium-sized enterprises to transfer technology and boost technology transfer serving agriculture, forestry and aquatic products in disadvantaged areas. NA Chairwoman Ngan rejected the fund, saying that it only expands the National Technology Renovation Fund, which is stated in hi-technology law. The Committee reached final conclusion that the draft law on technology transfer must be reviewed in accordance with Public Asset Management Law and avoid overlaps with laws on State budget, tax, investment, science-technology to ensure its feasibility. The law terminologies must also be reviewed to ensure the synchronisation with those stated in Law on Science and Technology.

http://english.vietnamnet.vn

ASIA-PACIFIC

AUSTRALIA

Low cost solar technologies

Commonwealth Scientific and Industrial Research Organisation (CSIRO) is part of a consortium that's working to develop a series of low-cost solar technologies to help meet the rising energy demand across the world. The Victorian Organic Solar Cell (VICOSC) Consortium is a research collaboration between CSIRO, Monash University, the University of Melbourne, Bluescope Steel, Innovia Films, Innovia Security and Robert Bosch SEA, with funding support from the Victorian State Government and the Australian Government through the Australian Renewable Energy Agency.

The consortium has developed flexible and lightweight printable solar cells, wherein printable 'solar inks' are deposited onto flexible plastic films using various techniques including spray coating, reverse gravure, slot-die coating and screen printing. Offering greater flexibility and affordability, these technologies are different from traditional, silicon-based solar cells. Being lightweight and flexible, solar panels can be integrated into windows, window furnishings, rooftops and even consumer packaging. Being affordable, these solar cells can provide for the energy needs of remote outback locations and developing communities.

Pilot-scale production is now ready for expansion. New organic materials and solar cell device architectures have been developed to achieve power conversion efficiencies of around 9 per cent on small-scale devices. The consortium's pilot-scale, roll-to-roll printing lines have successfully fabricated 10 x 10 centimetre flexible solar modules, while larger solar modules up to A3 size are also being printed.

Further development into hybrid organic-inorganic solar inks has significantly advanced the performance of large-area printed solar cells. The consortium can now produce pilot-scale quantities for incorporation into a wide range of prototypes. The low barriers to entry mean this technology can provide new opportunities for Australian manufacturing, opening up new markets and new jobs.

http://www.architectureanddesign.com.au

New record for solar cell efficiency

Researchers from the University of New South Wales (UNSW) in Australia has achieved an efficiency record of 12.1% for a 16cm^2 perovskite solar cell, the largest cell of its kind. Confirmed by the international testing centre Newport in Bozeman, Montana, the result sets a new world efficiency record for the perovskite photovoltaic cell certified with the highest energy conversion efficiency. Led by the Australian Centre for Advanced Photovoltaics (ACAP) senior research fellow Dr Anita Ho-Baillie, the team also achieved an 18% efficiency rating on a 1.2cm^2 single perovskite cell, and an 11.5% for a 16cm^2 four-cell perovskite mini-module. The cell is said to be 10 times larger than the current certified high-efficiency perovskite cells on record.

Ho-Baillie said: "This is a very hot area of research, with many teams competing to advance photovoltaic design. "Perovskites came out of nowhere in 2009, with an efficiency rating of 3.8%, and have since grown in leaps and bounds. "These results place UNSW among the best groups in the world producing state-of-the-art high performance perovskite solar cells. And I think we can get to 24% within a year or so."

The team is currently working to increase the efficiency of the perovskite solar cell efficiency to 26%. ACAP director and Ho-Baillie's mentor Martin Green said: "We will capitalize on the advantages of perovskites and continue to tackle issues important for commercialization, like scaling to larger areas and improving cell durability." UNSW said that the research is supported by $3.6m funding through the Australian Renewable Energy Agency's (ARENA) 'solar excellence' initiative.

http://solar.energy-business-review.com

CHINA

Ultra-efficient solar cells

Researchers in Hong Kong have taken a new type of solar cell developed in Japan to the next level of efficiency, opening the door to a wide range of applications. Perovskite solar cells, as they are called, use a thin film of perovskite crystal that combines metal atoms, such as lead, and organic substances containing elements such as bromine, to generate current. These cells can be produced cheaply and easily using printing technology to apply the material to a substrate or other object.

In 2009, researchers at Japan's Toin University of Yokohama confirmed that a thin film of perovskite crystal can function as a solar cell. The power conversion efficiency was initially less than 5% but was increased to over 10% in 2012. Researchers and companies around the globe have since been racing to achieve higher efficiency levels. Among them is a group of researchers led by Hong Kong Polytechnic University professor Charles Chee Surya. His team came up with perovskite-silicon tandem solar cells. A perovskite solar cell functions as the top layer, harvesting short-wavelength light, while the silicon-coated bottom layer absorbs long-wavelength light. The two layers enable the module to achieve a power conversion efficiency of 25.5%, the highest in the world for a perovskite cell, according to Surya. The previous highest rate was 22.8%, achieved by a Swiss team.

Perovskite cells are not only versatile, Surya's group also estimates that their power generation costs will be about 30% lower than those of conventional silicon cells. "The market for perovskite solar cells is going to grow quite substantially in the future," Surya said. He explained that the cells can be applied to a wide range of products, including wearable devices and sensors for home appliances. But there are safety and durability problems that must be overcome before perovskite solar cells can be put to widespread use. One concern is the use of lead, which is tightly regulated in much of the world. The decline in power conversion efficiency seen after just a few days is another hurdle to practical application.

http://asia.nikkei.com

Green biodiesel production

Biofuel is a natural and renewable diesel engine fuel derived from biological

materials, such as plant oils and animal fats. However, the purification of traditional liquid biodiesel catalyst generates a huge amount of wastewater. Hong Kong Polytechnic University (PolyU) researchers have thus adopted precise surface chemistry engineering to develop a new class of solid catalyst for use in biodiesel production.

This new Catalyst for Green Biodiesel can be synthesized in one step from low-grade unrefined feedstock such as waste cooking oil, with no aqueous treatment steps required. Ethanol or propanol extracted from plants can also be used to replace methanol in the synthesis to avoid the usual intense reliance on petroleum. With high catalytic activity, the catalyst can operate at significantly lower temperatures and pressures than existing solid biodiesel catalysts, and be reused more than 30 times. It is most certainly a clean, energy-saving and cost-effective innovation.

http://www.scmp.com

INDIA

Fuel from wastewater

The researchers at Indian Institute of Technology (IIT) - Kharagpur are generating the gas from distillery wastewater. This process will have a two-pronged effect: hydrogen production and bioremediation of the waste water, said Debabrata Das, faculty of the biotechnology department, who is leading the research. A bioreactor with a 10 meter cube volume has been installed at IIT Kharagpur to produce hydrogen continuously from distillery effluent. "This gas can also be used in the fuel cell directly to generate 52kwh of electricity that can light up an entire village," Das said.

"Hydrogen is found to be suitable as a fuel in vehicles and all major automobile companies are in competing to build hydrogen fuel automobiles in the near future. The humnngous rise in energy consumption by 2030 would require an alternative fuel resource with highest energy density . Hydrogen fulfils this criterion. Hydrogen is being considered as a `fuel for the future' because it has the highest energy density of 143kJg," Das explained.

The ministry of renewable energy in its "National Hydro gen Energy Road Map" has projected that by 2020, one million hydrogen-fuelled vehicles would be on Indian roads and 1,000MW of hydrogen-based power generating capacity would be set up in the country. It has entrusted IIT Kharagpur with the responsibility of reaching that goal as soon as possible.

http://timesofindia.indiatimes.com

Biofuel from aquatic weeds

Scientists at Indian Institute of Technology (IIT) – Kharagpur have unlocked the secret to ramp up yields of biofuel sourced from commonly found aquatic weeds such as water hyacinths. In a new study published on December 1 in Nature Scientific Reports, researchers have shown that this weed — which contains up to 50 percent hemicelluloses — can now be used as an economic and abundant source of biofuel.

"We show that the secret to rapidly producing soluble sugars from amorphous natural polymers such as hemicelluloses lies in their smallest scale-the pores," said Saikat Chakraborty, faculty member at the Department of Chemical Engineering and lead researcher of the Bioenergy Research Group at IIT – Kharagpur. Chakraborty and co-author Sajal Kanti Dutta have uncovered the pore-scale phenomena that result in "fourfold increase in the yields of fermentable sugars and bioethanol" from hemicelluloses.

"It turns out that three quarters of the soluble sugars we obtain for generation of bioethanol are produced from the pore-scale reactions. So increasing the polymer's porosity and degree of swelling will enhance the deconstruction of hemicelluloses from plant cell walls, thus increasing bioethanol," the authors said.

Hemicelluloses are the second most abundant natural polymer on earth — after cellulose — and a new technology engendered from this pore-scale phenomena could rapidly produce biofuels from locally available plant sources, added Chakraborty. Apart from water-hyacinth, hemicellulose-based bioethanol can also be produced from commonly available grasses, red and green algae, etc., which have 2.5 to 3 times more hemicellulose than cellulose. Scientists at the institute's chemical engineering department and PK Sinha Centre for Bioenergy are now working to transform these fundamental insights into new biofuel technologies that would help fight climate change.

http://tech.firstpost.com

Solar model for paddy harvesting

The final year automobile engineering students of Rajiv Gandhi Government Polytechnic, India, have developed a low cost-lightweight, environment-friendly manually operated solar paddy harvester (MOSPH) suitable for small farmers. The model has been developed under the guidance of in-charge, head of department, D Devarasiddappa. "The entire power source is packed and placed inside a bag. The harvester can be operated easily with power source unit carried on shoulder," Devarasiddappa said here.

The added advantage of the system is that it can also be used for domestic lighting when not being used for harvesting, he said. The overall cost of the developed model is approximately Rs. 14000. Unlike conventional paddy harvesters that require fossil fuel, MOSPH utilizes abundantly available solar energy to produce the required electrical energy to operate the paddy harvester. The model would be displayed at National Innovation Talent Contest for Polytechnics (NITCP) at NITTTR, Kolkata which is being sponsored by Sir Dorabji Tata Trust, Mumbai.

http://energy.economictimes.indiatimes.com

Solar energy to preserve seasonal produce

A Mumbai-based start-up has used solar energy to preserve seasonal produce, helping prevent undernourishment among rural women and women farmers. All that S4S Technologies (Science for Society) did was provide solar conduction dryers, which dehydrate vegetables and fruits, to 230 rural women in 17 of Maharashtra's villages. Another group comprising 200 women from villages in Thane and Aurangabad — called the control group — were not provided with the dryers.

Developed by S4S, the electricity-free solar-powered food dehydrator uses controlled radiation technology to trap the infrared rays that dry fruits and vegetables. The

dehydrated products regain their original properties when put in water. Every year, 25%-30% of the 250 million tonnes of fruits and vegetables produced in India are lost.

"Undernutrition or malnutrition is intergenerational. It passes from a mother to her children," said Vaibhav Tidke, chief executive officer, S4S. "Undernourishment is attributed to poverty, which results in poor ability to buy food and maintain dietary variations, food shortage across off-seasons when agri-products are not available on farms, gender inequality as women are not equipped to buy and supply nutritional food, and poor feeding practices that rely on staple food as major component of diet."

The women were trained to use the dryers to dehydrate onions, fenugreek, spinach, dried ginger, mangoes and papaya. These dehydrated products were integrated in their daily diet, especially during the lean season — January to June — when fresh produce is not available for consumption. The fact that vegetables were ready to be consumed during the lean season increased the Dietary Diversity Score — amount of nutrients in one's diet — in the experimental group by 37% more than the control group. "During the lean season, women end up eating starchy food. They boil potatoes with salt and some spice; all of which has no nutrition," said Tidke. "Dehydrating locally available seasonal food and cooking it improved the women's haemoglobin count by an average of one point — from 8g/dL to 9g/dL, for instance," he added.

With the dryer reducing moisture content in agri-animal produce and maintaining nutritional values, women farmers and rural women can preserve seasonal produce for six months to a year, without using chemicals. "When vegetables, fruits or any agricultural products are dehydrated, there is a less-than-5% loss in minerals and protein activity owing to the controlled temperature increase during the drying process. The concentration of nutrients, vitamins and protein activity is increased by almost five times owing to the removal of water. Hence, the net gain is enormous," said Bhaskar Thorat,head, chemical engineering department, ICT, and advisor for S4S. "This concentration increases energy levels and improves haemoglobin levels," he added.

In addition to consuming the dried product and preventing wastage, the women also sold the surplus. Of the 200 women in the experimental group, 105 sold the surplus dehydrated food — approximately 20,000kg of agricultural products. With more than Rs10 lakh in proceeds, the consumption of dehydrated vegetables and fruits helped the women save Rs40 to Rs60 a week during the lean season. The team plans to write to the state women and child welfare and tribal departments with the proposal to introduce solar conduction dryers in villages. "There needs to be a policy intervention in terms of installing solar dryers at the panchayat levels," said Tidke.

The two-year project was executed by S4S, Institute of Chemical Technology, Mumbai and Hyderabad-based National Institute of Nutrition. It is supported by the Biotechnology Industry Research Assistance Council (Department of Biotechnology), Bill & Melinda Gates Foundation and USAID. The solar conduction dryer is a patented technology recognised by the UN, USAID, UKAID, FICCI and University of Texas. It costs three to five times less than other solar dryers and processes 1 tonne material annually.

http://www.hindustantimes.com

JAPAN

Safe and inexpensive hydrogen production

A research team led by Kiyotomi Kaneda and Takato Mitsudome at Osaka University have now developed a catalyst that realizes efficient environmentally friendly hydrogen production from organosilanes. The catalyst is composed of gold nanoparticles with a diameter of around 2 nm supported on hydroxyapatite. The catalyst was synthesized from chloroauric acid using glutathione as a capping agent to prevent nanoparticle aggregation, resulting the formation of small size of gold nanoparticles. Glutathione-capped gold nanoparticles were then adsorbed on hydroxyapatite and glutathione was removed by subsequent calcination.

The team then added the nanoparticle catalyst to solutions of different organosilanes to measure its ability to induce hydrogen production. The nanoparticle catalyst displayed the highest turnover frequency and number attained to date for hydrogen production catalysts from organosilanes. For example, the nanoparticle catalyst converted 99% of dimethylphenylsilane to the corresponding silanol in just 9 min at room temperature, releasing an equimolar amount of hydrogen gas at the same time. Importantly, the catalyst was recyclable without loss of activity. On/off switching of hydrogen production was achieved using the nanoparticle catalyst because it could be easily separated from its organosilane substrate by filtration. The activity of the catalyst increased as the nanoparticle size decreased.

A prototype portable hydrogen fuel cell containing the nanoparticle catalyst and an organosilane substrate was fabricated. The fuel cell generated power in air at room temperature and could be switched on and off as desired. Images of the catalyst after use in the fuel cell resembled those of the unused catalyst, indicating that the hydroxyapatite-supported nanoparticle catalyst readily resisted aggregation. Generation of hydrogen from inexpensive organosilane substrates under ambient conditions without additional energy input represents an exciting advance towards the goal of using hydrogen as a green energy source.

https://www.eurekalert.org

EUROPE

GERMANY

Multicrystalline silicon solar cell

The potential of photovoltaics (PV) has not yet been exhausted. Both industry and research continue to work intensively on increasing the efficiency and reducing the costs of solar cells, the basic component of every PV power plant. Now researchers at Fraunhofer ISE have produced a multicrystalline silicon solar cell with 21.9 percent efficiency, successfully bringing the world record back to Freiburg. The potential of photovoltaics (PV) has not yet been exhausted. Both industry and research continue to work intensively on increasing the efficiency and reducing the costs of solar cells, the ba-

sic component of every PV power plant. Now researchers at Fraunhofer ISE have produced a multicrystalline silicon solar cell with 21.9 percent efficiency, successfully bringing the world record back to Freiburg.

Higher efficiencies and optimized processing steps are decisive for decreasing the cost of solar electricity even further. Both of these are an integral part of the photovoltaic research at the Fraunhofer Institute for Solar Energy Systems. With its newest efficiency value, the Freiburg researchers have once again broken a world record: A multicrystalline silicon solar cell converts 21.9 percent of the incident sunlight into electricity. As in the years from 2004 to 2015, Fraunhofer ISE again holds the world's record for multicrystalline silicon. The record solar cell consists of n-type high performance multicrystalline silicon, or HP mc-Si. Compared to p-type silicon, this material shows a higher tolerance to impurities, especially iron. The industrial production today uses multicrystalline p-type silicon material with average solar cell efficiencies of about 19 percent. The new material and technology approaches applied by Fraunhofer ISE for the record cell have the potential to improve the efficiency of multicrystalline silicon even further in the near future.

"We are very happy about this excellent result, which is due largely to the fact that Fraunhofer ISE's expertise runs along the entire value chain of silicon photovoltaics," says the visibly pleased Institute Director, Dr. Andreas Bett. "At the Institute our expertise spans the entire range from the crystallization of silicon through to the quality assurance of PV power plants. The research areas of material development, characterization and cell technology all played a part in the development of the world record cell." The various research groups at Fraunhofer ISE consulted continuously, optimizing the material and the cell process in tandem. Dr. Stephan Riepe, Head of the Group "Silicon – Crystallization and Epitaxy," explains the procedure as follows: "In our Silicon Material TEchnology Center SIMTEC, we adjusted the crystallization process with the goal of creating a material optimized for the planned solar cell processing procedure. We worked closely and in constant exchange with our colleagues until we all achieved our common target of world record efficiency."

The work of the ambitious researchers at Fraunhofer ISE, however, continues further. The "multiTOP" project, in which the record cell was achieved, continues to run up to March 2018. The project is headed by Dr. Jan Benick, Team Leader of Innovative Clean Room Technologies for High Efficiency Silicon Solar Cells. He looks into the future: "Our goal is to develop an advanced cell technology for the n-type multicrystalline wafer that really demonstrates its full potential. The question is, how far can we get to closing the efficiency gap to monocrystalline material." The colleagues in solar cell characterization acted as a decisive link between the researchers in materials and cell technology.

Dr. Martin Schubert, Department Head of Characterization and Simulation assumed the role of navigator: "With our characterization work, we were able to help our colleagues in materials to improve the material quality and to customize it for the production process. On the other side, we were able to provide our colleagues in solar cell development with tips on where the relevant losses in the current cell technology can be found."

https://www.ise.fraunhofer.de

NORTH AMERICA

CANADA

Mass production of solar cells

Printing solar cells may soon be as easy and inexpensive as printing a newspaper, thanks to researchers who have cleared a critical manufacturing hurdle in the development of a new class of solar devices. Dr. Hairen Tan and his team have cleared a critical manufacturing hurdle in the development of a relatively new class of solar devices called perovskite solar cells. This alternative solar technology could lead to low-cost, printable solar panels capable of turning nearly any surface into a power generator, researchers said.

"Economies of scale have greatly reduced the cost of silicon manufacturing. Perovskite solar cells can enable us to use techniques already established in the printing industry to produce solar cells at very low cost," said Ted Sargent from University of Toronto in Canada. "Potentially, perovskites and silicon cells can be married to improve efficiency further, but only with advances in low-temperature processes," said Sargent. Today, virtually all commercial solar cells are made from thin slices of crystalline silicon which must be processed to a very high purity. It is an energy-intensive process, requiring temperatures higher than 1,000 degrees Celsius and large amounts of hazardous solvents.

In contrast, perovskite solar cells depend on a layer of tiny crystals – each about 1,000 times smaller than the width of a human hair – made of low-cost, light-sensitive materials. Since the perovskite raw materials can be mixed into a liquid to form a kind of 'solar ink', they could be printed onto glass, plastic or other materials using a simple inkjet printing process.

However, until now, there has been a catch – in order to generate electricity, electrons excited by solar energy must be extracted from the crystals so they can flow through a circuit. That extraction happens in a special layer called the electron selective layer (ESL). The difficulty of manufacturing a good ESL has been one of the key challenges holding back the development of perovskite solar cell devices. "The most effective materials for making ESLs start as a powder and have to be baked at high temperatures, above 500 degrees Celsius," said Dr Heiren Tan. "You can not put that on top of a sheet of flexible plastic or on a fully fabricated silicon cell – it will just melt," he added.

Tan and his colleagues developed a new chemical reaction than enables them to grow an ESL made of nanoparticles in solution, directly on top of the electrode. While heat is still required, the process always stays below 150 degrees Celsius, much lower than the melting point of many plastics. The new nanoparticles are coated with a layer of chlorine atoms, which helps them bind to the perovskite layer on top -this strong binding allows for efficient extraction of electrons. Researchers reported the efficiency of solar cells made using the new method at 20.1 per cent.

The study was published in the journal Science.

http://indianexpress.com

USA

Sustainable energy storage

A battery developed by scientists at Oregon State University is said to show promise for sustainable, high power energy storage. According to the researchers, it is the first battery to use only hydronium ions as the charge carrier. Hydronium is a positively charged ion produced when a proton is added to a water molecule. The researchers have demonstrated that hydronium ions can be reversibly stored in an electrode material consisting of PTCDA; an organic, crystalline, molecular solid. The battery uses dilute sulphuric acid as the electrolyte.

"It doesn't use lithium or sodium or potassium to carry the charge, and just uses acid as the electrolyte," said assistant professor Xiulei Ji. "There's a huge natural abundance of acid, so it's highly renewable and sustainable." According to Ji, cations used in batteries have always been alkali metal, alkaline earth metals or aluminium. "No non-metal cations were being considered seriously for batteries," he said.

The study observed a big dilation of the PTCDA lattice structure during intercalation – which meant the electrode was being charged. "Organic solids are not typically contemplated as crystalline electrode materials, but many are crystalline, arranged in an ordered structure," Ji explained. "PTCDA has a lot of internal space between its molecule constituents so it provides an opportunity for storing big ions and good capacity."

The hydronium ions also said to migrate through the electrode structure with low friction which translates to high power. "It's not going to power electric cars," Ji said. "But it does provide an opportunity for battery researchers to go in a new direction as they look for alternatives for energy storage, particularly for stationary grid storage."

http://www.newelectronics.co.uk

CO_2 emissions into renewable fuels

Researchers with the Department of Mechanical Engineering at Texas A&M University are making the best use of our energy waste—turning one of our most potent pollutants and greenhouse gasses, carbon dioxide (CO_2), into hydrocarbon fuels that can help the environment and solve growing energy needs. "We're essentially trying to convert CO_2 and water, with the use of the sun, into solar fuels in a process called artificial photosynthesis," said Dr. Ying Li, associate professor of mechanical engineering and principal investigator. "In this process, the photo-catalyst material has some unique properties and acts as a semiconductor, absorbing the sunlight which excites the electrons in the semiconductor and gives them the electric potential to reduce water and CO_2 into carbon monoxide and hydrogen, which together can be converted to liquid hydrocarbon fuels."

The first step of the process involves capturing CO_2 from emissions sources such as power plants that contribute to one-third of the global carbon emissions. As of yet, there is no technology capable of capturing the CO_2, andat the same time re-converting it back into a fuel source that isn't expensive. The material, which is a hybrid of titanium oxide and magnesium oxide, uses the magnesium oxide to absorb the CO_2 and the titanium oxide to act as the photo-catalyst, generating electrons through sunlight that interact with the absorbed CO_2 and water to generate the fuel.

The project is still in the fundamental research stage. One of the challenges with this technology is that the current conversion efficiency of converting CO_2 and water into renewable solar fuels remains low, less than a few percent. According to Li, the conversion process also takes considerable time and the material can only absorb a fraction of the emitted sunlight. For Li and his team, solving these issues revolves around engineering more efficient materials with nano-scale structures and advancing the reactor design so that the materials placed within the reactor can absorb sunlight in the most efficient manner. "There are also other considerations," said doctoral student Huilei Zhao, a student contributing to the ongoing research in Li's research group. "Concentrated sunlight exposure can lead to a higher conversion efficiency and we've found that if we operate at a higher temperature with this reaction, the conversion efficiency can be dramatically increased."

https://phys.org

New energy-efficient technology

Rutgers' Richard E. Riman has developed a new invention to prove that the future will see a wide variety of composite materials that are expected to be cheaper, lighter, stronger and greener for our planet. Riman, a renowned professor in the Department of Materials Science and Engineering in the School of Engineering, developed an energy-efficient technology capable of harnessing mostly low-temperature, water-based reactions. This invention brought about nine years ago by Riman has now resulted in his team being able to produce things in water that earlier were produced at temperatures much higher than those required to thermally decompose plastics.

So far, the revolutionary technology has been employed to produce more than 30 different materials, including concrete that has the potential to store carbon dioxide, the key greenhouse gas connected to climate change. Other materials include several multiple families of composites that incorporate a variety of ceramics, polymers and metals whose behavior can be processed to resemble seashells, bone, wood and also steel.

Riman, recently named a fellow of the National Academy of Inventors and holder of a number of patents, stated that a promising option is developing materials for lightweight automobiles. The materials could be used for engine, exterior and interior applications. Other materials could carry out improved magnetic, optical and electronic functions that replace mechanical ones. With 30 years of teaching experience in the Department of Materials Science and Engineering, Riman concentrates on developing ceramic materials under sustainable conditions. This refers to low energy with a low carbon dioxide footprint.

Riman's patented technology develops bonds between materials at low temperatures. This technology is called reactive hydrothermal liquid-phase densification (rHLPD), also referred to as low-tempera-

ture solidification. rHLPD has been used in producing a variety of ceramic composite materials at Rutgers, according to an article featured last summer in the *Journal of the American Ceramic Society*.

Riman invented this new technology after analyzing how engineers densified Alaskan fields of ice and snow to develop airplane landing strips. Even though Riman had this idea decades ago, he launched the technology only after climate change became a major problem.

http://www.azobuild.com

Solar-powered water purifier

Researchers have developed a solar-powered purifier which could provide a highly efficient and inexpensive way to turn contaminated water into potable water for personal use. The device could help address global drinking water shortages, especially in developing areas and regions affected by natural disasters, researchers said. "Using extremely low-cost materials, we have been able to create a system that makes near maximum use of the solar energy during evaporation. At the same time, we are minimising the amount of heat loss during this process," said lead researcher Qiaoqiang Gan, associate professor at University at Buffalo (UB) in the US.

The team built a small-scale solar still. The device, which they call a "solar vapour generator," cleans or desalinates water by using the heat converted from sunlight. The sun evaporates the water. During this process, salt, bacteria or other unwanted elements are left behind as the liquid moves into a gaseous state. The water vapour then cools and returns to a liquid state, where it is collected in a separate container without the salt or contaminants.

"People lacking adequate drinking water have employed solar stills for years, however, these devices are inefficient," said Haomin Song, PhD candidate at UB. "Many devices lose valuable heat energy due to heating the bulk liquid during the evaporation process. Systems that require optical concentrators, such as mirrors and lenses, to concentrate the sunlight are costly," Song said.

The team addressed these issues by creating a solar still about the size of mini-refrigerator. It is made of expanded polystyrene foam and porous paper coated in carbon black. Like a napkin, the paper absorbs water, while the carbon black absorbs sunlight and transforms the solar energy into heat used during evaporation. The solar still coverts water to vapour very efficiently. For example, only 12 per cent of the available energy was lost during the evaporation process, a rate the research team believes is unprecedented. The accomplishment is made possible, in part, because the device converts only surface water, which evaporated at 44 degrees Celsius.

Based upon test results, researchers believe the still is capable of producing three to 10 litres of water per day, which is an improvement over most commercial solar stills of similar size that produce one to five litres per day. Materials for the new solar still cost roughly USD 1.60 per square meter - a number that could decline if the materials were purchased in bulk, researchers said. The research was published in the journal *Global Challenges*.

http://energy.economictimes.indiatimes.com

Crystalline material could double efficiency of solar cells

A new material has been shown to have the capability to double the efficiency of solar cells by researchers at Purdue University and the National Renewable Energy Laboratory. Conventional solar cells are at most one-third efficient, a limit known to scientists as the Shockley-Queisser Limit. The new material, a crystalline structure that contains both inorganic materials (iodine and lead) and an organic material (methyl-ammonium), boosts the efficiency so that it can carry two-thirds of the energy from light without losing as much energy to heat. In less technical terms, this material could double the amount of electricity produced without a significant cost increase.

Libai Huang, assistant professor of chemistry at Purdue, says the new material, called a hybrid perovskites, would create solar cells thinner than conventional silicon solar cells, and is also flexible, cheap and easy to make. "My graduate students learn how to make it in a few days," she says. The breakthrough is published this week in the journal *Science*.

The most common solar cells use silicon as a semiconductor, which can transmit only one-third of the energy because of the band gap, which is the amount of energy needed to boost an electron from a bound state to a conducting state, in which the electrons are able to move, creating electricity. Incoming photons can have more energy than the band gap, and for a very short time – so short it's difficult to imagine – the electrons exist with extra energy. These electrons are called "hot carriers," and in silicon they exist for only one picosecond (which is 10^{-12} seconds) and only travel a maximum distance of 10 nanometers. At this point the hot carrier electrons give up their energy as heat. This is one of the main reasons for the inefficiency of solar cells.

Huang and her colleagues have developed a new technique that can track the range of the motion and the speed of the hot carriers by using fast lasers and microscopes. "The distance hot carriers need to migrate is at least the thickness of a solar cell, or about 200 nanometers, which this new perovskite material can achieve," Huang says. "Also these carriers can live for about 100 picoseconds, two orders of magnitude longer than silicon." Kai Zhu, senior scientist at the National Renewable Energy Laboratory in Golden, Colorado, and one of the journal paper's co-authors, says that these are critical factors for creating a commercial hot-carrier solar cell.

"This study demonstrated that hot carriers in a standard polycrystalline perovskite thin film can travel for a distance that is similar to or longer than the film thickness required to build an efficient perovskite solar cell," he says. "This indicates that the potential for developing hot carrier perovskite solar cell is good." However, before a commercial product is developed, researchers are trying to use the same techniques developed at Purdue by replacing lead in the material with other, less toxic, metals. "The next step is to find or develop suitable contact materials or structures with proper energy levels to extract these hot carriers to generate power in the external circuit," Zhu says. "This may not be easy."

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FINANCING OF BIOENERGY PROJECTS IN ASIA

UNDERSTANDING AND MITIGATING RISKS

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Abstract

Biomass is already the most commonly used renewable resource of energy in Asia, especially in rural areas. The increased availability of technologies for processing dedicated crops and residues has allowed for substantial increase in transforming biomass into bioenergy for electricity generation, heat production and transportation. Despite its growing importance, bioenergy projects, like many renewable projects, face significant hurdles in obtaining financing in the current market. This is not only because other types of renewable energy projects are more attractive to investors but also that many bioenergy projects simply do not have a robust risk management scheme to satisfy investors' requirements. Experiences from the field have demonstrated that good risk management can make bioenergy projects bankable. Superior risk management can lead to significantly improved financial returns, making the project attractive to both equity investors and lenders. This article presents a consolidated list of key risks, as perceived by many investors, which make them less attractive than other alternatives available in the renewable industry. Further, the article discusses, under each of the risk categories, possible approaches to mitigate and quantify the risks in a manner easy for the investors to comprehend.

Bioenergy in Asia

Bioenergy is energy derived from the conversion of biomass where biomass may be used directly as fuel, or processed into liquids and gases. Popular sources for bioenergy come from agricultural crops and residues, sewage, municipal solid waste, animal residues, industrial residues, forestry crops and residues (IEA, 2017). Of which, wood is one of the most important sources, with more than 70% of wood being harvested in Asia and the Pacific (OECD/IEA, FAO, 2017).

The global bioenergy market was valued at US$168.18 billion in 2016 and is projected to reach US$246.52 billion by 2024 at a CACR of 4.9% from 2016 to 2024 (Transparent Market Research, 2016).

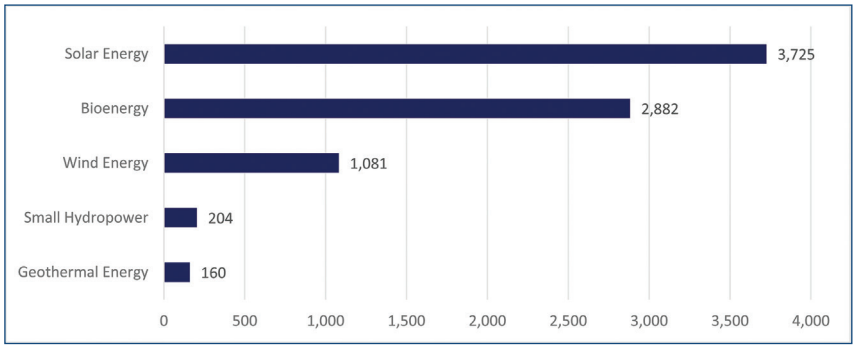
The use of bioenergy has been growing at around 2% per year since 2010. Today, bioenergy is the single largest renewable energy source, providing 10% (50 exajoules) of global total primary energy supply (TPES) (IEA, 2017). It plays a significant role in many developing countries, where it provides basic energy for cooking and space heating. Well over 2.7 billion people – 38% of the world's population – are using traditional bioenergy as their main source of energy (IEA, 2017). The development of more efficient technologies for converting biomass to energy is resulting in multiple environmental and social impacts, including reduction in greenhouse gas emission, energy security enhancement, health improvements, and generation of new job opportunities. According to the IRENA's report, while the renewable energy industry employed 8.1 million people worldwide in 2016, a 5% increase from 2015, bioenergy is one of the key employers, with almost 2.9 million jobs (IRENA, 2016) (Figure 1).

Asia, with its abundant bioenergy resources (Table 1), holds a strategic position in the global bioenergy atlas. Thailand, Indonesia, Philippines and Vietnam generate 34 million tons of bagasse every year. Meanwhile, Malaysia, Indonesia and Thailand account for 90% of global palm oil production leading to the generation of 27 million tons of waste per annum in the form of empty fruit bunches, fibers and shells, as well as liquid effluent (Zafar, 2015).

An increase in demand for electricity due to fast population growth, and a growing need for more environmentally sustainable energy sources, has accelerated the drive to implement the latest conversion technologies to tap the unharnessed potential of biomass resources in Asia. Bioenergy currently accounts for roughly 4% of regional Total Primary Energy Supply (TPES) (with a total installed capacity of 28,975 MWe) (Figure 3).

Consumption of bioenergy is dominated by the residential sector (80.62%) (Figure 4), reflecting the high proportion of people in the region relying on traditional bioenergy for basic energy services such as cooking and heating.

Bioenergy indeed is bringing changes to many Asian cities and rural communities, from reducing emissions as a means to tackle climate change to fostering rural employment and development. Poor energy access to electricity is still a major issue in Asia. In 2016, over 500 million people in developing Asia lacked access to electricity (IEA, 2016). Small-scale bio-



*Source: IRENA 2016. **Bioenergy includes liquid biofuels, solid biomass, and biogas.*

Figure 1: Renewable energy employment by technology unit: jobs (thousands)

Table 1: Bioenergy potential in selected Asian countries

Country	Estimated Potential (MW)	Main Sources
India	36,000	Various forms of biomass
Indonesia	50,000	Palm oil and agriculture Residues
Malaysia	29,000	Palm oil and wood wastes
Philippines	200	Coconut
Thailand	29,805	Sugar cane, rice, oil palm and wood wastes
Vietnam	2,420	Rice husk, bagasse, coffee husk, wood chip

Source: REEP, 2017

energy can provide access to clean and efficient source of energy.

On a regional basis, Asia is the largest emitter of greenhouse gases in the world. Since 1960, CO2 emissions per capita have grown by an average rate of 3.2 % per annum. The emission continues on the rise, with little to no signs of abating (IEA, 2009). The International Energy Agency (IEA) affirmed that using bioenergy in transport, heat and power generation is a more cost-and-land-efficient way to reduce greenhouse gas emissions, particularly if fossil fuels are the fuels replaced (IEA, 2009).

The way biomass in Asia being collected, consolidated and delivered across the supply chain from farms to the points of use, by far, has created a significantly higher number of sustainable jobs per US dollar invested. Indonesia's labor-intensive palm oil-based biodiesel industry, for instance, supports 223,000 jobs. Meanwhile, bioenergy creates 178,000 jobs in India and 76,900 jobs in Thailand (IRENA, 2015).

The governments of Asian countries are promoting bioenergy programs to address energy security and environmental problems as well as to increase farm income and employment opportunities. Along with implementing ambitious targets and mandates (Table 2), Asian governments have also adopted or are considering a range of supplementary policies including price support for feedstock production, feed-in tariffs, tax advantages, capital grants and/or loans and funding for research and development (Damen, 2012).

Despite its growing importance, bioenergy projects face significant hurdles in obtaining financing in the current market. Many investors still perceive bioenergy projects with high risk and would often prefer to invest in other renewable energy projects such as wind and solar photovoltaic (PV), now that the cost of those projects have been reduced drastically. In fact, global investments committed to bioenergy sharply fell since 2008 (Figure 5). Year-on-year investments dropped roughly by 11% on average during the period between 2008 and 2015. By the end of 2015, investments to bioenergy scored below US$10 billion.

Among challenges such as low fossil fuel prices and rapidly falling installation costs per megawatt (MW) of wind and solar PV, the sharp drop in investment is attributed by the fact that many bioenergy project developers fail to quantify and manage the different elements of risk, thus making projects less attractive to equity investors and lenders. Risks associated with bioenergy projects include market, feedstock, location, engineering and construction, operational and financial risks. Experiences from the field have demonstrated that good risk management can make bioenergy projects bankable. Superior risk management can lead to significantly improved financial returns, making the project attractive to both investors and lenders.

Biomass – understanding and mitigating risks

Market risk

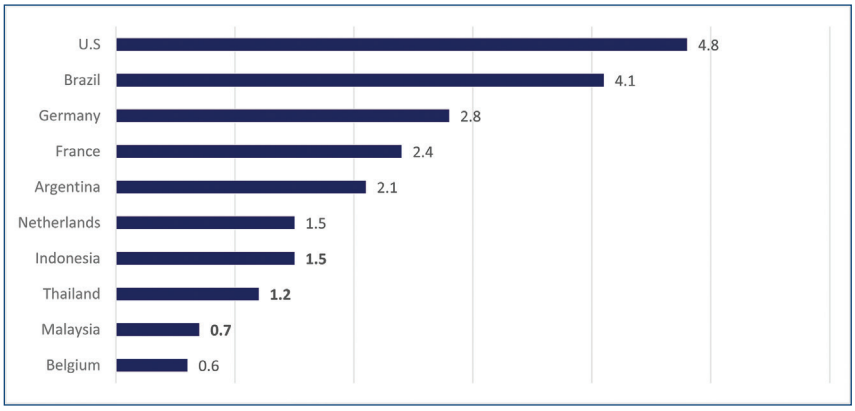
Market risks for biomass project range arise from lack of continued government policy support, status of the underlying commodity markets at both the feedstock end and product end, off-taker's capability and any such conditions that are completely external to the project itself but influence the performance significantly.

Long term consistency of government policy in terms of capital and operational subsidies may not always be available. In 2013, UK Government had contemplated capping the power purchase price subsidies to only 400 MW for biomass, thus affecting several projects that were under development at that time (Harrabin, 2013). Project developers are also required to appraise themselves of policies in the realm of land use, agriculture, forestry and transportation (especially in case of biofuels) as biomass is either a derivative of agriculture or forestry operations. As an example, the reduced availability of rice husk due to a reversal of policy in the rice-pledging scheme in Thailand resulted in

acute rice husk shortage in the biomass power plants, causing several of them to either shut down or reduce the output. While the policy was mainly an output of the agriculture department, the impact was on the power/energy business. Such inter-departmental play is increasingly visible in the policy areas for bioenergy projects. The guidelines for land use in terms of food versus fuel have been often controversial and this debate has led by interested groups/NGOs, rendering allocation of unforeseen resources to either resolve them or find alternatives at the development stage of the project, causing delays and additional costs.

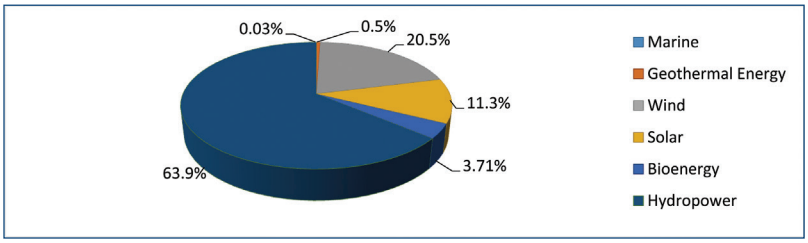
Underlying commodity market risks could severely affect both the feedstock end and the product end. At the feedstock end, price fluctuations occur resulting in a challenge for the project to provide a consistency in the operating margins. The high price of rice husk caused by the shortage in supply in Thailand, as mentioned earlier, led to a sharp increase in the cost of power generation. At the product end, i.e biofuels or electricity, both are affected either directly or indirectly by crude oil prices. In addition, heavy subsidies on fossil and grid electricity in some Asian countries are making bioenergy less attractive. India, for instance, spent as much as US$277.3 billion in 2015 on fossil fuel subsidies (IMF, 2015).

Off-taker's financial and technical capability are to be understood and appropriate risk management. While financial capability in terms of actual time taken to make payments (beyond the agreed credit terms) is a key consideration for providing working capital for the projects, technical capability in terms of grid stability could be a challenge in several locations. Many biomass projects connected to weak grid networks face several electrical trips during operations and each of those stop-start situations cost additional money. Despite their vigorous efforts in reforming the national power market, countries in Asia is still struggling to put in place enough power-generation capacity and infrastructure for transmission. In biofuels projects, the off-taker's management of their own logistics in terms of sending tankers on time could cause pressure on working capital.



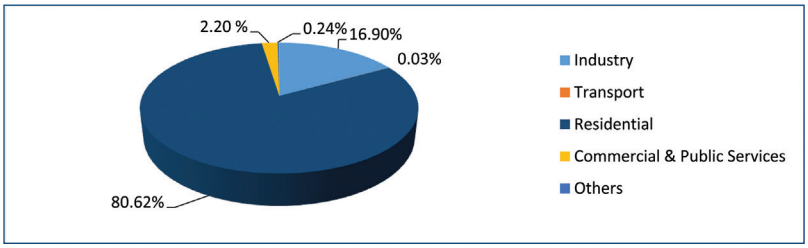
Source: Statista, 2015

Figure 2: The world's top ten biodiesel producers in 2015, by country (Unit: billion liters)



Source: IRENA REsource, 2016

Figure 3: Renewable energy electricity generation by technology



*Source: IEA, 2015. **Asia excluding China*

Figure 4: Final bioenergy consumption in Asia by sector, 2015

Diversifying feedstock, products and markets helps reduce and counterparty risk. Wherever possible, for the sale of power, several market options should be considered, such as utility-scale power purchase agreement (PPA), wholesale market, and/or bilateral PPA. Developing concrete co-product strategies to increase revenues is also highly recommended as a way to minimize risks. For example, for power project additional revenues can be sought from sales of ash, compost and steam and for biofuels projects co-products could be compost, animal feed, carbon dioxide, compressed biogas (as a replacement of compressed natural gas – CNG).

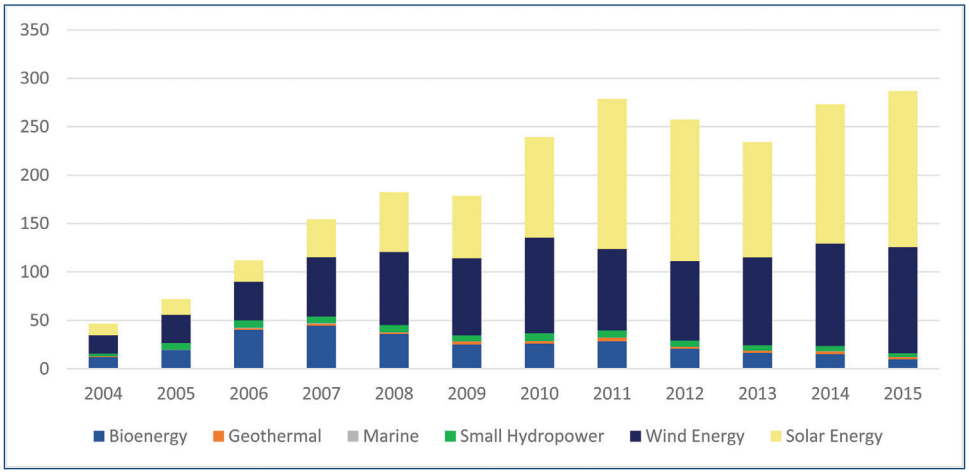
Feedstock risk

The fluctuation in feedstock volumes and prices add substantial risks to bioenergy projects. Commodity price volatility severely affects feedstock prices. It is important to understand various biomass sources and underlying commodity related risks.

Table 2: Bioenergy mandates and targets in selected countries in Asia

Country	Biofuel mandates/targets	Biomass heat & power targets
India	5% blending mandate for ethanol E10 20% blending of ethanol by 2017	10 GW by 2022
Indonesia	B20 20% blending of biofuels in transport, industry, and commercial sectors; 30% blending in power plants. This creates a demand of 5.57 million kiloliters of biodiesel and 3.77 million kiloliters of bioethanol.	810 MW by 2025
Malaysia	B7 and B10 7% blending of biofuels in transport and industry sectors.	1,065 MW by 2020
Philippines	10% blending of ethanol by 2020, and to 20 % by 2030	267 MW by 2030
Thailand	B5; 5 billion liters of biofuel production by 2022	5,570 MW by 2036
Vietnam	550 million liters of biofuel production by 2020	500 MW by 2020

Source: REEP, 2017.



Source: IRENA REsource, 2016.

Figure 5: Global trends in renewable energy investment, 2004-2015

Secure, long-term supplies of low-cost, sustainably sourced feedstocks is critical to the economics of bioenergy projects.

Feedstock quantity and quality variations due to seasonal and other reasons should be predicted and provided for. For instance, biomass from agriculture, such as rice husk and rice straw, is available only after harvesting period which can stretch only for 6-7 months in a year. Therefore, it is required to procure and store adequate quantity of biomass within this stipulated time. Farm holding size, contractual consistency and other unpredictable local issues might influence the feedstock supply and the availability of the feedstocks. Biomass from forest processing residues may vary depending on the final product being made by that factory (for example, size of wood offcuts) and the impact of chemicals used in their processing (for example, veneer waste from plywood industry may contain glues).

Some countries in Asia, notably Thailand and Indonesia, are deploying the anaerobic digestion technology to treat a range of waste materials-including effluents from cassava starch production, palm oil processing and ethanol production. These waste feedstocks can be more volatile in supply and price when the prices of such commodities as palm oil and cassava are fluctuated. The waste-to energy project in Southern Thailand, for example, has been in operation since early 2016, processing palm oil mill effluent and producing 12,300 MWh annually, which is exported to the neighboring electricity grid (REN 21, 2016). The operation of this power plant significantly depends on the availability of palm fruit and its processing which in turn depends on the prevalent economics of palm oil production.

Feedstock costs can be zero for some wastes, including those produced onsite at industrial installations, such as black liquor at pulp and paper mills, or bagasse at sugar mills (IRENA, 2014). Some waste

feedstock projects are paid to take wastes or pay at low cost, such as the case of municipal waste and solid waste. However, a number of projects designed around feedstock waste streams have not been financed due to waste feedstock risk, including price escalation for transportation and handling, and price risk, if there is competition for the waste (Hanson, 2012).

Energy crops, grown for specific bioenergy projects, need to have considerations for land use for fuel versus fuel, overall and sustainable economics of growing it for long periods of time from the point of view of yield per hectare, seed costs, land preparation costs, fertilizer/ pesticides and other chemicals, crop care costs, harvesting, baling and other compacting methods and handling, transportation, competitive uses of land and other local factors influencing land use. A couple of ethanol projects in the Philippines, that were designed with an integrated farming approach for feedstock supply, have faced considerable delays in the conversion of the land use from cash crops/others to energy crops.

Feedstock logistics are not often accounted for very clearly and project need to itemize logistics and fuel preparation costs across the supply chain. In certain countries like India, a third party like Punjab Renewable Energy Services Pvt Ltd., provides consolidation services covering all these costs, with a delivered cost at the gate. Activities encompass collection from several points of collection, loading at point of collection, transportation, unloading at point of storage, reclaiming & loading on to conveyors to boilers, administrative costs, storage costs and care during storage, fuel preparation (sizing, mixing, palletization, crushing etc.). Concerns to be addressed are availability of labor for loading/unloading, availability of trucks to support delivery schedules, availability of authorized personnel at collection points, delivery is possible only over a limited period and certain days of the week, increased inventory carrying costs, increased transportation/ administrative costs, losses during storage and handling.

A good risk management strategy could be to use blended feedstock strategy/ multiple feedstock strategy. Security of fuel supply could also be sought through providing the fuel suppliers an equity stake in the project. Adequate margins must be provided in the feedstock supply.

Varying feedstock sources and preparing adequate working capital must be required in the design and operation of the project. This will significantly improve the revenues and the ability to service fixed costs. Carefully planning stocking and transporting feedstock also helps reduce the costs caused by quality degradation and storage loss while sustaining feedstock supply continuity. Cost considerations for each of the above activities listed in the fuels supply chain and clear plan to address the concerns are a key expectation from investors.

Feedstock procurement planning, linked to the project's output and considering seasonal variations, should be undertaken at project stage and layout the procurement and inventory management plan in details. This exercise should link to the working capital costs and inventory carrying costs for the feedstock. In highly competitive supply situations, it is recommended to manage the suppliers like "customers" and apply all key "customer" relationship management (CRM) methods to bind and secure suppliers to the project. Advance purchase of standing crop is a common practice in the sugarcane industry and has been applied very little outside of this segment in the energy industry and such practices can be investigated for their applicability to procurement of other biomass/energy crops.

Location risk

A key success factor of bioenergy projects is the location. It is necessary for the project to be located as close to their markets e.g. grid, blending depots, port facilities. This helps reduce operational costs while ensuring smooth operation and also reduces other concerns such as logistics for biofuels transportation.

Proximity to feedstock is obvious because of logistics limitations, the economically feasible transport range being limited to a 50 km radius from project site (REN 21, 2016). The collection of feedstock poses the largest barrier since ag¬ricultural production in Asia is mostly small-scale and geographically scattered. Competing uses of biomass from similar projects in the vicinity and from others, for example, cassava roots and chips are used for manufacturing starch and ethanol and thus the same produce of roots from the feedstock for ethanol factories located adjacent to each other and starch factories in the same vicinity. Even when being put in use for similar end use such as generation of steam, the capability of factories that produce food and beverages to be a higher price for rice husk could be much higher than that of a power producer. Woody feedstock fetches far higher prices from paper and pulp producers than being used for boilers in power plants.

Access to infrastructure such as good roads, storage facilities and ports are important considerations. Another important consideration is the availability of waste disposal facilities. Rice husk based power plants in North Eastern part of Thailand have always sought to export their high quality ash but have been deterred by the staggering costs for packaging and transporting them to ports in Central Thailand. This further leads to the challenge of disposing the ash in an environmentally friendly manner. Ethanol plants have always been challenged with the disposal of treated waste water, one option being disposing to farms in the vicinity, provided they exist and the infrastructure for this is available.

Labor and skill availability is also a consideration for location selection. Sensitivity of local communities must also be factored in, to reduce any future social conflicts with them.

Risk mitigation should include a levellized cost of land including long term operating costs effects on additional operating costs due to logistics on the product side/ grid transmission losses, feedstock supply chain costs, waste disposal costs, labor and skill development costs. Additionally, the cost of land levelling and preparation, to be discussed in the subsequent sections, is also a contributing factor to this calculation.

Engineering and construction risks

Inappropriate engineering might lead to the failure of a project. It is often the case in Asia that a preferred supplier is identified at an early stage of the project and several inputs in the project design are taken from inputs provided by such a technology supplier. While this may provide validated capital and operating costs, it is sometimes not possible to extrapolate these from one project to the other. An example of this would be in the selection of the level of automation in the technology. A number of ethanol projects in Asia have designed with a high level of automation and energy and water integration, largely on the lines of such projects elsewhere in Europe/USA. While these designs are flawless, the necessary skills to operate and maintain them do not exist in many parts of Asia. Thus a project developer who may be very impressed with such features in the technology may opt for this, which may be very hard to operate on the ground by the project personnel. This shall then defeat the purpose of the extra capital costs spent in acquiring the sophistication in the technology as some of those features may take a long time (2-3 years) for the operating personnel to learn and put to use. In addition, this may also cause an error in the planning for the number of personnel required to operate, as the original estimate may be based on a fully automated plant. It would rather be that such upgrades are executed in steps, over a period of time.

Another area that is often left unattended is the design of the "balance of plant" or "utilities". While the key components of the project (such as boiler/steam turbine for power projects and the ethanol production block for bioethanol projects) attract a lot of attention at the project development stage, the same is not the case on the rest of the project, leading to challenges in balancing the operations of the project. As an example, a biomass power plant in Thailand had never considered the high level of chlorides in the raw water source and supplied a water pretreatment plant not suitable for this project. The contractor was not provided these inputs as the project developer never focused on this at the development stage. A few samples of water were drawn from "neighbors" and used as the basis, but not enough local expertise was sought because as they discovered later, this was a common issue in that locality. In ethanol plants, the ethanol block suppliers only provide utility requirements at their battery limits e.g. steam flow and temperature under minimum/maximum/normal conditions of operations. Rarely do project developers involve a stem system expert to arrive at configuration that can cater to these conditions in real operating conditions. Neglecting such areas cause significant operational inconvenience and costs.

In terms of construction, the profile of land in terms of the quality of soil and contour have a significant impact on the construction costs. A number of tools are available for getting all relevant data in this connection making this not only convenient but also fast and inexpensive. Such critical information should form a part of the business development and issued to the bidders of the project as a key input for their design.

Selection of the right contractor is always a challenge. Sectoral and geographical experience is of utmost importance. Relying only the financial strength of the contractor is not sufficient. Most investors expect a single-point turnkey solution provider who additionally goes to guarantee the technical performance of the entire project. While sectoral experience may be temporarily acquired during the project stage by hiring the right personnel, geographical experience cannot be "hired" but has to be gained over a period of time. The latter should not be underestimated as each of the countries within Asia (and also elsewhere) have their own local nuances and sub-contracting practices that needs the understanding and appreciation from the main contractors, usually possible only by experience. There are several project examples of delays and cost over-runs when contractors have executed their projects for the first time in certain countries in South East Asia.

Obtaining permits and licenses for construction is time consuming, and the costs and time for those should be taken into account. A clear roadmap may be drawn for this including costs and timelines.

Operational risk

Operational risks are related to not achieving the desired performance due to operational inefficiencies, either because of technical, personnel and other reasons or a combination of these. Hiring experienced personnel is a key to mitigating this risk. The experience with the technology and geography are important.

Project must establish procedures for production planning and link this to feedstock management and utilities management. Feedstock management may throw up scenarios of multiple feedstock/blended feedstock, necessitating to have complete production menus developed for these scenarios upfront.

Several of these projects do not maintain a clear technical records right from the construction stage onwards continuing into the operations. This often inhibits the resolution of operating problems in a timely and economical manner. Data collection and storage during production also does not form a component of the project design, beyond probably a basic Distributed Control System (DCS) capability. Modern tools like data analytics, predictive plant performance, internet-of-things (IOT) based solutions may be explored to tap on higher level of expertise available in the domain, beyond the operating personnel of the plant.

Projects lack an analytical approach in many cases, not only because of lack of data as mentioned above, but also due to lack of laboratory facilities for analyzing feedstock and work in progress. The feedstock analysis largely gets restricted with outputs relevant to assessing quality for making payments to suppliers and not beyond that. Laboratories form an integral part of the production process, with continuous sampling and feedback provided to the production personnel to make adjust to manage outputs efficiently. It is also important to thoroughly document potential equipment errors for maintenance, breakdown and damage repair.

A key focus during operations is the community around the project and hence Corporate Social Responsibility (CSR) programs must form a part of the project design. A certain part of the revenue may be set off for local development activities and this should be budgeted in the project design. A good CSR strategy which allows the engagement of local communities is essential. It helps strengthen project sustainability, manage potential reputation risks for investors, avoid social conflicts within communities, and help reduce political risks.

Designing and operating safety systems beyond compliance requirements is highly desirable. For example, the statutory requirements for safety may be far lower than the actual requirements for ethanol and biofuel projects. Where large volumes of biomass feedstock are stored, impact on safety due to dry biomass, and fine dust, are to be studied and adequate safety should be provided for.

Financial risk

Financial risks exist in the form of lack of capabilities for a follow through investment, capital structure of the company, debt servicing, working capital planning, availability of exit options for investors, focus in creating a sinking fund, currency risks, and providing for CSR.

It is quite common that projects require funds for debottlenecking to achieve its full potential. When such a situation occurs, either the capital structure of the project or the initial investment ask from the investor and/or their committed investment come in the way. This causes impairment to the value of the project due to delays in either mobilizing the funding and/or creating the appropriate corporate structure to accommodate the same. It is desirable that project developers envisage and provide for such follow-through investment in the project design by way of an appropriate amount of investment asked upfront and create the appropriate capital structure to accommodate such additional capital injection.

Debt servicing is one of the key operating challenges for bioenergy projects with variation in costs and revenues. This is expected to be covered through a reserve account, mandated by the lender. However, in order to make sufficient funds available in such a reserve account projects may need to be in operation for a couple of years and any shortfalls in servicing the debt prior to that provide significant challenges to equity investors. Exploring loan guarantee mechanisms and integrating them with the project may be worth the while. Such guarantee mechanism take time and also do cost an additional fee but do provide comfort to the project in terms of covering debt servicing risks.

In several cases, the lack of working capital planning at the project design stage have caused stressful situations, making it hard for the project to raise additional working capital subsequently during such times. Seasonal fluctuations in working capital requirements should also be factored in the planning.

Providing plausible exit options for investors are crucial to project financing. While exit is part of the project design in case of most debt providers, for equity creating an appropriate exit as part of the project design is important. It may be noted that unless a project is of a significant investment (which most standalone bioenergy projects are not), stating an initial public offering (IPO) is often not a plausible and feasible option for exit. The higher the number of exit options available, the more attractive the project could be to investors and all possible scenarios may be discussed with the investors.

A sinking fund, provides for the "rainy day", and could be a good hedge in times of seasonal fluctuation of feedstock prices (for example, the project may buy and stock feedstock at lower prices during the season) and or provide for unforeseen plant maintenance expenses. Even though projects may be covered by insurance policies for operational breakdown, it is expected that the project developers spend their own funds to get it fixed, while the claim from the insurance is being processed. This results in lesser downtime and loss of revenue. A sinking fund is one created beyond the stipulation of lenders, such as the reserve account, and should be a norm to deposit a certain portion of the revenues into a controlled account.

International investors often face significant currency risks where the revenues and dividends are in local currency. Investors quite often attribute hedging costs for the currency and consider this as part of their costs in the project. While the project developers may not be accounting for this, it is a consideration at the investor's end. As enumerated in the earlier section, a CSR related fund should also be a part of the project design.

Conclusion

It is often the case that investors view the risk adjusted returns of the projects after accounting for all of the above risks and more. It is recommended that project developers cover as many of the above risks as mentioned in this article and quantify them in terms of costs, either at the project development stage or at the operating stage, i.e either in capital or operating costs. This not only provides a clear picture to the investor but also helps the project developer build and operate the project successfully.

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Asia Pacific SEforALL Hub

The Asia Pacific SEforALL Hub is led by ADB, UNDP and ESCAP, with the Hub Secretariat hosted at ADB Headquarters in Manila, Philippines. The three organizations will help catalyze major new investment opportunities to speed-up the transformation of the world's energy systems, pursue the elimination of energy poverty, and boost prosperity. The Hub will leverage on the existing structures of ADB, UNDP and ESCAP energy programs and integrate the strengths of all three development partners. It looks to grow its partnerships and consolidate efforts to promote Sustainable Energy for All in Asia and the Pacific region.

The SEforALL Asia Pacific Hub aims to accelerate and facilitate the achievement of SEforALL's goals to transform energy systems for a sustainable, prosperous future by harnessing its three development partners' convening power, country presence and networks to mobilize partnerships to catalyze concrete actions at the country level.

The Asia Pacific Hub will facilitate and coordinate core activities in the region, with respect to the SEforALL goals, in close cooperation with the SEforALL's Global Facilitation Team. A better policy environment will accelerate the further development of sustainable energy, which is why the AP-SEforALL Hub established a Sustainable Energy Center for Excellence, hosted by the Sustainable Energy Association of Singapore. The Singapore-based facility will become a venue for the region's policy makers to receive training on policy, technology, and project financing matters in the sustainable energy sector.

Forging partnerships with diverse groups of institutions is crucial in addressing energy challenges facing the region. Partnerships mobilize resources (financial, human, and others), leverage knowledge, meet unique needs for highly specialized development projects, and make aid more effective throughout Asia and the Pacific. The Asia Pacific Hub is always seeking new partners to support inclusive, environmentally sustainable growth and development in the region.

Key activities of the Asia-Pacific Hub for the SEforALL Initiative:

- Support the preparation of rapid assessments, country action plans and investment prospectuses
- Facilitate policy dialogues among stakeholders
- Catalyze investments in energy access, renewable energy, and energy efficiency
- Develop market-based approaches for the delivery and consumption of energy
- Build synergies and promote knowledge sharing among its stakeholders
- Conduct regular monitoring and evaluation of activities and initiatives of its stakeholders

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ASEAN BEST PRACTICES IN CLEAN ENERGY

How SME could benefit

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ACE Building, 6th Fl., Jl. HR. Rasuna Said Block X-2, Kav. 07-08,
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Abstract

Small and Medium Enterprises (SMEs) play an important role in the economic development of the ASEAN region. SMEs make up the vast majority of business enterprises across ASEAN and create most of the region's job opportunities. Today, between 95 and 99 percent of businesses in the ASEAN Member States (AMS) are SMEs. These SMEs create around 43-97 percent of employment, and contribute around 23-58 percent to the region's gross domestic product (GDP), and 10-30 percent to total exports. Historically, as SMEs grow, there is an increase in energy consumption in industry and commercial sectors. This consumption also indicated high dependency on fossil fuels. Nevertheless, a number of SMEs in ASEAN have successfully implemented clean energy projects. These projects became some of ASEAN's best practices in clean energy and earned the SMEs the ASEAN Energy Awards. Their success stories are presented here to raise awareness on the issue, and to further inspire other SMEs in taking real actions in clean energy. Undertaking clean energy projects indeed brings more potential benefits to SMEs in reducing costs, gaining technology and knowledge transfer, reducing CO2 emissions, obtaining a green company brand, and contributing to the achievement of national and regional clean energy targets.

Introduction

Small and Medium Enterprises (SMEs) play an important role in the economic development in the region. SMEs make up the vast majority of business enterprises across ASEAN and they create most of the region's employment opportunities. They constitute the largest number of establishments and contribute significantly to the AMS' labour force. SMEs account for between 88.8% and 99.9% of total establishments in the AMS, and between 51.7% and 97.2% of total employment. The contribution of these enterprises to each AMS' GDP is between 30% and 53%, while the contribution of SMEs to exports is between 10% and 29.9%. For that reason, these enterprises are important in terms of income and employment generation through their diverse business participation, and their widespread presence in the non-urban and rural areas. SMEs are thus the backbone of ASEAN. The development of SMEs is fundamental towards achieving long-run and sustainable economic growth and narrowing the development gap. The numbers above are proof that the region overtook France as the sixth richest economy in the world in 2015, and also third among the Asian countries, after China and Japan[1].

As clearly laid down in the ASEAN Economic Community (AEC) Blueprint clause C1, one of the AEC's objectives aims at increasing the contribution of SME to the overall economic growth and development of ASEAN as a region by enhancing the competitiveness and expansion of SME. As the region moves towards increased economic integration under the AEC—which was launched officially by the end of 2015--SME are expected to play significant role in ensuring the different levels of economic development in the AMS, in a way that the AEC could benefit all of the AMS equally.

The ASEAN SME Agencies Working Group (SMEWG) is the ASEAN body responsible for SME development and promotion in ASEAN. Its membership is composed of the representatives of all SME agencies from all AMS. An SME Advisory Board comprising both members of SME agencies and the private sector aims to enhance the public-private partnership in SME activities. The ASEAN SMEWG also holds consultations with Japan, The Organisation for Economic Co-operation and Development (OECD) and the ASEAN Business Advisory Council (BAC). Its work is also supported by the Japan-ASEAN Integration Fund, OECD and the USAID ASEAN Connectivity for Trade and Investment, the latter in cooperation with the US-ASEAN Business Alliance for Competitive SMEs. In 2014, the SMEWG embarked on a task of developing a ten-year ASEAN Strategic Action Plan for SME Development (SAPSMED 2016-2025) under the post-2015 ASEAN Vision. The SAPSMED 2016-2025 serves to strengthen SME and micro enterprises' engagement in an increasingly competitive economic environment and to support their growth and development through the vision 'Globally Competitive and Innovative SMEs'. By 2025, ASEAN shall create more globally competitive and resilient SMEs. The Plan's five goals are to promote technology, production and innovation; increase access to finance; enhance market access and internationalisation; enhance the policy and regulatory environment; and promote entrepreneurship and human capital development.

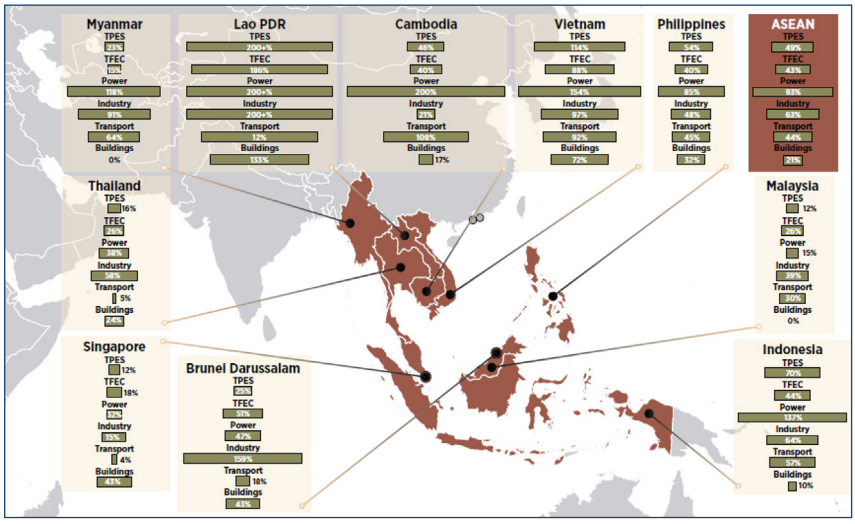
In implementing this plan, SMEs in the region are meeting new opportunities and challenges[2]. Additionally, there is plenty of room to increase the SME' contribution to the AMS' GDP and the growth of the region as a whole. The region's business players are preponderantly SMEs (including micro

[1]ASEAN Secretariat. 2016.
[2]ACCA. 2016.

enterprises), so that the pursuit of SME development is in fact not just for equitable development in the region under the third pillar of the AEC Blueprint, but also for the strengthening of the region's competitiveness and robustness which depend, to a large extent, on the competitiveness and robustness of the region's SMEs.[3] Because SMEs are critical for the robust growth of the AMS, it is important for the policymakers in the region to facilitate SMEs growth and development. In the assessment results summary, it is identified that the biggest gap in policy (i.e. to promote technology and technology transfer) is due to the lack of strategic policies that support the SMEs innovations; to poor provision of information on innovation support; to limited access to standard certification; to lack of technology support in universities, and to limited connection between SMEs, R&D labs and incubators. Thirty business incubator and innovation centres make up the ASEAN Business Incubator Network (ABINet) to promote business matching and development, but the role needs to be enhanced as well.

This finding on SME development is not isolated from the energy issue in the region. Energy is a common concern for all SMEs and while they know their businesses well, they can sometimes be unaware of the impact of appliances they use, such as heating and lighting. Energy costs associated with operations are the SME's common threats, along with profitability and price concerns. Lack of strategic approach to innovation policy on energy, limited knowledge and capability in energy technology, as well as financing concerns, among others, are the main causes of SME's lack of efforts in managing their energy concerns.

One major obstacle that prevents companies from doing innovations and building up absorptive capacity is their perception of the costs and risks being too high[4]. In this regard, it is very important for SMEs in the region to learn from various existing best practices in clean energy. The ASEAN Energy Awards, an annual official event that is organised by the ASEAN Centre for Energy (ACE) in conjunction with the annual ASEAN Ministers on Energy Meeting (AMEM), is an event that recognises the achievements of companies and individuals in promoting clean energy in the region. First held in 2000, the Awards provide hundreds of best practices in clean energy which can be taken as lessons-learned and adopted by the SMEs in region.



Source: ACE & IRENA. 2016. RE Outlook for ASEAN – a REmap Analysis.

Figure 1: Increase in energy demand by 2025 over 2014 levels

Energy demand

It is important to understand the source of energy that fuels the SME's growth today and in the coming decades. In 2016, ACE released its joint study with the International Renewable Energy Agency (IRENA), titled *Renewable Energy Outlook for ASEAN – a REmap Analysis*. From this study, it was identified that ASEAN's population will increase from around 615 million in 2014 (already 628.9 million in 2015)[5] to 715 million by 2025. The economy will grow more than 5% per year, resulting in a rapid rise in energy demand. The region will see 4% annual growth in energy demand until 2025, amounting to a rise of 50% over the 2014 levels. Electricity demand will double between 2014 and 2025. Energy demand for electricity production will rise with the fastest pace, but fuel demand in industry and transport will also increase rapidly. According to developments likely to occur based on current or planned policies or expected market developments, most demands will be met with fossil fuels, but the Study also foresees significant growth in hydropower, geothermal power, and some forms of modern bioenergy for heating and cooking.

At country level, the growth in energy demand and by sector varies, as Figure 1 shows. AMS with the lowest per capita income will see some of the largest growth over the period. Energy demand in Lao PDR will grow astoundingly 200% across most sectors, but much of the increase in the power sector is electricity intended for export. Demands in other AMS such as Cambodia, Myanmar and Vietnam, will grow by 150-200%. Indonesia, the Philippines and Vietnam will all experience significant growth in energy demand in industry, buildings and transport. Some AMS with higher per capita income and energy demand levels will see their energy demand grow as well, but it will be less than the growth in the above-mentioned Member States.

[3]ERIA. 2014.
[4]ERIA. 2014.
[5]ASEAN Secretariat. 2016.

This growing energy demand is mostly met with fossil fuels. As Figure 2 shows, demand for coal will rise by 128 Mtoe to become the largest fuel source in 2025. Oil use will increase significantly, by 59 Mtoe, to become the second largest source, and natural gas will become the third largest, growing by 67 Mtoe. Compared to 2014, growth in the use of fossil fuels by 2025 will range from 31% for oil, with the majority still used in transport; 90% for coal, driven largely by power generation; and 65% for natural gas, which has mixed uses. With the exception of coal, the region has limited indigenous oil and natural gas supplies (Brunei Darussalam and Indonesia excluded) to meet this rising demand. An increasing share will have to be met with imports.

It is difficult to calculate the actual energy demand for SMEs. However, by putting the assumption on the share of SME in each consumable sector, particularly industry and commercial, we may be able to identify SME's heavy reliance on energy, particularly from fossil fuels which dominate their production costs, as Figure 3 shows.

This finding sends an alarm to the SME, so they would closely observe and understand their energy consumption patterns and translate it into efficient use of energy, thus pursue more renewable energy. In the long run, this will build SME's competitiveness. The next paragraphs explain why implementing clean energy use is the best option for SMEs.

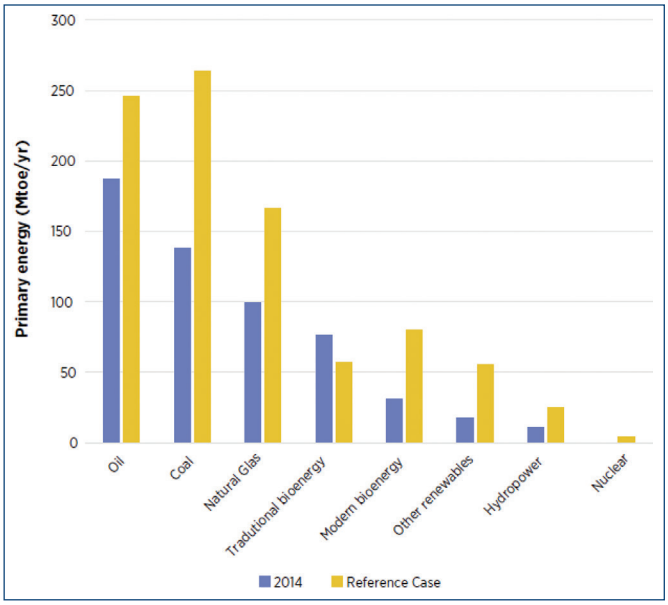
Regional approach

Regional cooperation to foster SME used to be guided by the ASEAN Policy Blueprint for SME Development (APBSD) 2004-2014. The Blueprint provides the framework for SME development in ASEAN to narrow the development gap in the region. It aims to accelerate the pace of SME development and enhance the competitiveness and dynamism of ASEAN SME by facilitating their access to information, market, human resource development (HRD), finance, and technology. It also aims to strengthen the resilience of SMEs to withstand adverse macroeconomic and financial conditions along with challenges arising from a more liberalised trades environment, as well as to improve SME's contribution to ASEAN's overall growth and development. Under this blueprint, the Strategic Action Plan for ASEAN SME Development 2010-2015 emphasising the regional commitment for SME developments, was adopted and endorsed to further enhance the competitiveness and flexibility of SMEs in moving towards a single market and production base in ASEAN. With the launch of ASEAN Economic Community (AEC) in 2015, the APBSD envisions ASEAN SMEs as competitive, innovative, and world-class enterprises that perform major roles in regional and global supply chains, and are able to take advantage of the opportunities from ASEAN economic integration. By 2025, ASEAN shall create globally competitive, resilient and innovative micros, small & medium enterprises (MSME), seamlessly integrated into ASEAN community and inclusive development in the region.

To realise this vision, ASEAN SMEs need to look further at every sector, including how to have secure and affordable but environmental friendly energy resources. The main regional reference for ASEAN SMEs to deal with energy issues is the ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025. The APAEC's theme "Enhancing Energy Connectivity and Market Integration in ASEAN to Achieve Energy Security, Accessibility, Affordability and Sustainability for All" reflects the central elements of SME's competitiveness. The key initiatives under this APAEC include various action plans to reduce energy intensity by 20% in 2020 based on 2005 level, and to increase the component of renewable energy (RE) to 23% by 2025 in the ASEAN Energy Mix.

ASEAN Energy Awards

ASEAN Energy Awards (AEA) is ASEAN's highest recognition for excellence, creativity, practicality and dedication to the field of energy. It promotes better energy management in which SME and large industry are categories for the Awards. With only 2 (two) categories initially, the AEA now consists of five categories, including awards for energy efficiency in buildings, energy management, RE and green buildings. The AEA is quite a popular accolade among building developers, with a total of 628 companies participating and 411 awards won since the introduction of the categories in 2015. The ASEAN Energy Awards aim to encourage more private sector's participation (including SME and large industries) to implement clean energy projects with clean technologies. Through ASEAN Energy Awards, the SME who participated



Source: ACE & IRENA. 2016. RE Outlook for ASEAN – a REmap Analysis.

Figure 2: Primary energy demand by fuel or source, 2014 and reference case in 2025

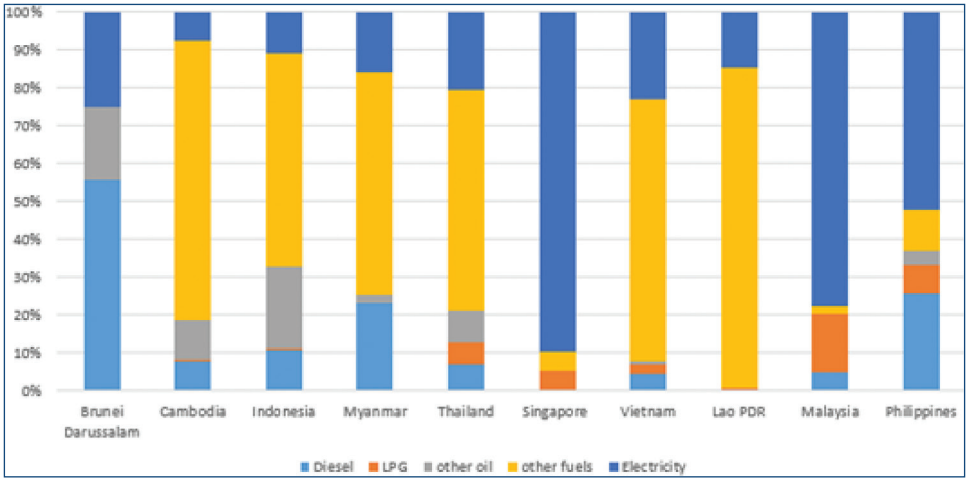
received a recognition at the national and regional levels.

The following part showcases the best practices of SMEs who received the AEA. These SME implemented energy efficiency (EE) and RE initiatives towards cleaner energy use. In the EE category, the best practices from SMART Modular Technologies from Malaysia and PT Phapros Tbk from Indonesia will be discussed, while for RE, the best practices from Thai Eastern Bio Power Co., Ltd. from Thailand and Kaung Kyaw Say Co., Ltd. from Myanmar will be discussed.

Smart Modular Technologies manufactures memory modules. This small enterprise is committed to create a healthy environment for all its employees in doing their business. The company encourages the boards to reduce greenhouse gas (GHG) emissions in the operation and manufacturing process by improving energy efficiency. The energy conservation initiative called "Six Sigma Energy Saving Project" was successfully implemented to reduce the energy with a saving around 1,735,157 kWh equivalents to saving RM 600,841.4 or eliminating 1,262.09 tonnes of CO2. In 2015, the company's energy efficiency index has reduced about 219.72 kWh/m2/year from the previous year's number of 1,101.86 kWh/m2/year. In 2015, the initiative spent a total investment of RM 217,109 with a 3-year return on investment for LED, HVAC, and air compressor. Fixed LED with an investment of RM 204,111 had a ROI of 2.14 years, while an investment of RM 157,972 for HVAC recorded the lowest ROI of 3.99 years.

PT Phapros Tbk is a pharmaceutical company under RNI Group, which was established on 21 June 1954. Medicines are produced under the trade name while generic drugs are sold in the form of generic drugs bearing (OGB). To preserve the environment, PT Phapros Tbk has committed to implement EE programmes by setting the targets to reduce energy consumption per tonne of product by 60 MMBtu, also to reduce consumption of energy and natural resources by 30% in 2017. As a developing SME, the demand for the product increases each year, which consequently increases energy demand annually. Energy efficiency programme benefits SMEs by controlling its energy needs. PT Phapros Tbk is committed to go from 83 MMBTU/tonne of products in 2013, to 66 MMBTU/tonne of products. This is equal to 20% of energy saving from 2013. With a total investment of only slightly above USD 200 thousand (for total investment in 2 years; 2013-2015), this company saved their money for energy costs of about USD 72 thousands/year or equal to 235.2 kWh/year for their energy saving initiative. In regard to the environment, PT Phapros Tbk, recorded a reduction of GHG emissions as much as 426 tonnes of CO_2 equivalent in the period of 2013-2015. In this company, the long payback periods are for diesel engine replacement programme (35 years) and the replacement of R22 by MC22 (18 months). For the rest of programmes, the payback period is less than 7 months. Variable speed drives (VSD) installation in the air handling unit (AHU) machines, adjustment of working hours for heating, ventilation and air conditioning (HVAC), solar cell installation, and transition to LED programmes are the three examples of the initiative with payback periods of less than 7 months.

In RE, Thai Eastern Bio Power Co., Ltd. from Thailand and Kaung Kyaw Say Co.,Ltd. (known as KKS) from Myanmar, won the ASEAN Energy Awards 2016 with their successful RE projects. Thai Eastern Bio Power Co., Ltd is a subsidiary of Thai Eastern Group. Thai Eastern Bio Power Co., Ltd. Focused on reducing the environmental effect of their rubber plant and palm oil plant by adding value to wastewater, and producing biogas. In its project, Thai Eastern Bio Power Co., Ltd. built a biogas production system which was designed to treat wastewater at maximum 630 m^3/day and hydraulic retention time (HRT) of 35 days with average production of 23,133 m^3/day. Furthermore, unutilised biogas that exceeds the demand of rubber production was used as fuel for gas engine to produce electricity. This project implements the conceptual 3Rs (reuse, reduce, recycle) which led to zero waste and zero discharge. With a capital investment of about USD 2.7 million, Thai Eastern Bio Power Co., Ltd. harvested the benefits of this project after 2.5 years of payback period. The effective-



Source: ASEAN Energy Database System (AEDS). Author's calculations on SME' portion.

Figure 3: Energy mix for SMEs in the ASEAN region

ness ratio is at 0.1 USD/kW. In addition, the company reduced GHG emissions by about 298,964 tonnes of CO2 and reduced water consumption by about 2,686.8 m^3. Accumulated GHG emissions reduction between 2014 and 2016 is 691,782 tonnes of CO2 eq. Taking this emissions reduction into consideration, the investment costs were worth the values of environment sustainability. Comparison between project sustainability and future opportunities shows that the project is financially viable. Furthermore, it is investigated that biogas energy production cost is lower than other types of energy. In 2015, the cost of electricity production was USD 0.065/kW. In addition, Thai Eastern Bio Power Co., Ltd. acquired users benefits such as six-year profit margin gain that supports the company's business expansion; utilisation of waste heat in rubber production process put more capacity in biogas production that supports future production plan; more revenue from selling electricity to Provincial Electricity Authority from 2016 to 2020; and increase in staff's technical skills with trainings in Power House operation. Other positive impacts from this project are the establishment of an RE learning centre, the more stable electricity supply for surrounding community, the creation of new jobs for the locals, the creation of alternative income for the locals with the company's purchase of agricultural products such as palm oil and rubber.

In Myanmar, KKS successfully implemented an RE project by building a solar PV rooftop system in their office in Yangon. The project's commercial operation date (COD) was in March 2013, and after 3 years the company gained many benefits from it. With a cost of about USD 8,500, and a life time of 25 years, the solar PV could reduce as much as 81,851.25 tonnes of CO_2 eq., or 3274.05 tonnes of CO_2 eq. annually. Since 2013, the number of GHG emissions reductions of this project is equal to 9,822.15 tonnes of CO_2 eq. The payback period is less than 5 years with the new tax structure and incentives from new government of Myanmar, and 7.5 years due to high import tax before the new government. The effectiveness ratio of this technology is about USD 1.5 million per megawatt. This solar PV rooftop has already

Figure 4: Various companies received the highest recognition in energy efficiency from the ASEAN Ministers on Energy in Myanmar, 2016 (Photo credit: ACE)

provided many benefits to the owner by saving electricity bill, and reducing the use of fossil fuels to preserve the environment. From an economical point of view, this technology is very profitable for the SME and its stakeholders by reducing energy costs (by saving on expensive fossil fuels) and lowering the poverty of the surrounding community (with jobs creation). The SME also reaped benefit of knowledge transfer and could brand their business as a clean energy company.

The four companies above are only a few from the hundreds of best practices found in ASEAN Energy Awards that could be used as benchmarks or references for other SME in pursuing clean to enhance their competitiveness. In many businesses, electricity is essential in the production process, and makes up a big portion of the production costs. Electricity could be generated with many types of energy resources, including renewables, which are cleaner alternative to fossil fuels. Based on ACE's latest study that looks into the details of levelised cost of electricity from various RE technologies in the region, the average cost of solar PV projects is USD 0.22 per kWh, that of biomass projects is USD 0.092 per kWh, and that of hydropower projects is USD 0.044 per kWh. Interestingly, the Study shows that some RE projects in ASEAN have already achieved a good competitive level of cost to generate electricity. This is shown in the comparison of 4 (four) national utilities electricity selling prices in ASEAN, such as USD 0.073/kWh for TNB (Malaysia), USD 0.109-0.289/kWh for PLN (Indonesia), Meralco (Philippines) about USD 0.120/kWh and EGAT (Thailand) at USD 0.096/kWh. Yet in some Member States, solar PVs are still not as competitive as fossil fuels. The other important thing to note is that the cost for solar PV is very dependant on the business model and the supporting regulations for this technology.

In the long-term, RE technologies in ASEAN are expected to cost less within the cost range of conventional energy or slightly below. Hydropower, geothermal and bioenergy (including waste-to-energy) will drop to between USD 40 and USD 60 per MWh, while costs for solar PV and wind could be as low as USD 40 per MWh and USD 60 per MWh, respectively. In heat generation, the most common alternative to fossil fuels in the industry are biomass and waste. Depending on availability, biomass residues can generate heat process at a competitive cost around USD 17-42 per MWh. For SMEs in commercial/service sector, the most suitable RE technology to be adopted is solar thermal, which is affordable at around USD 18- 22 per MWh. In comparison, coal power generation will range from

Table 1: Commodity price on energy in ASEAN, 2014 vs 2025

Commodity prices	Unit	Business Perspective				Government Perspective			
		2014		2025		2014		2025	
		Low	High	Low	High	Low	High	Low	High
Steam coal	USD/GJ	2.0	4.3	2.6	4.3	2.0	4.8	3.2	6.0
Electricity household	USD/kwh	0.05	0.23	0.05	0.24	0.05	0.23	0.05	0.24
Electricity Industry	USD/kwh	0.06	0.17	0.07	0.18	0.06	0.18	0.07	0.18
Natural gas household	USD/GJ	7.0	13.2	10.9	21.1	7.0	11.0	10.9	17.6
Natural gas industry	USD/GJ	4.6	11.6	6.3	18.5	5.1	9.6	6.9	18.5
Petroleum products for heating/electricty	USD/GJ	15.0	37.3	17.5	39.1	12.8	33.6	15.0	37.3
Gasoline for transport	USD/GJ	12.2	49.4	15.6	51.8	16.1	27.1	18.9	34.2
Diesel for transport	USD/GJ	6.3	34.1	8.0	35.8	16.0	24.4	18.7	28.6
Conventional liquid biofuels for transport	USD/GJ	24.8	39.5	21.7	36.1	21.7	36.1	20.1	33.1
Advanced liquid biofuels for transport	USD/GJ	43.5	82.7	29.8	56.9	32.2	38.2	25.6	34.8
Biomethane	USD/GJ	22.8	44.4	22.8	44.4	20.0	25.0	20.0	30.5
Primary bioenergy	USD/GJ	10.8	18.7	10.0	22.4	10.8	18.7	10.0	22.4
Biomenergy residues	USD/GJ	2.5	4.7	2.1	4.9	2.5	4.7	2.1	4.9
Waste	USD/GJ	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.2
Discount Rate	%/year	5.0	15.0	5.0	15.0	8.0	10.0	8.0	10.0

Source: ACE & IRENA. 2016. RE Outlook for ASEAN – a REmap Analysis.

USD 60 to USD 100 per megawatt-hour (MWh) by 2025. Moreover, industries in ASEAN largely use coal or natural gas to deliver process heat, typically costing between USD 18 and USD 40 per MWh. If we compare the expected RE prices in the long-term (above) with the conventional fuels-based technologies, as Table 1 shows, RE will provide SMEs with cleaner and cheaper prices. Furthermore, RE is more promising to be used in the future because of their higher conversion energy, their life time and lower carbon emissions.

Way forward

Given the challenges that SMEs face in adopting clean energy initiatives, and learning from various best practices provided by the SME that received the ASEAN Energy Awards, SME should consider three key principles in their clean energy transformation journey: investing in human capital; better energy bill; and developing a regional mindset.[6]

Most SMEs may not have a dedicated person in charge of energy management due to lack of financial support or limited resources that are already occupied with the main core business. However, at some level, SMEs may allocate their investment in their operational and maintenance people to increase their knowledge in energy management. SMEs may also tap the support from the government in various energy manager accreditation system, such as ASEAN Energy Management Scheme (AEMAS). AEMAS had trained and certified energy managers who then implemented sustainable energy management systems within their industries/companies. At the same time, AEMAS had increased the professional standing of accredited energy managers.

SMEs often face challenges in financing the costs of their growth. In reality, by adopting energy efficiency initiatives, SME would be able to use the same amount of energy or electricity for their production but with lower costs. Two examples from the ASEAN Energy Awards above show how SMEs are able to get their return on their investments in energy efficiency and to continuously save their energy bills.

As ASEAN is entering the integration phase with the launch of AEC, SMEs in ASEAN could enjoy free flow of goods, investment and services. This leads to the SMEs competing not only locally and nationally, but also regionally. At the same time, the opportunity for SMEs to grow is not only in the limit of their border, but beyond that; they could reach the regional market of 629 millions people. For this reason, SMEs need to consider the clean energy trends in the region. Learning from the experience of hundreds of SMEs that successfully implemented their clean energy

[6]Ho. 2017.

practices, SMEs in ASEAN could build their market in a cleaner way, and at the same time at a lower cost.

To support the SMEs in using more RE and more energy efficient technologies, AMS already took several actions including establishing RE policies, such as setting national target, issuing renewable and/or energy efficiency development plan, selling tariff, giving incentives and financial support, regulating permits and licences, also improving technical aspects and public fund for RE and EE. From one of ACE's study (2016), two policies with the most positive impacts to the clean energy technologies deployment are the settlement of net metering system (for renewables) and energy service company (ESCO) ecosystem. Net metering system is defined as a consumer-based RE incentive scheme wherein electricity generated by an end-user from an eligible on-site RE-generating facility and delivered to the local distribution grid may be used to offset electricity provided by the distributed generators to the end-user during the applicable period. This scheme will positively impact the SMEs who would like to have their own electricity production to cut the electricity costs by using RE technologies. In addition, this policy can ensure SMEs to produce their own electricity by providing monthly metering for the electricity sold and self-produced. This certainty of selling electricity using renewable technology is the determinant point that could motivate SMEs to implement more clean energy projects. ESCO is defined as a company which provides energy efficiency and/or renewable energy-related services including project consulting, project development and management, technical design, energy audits, equipment installation, and project implementation and financing for energy savings and/or renewable energy projects. Once a well-established ESCO supports an SME's programme, the SME would be able to implement more energy savings or renewable energy initiatives. A successful collaboration between ESCO and SMEs will give the SMEs the benefit of being recognised. This is because ESCO's main role is guaranteeing the implementation of energy savings by using more efficient technologies or renewable energy technologies in industries.

This article presents how RE technologies and EE programmes can be beneficial for SMEs and within the reach of SME, as shown by hundreds of successful cases in the ASEAN Energy Awards. Pursuing this not only means that SME could acquire the energy cost reduction and energy savings, but also contribute to reducing a number of GHG emissions, preserving the environment, helping their Member States to achieve the national pledge's targets and ASEAN commitments, as well as getting the recognition at the regional level through ASEAN Energy Awards, among others.

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Asia Pacific Energy Portal

The Asia Pacific Energy Portal is one aspect of ESCAP's support to regional member States under the Asian and Pacific Energy Forum (APEF). The 2013 APEF Ministerial Declaration and Plan of Action and Commission Resolution 70/9 have established the regional energy agenda and request the secretariat to provide implementation support, facilitate knowledge exchange, and review and assess progress leading up to APEF 2018. The portal has been designed to serve as an informational foundation, helping to meet that mandate and support ESCAP's ongoing energy-related activities. The portal was launched at the 71st Commission Session in May 2015.

The Asia Pacific Energy Portal offers access to a comprehensive set of 200+ indicators and 1300+ policy documents related to energy and development from across the Asia-Pacific region. Unique features include flexible and shareable data visualizations, multi-indicator comparisons, policy cross-sections, and searchable full-text policies.

The scope of the portal includes Access, Efficiency, and Renewable Energy, as well as Environment, Pricing, Connectivity, Trade, Investment, Technology and Governance. The portal is designed to support research, analysis and informed decision-making, and, based on user needs, new features will continue to be introduced under an ongoing development process.

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THE CONSUMER AS ENERGY PRODUCER

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Abstract

Sri Lanka is a nation rich in renewable energy resources with over 50,000MW of exploitable wind, water, solar and biomass sources. If these sources are tapped, then, by 2050, Sri Lanka stands to reduce end-user power by a factor of more than 35% and significantly reduce pollution related health issues, increase wellbeing and increase contentment. The present government is strongly committed to moving swiftly to a sustainable era via turnkey programs implemented by HE the President Maithripala Sirisena himself against his own mandate and his statement of intent and commitment to the international community during the key climate and sustainability summits of 2015.

However, there is still a strong liking for a coal-intense energy future for Sri Lanka on the part of the monopoly service provider which seems to be implicitly tied into the coal and oil mafia and their resistance to renewables is both strong and aggressive. Despite the fact that the Strategic Enterprise Management Agency (SEMA) as a key oversight agency for monopoly state enterprise, the Public Utilities Commission of Sri Lanka (PUCSL) as the chief regulator and the President's office have countered these with sustainability-critical policy changes, there are yawning gaps between policy and practice. On the one hand, reducing this gap and ultimately eradicating it lies firmly in the hands of consumers and the extent to which they can work together with the regulators to improve energy service price, quality and continuity. On the other hand, as part of its set of sustainability rubrics, the government has commenced ambitious programs to turn consumers into energy producers.

This article outlines the policy overarch, the basis for renewables, the toque that exists between the various stakeholders and players, possible mitigation and approaches to resolving these conflicts and finally, outlines the mechanisms, instruments and arrangements of the government to utilize integrated, holistic small-smart models with tight citizen ownership to bootstrap Sri Lanka into a sustainable future.

Introduction

With the investiture of Hon. Maithripala Sirisena as the sixth Executive President of the Democratic Socialist Republic of Sri Lanka, in accordance with his manifesto "*A compassionate maithri governance, a stable country*" to the people of Sri Lanka, as well as His Excellency's declaration at COP 21 in 2016, Sri Lanka has committed itself to swiftly and aggressively move towards a development paradigm based on the Global Sustainable Development Goals (SDGs) within an action framework founded on an innovative, knowledge based economy. In terms of the energy sector, two clear directional signals were sent by the President when he declares:

1) *Special attention will be given to energy security due to escalating fuel prices and daily aggravating environmental issues. I will prepare the groundwork for the country to fulfill the basic energy requirements of the people through renewable energy sources such as dendro (biomass) power, wind power, solar power, ocean energy etc. I will specially take action to build dendro power stations throughout the country so that electricity consumers' money that hitherto drained to the pockets of the coal and oil mafia will flow into the rural peasantry. Thus I will make power generation a chief means of raising the living standards of the peasantry.*
2) *I will gradually remove all subsidies now given for fossil fuel and hand them over to obtain renewable energy technology. In this way I will take steps to supply energy to the consumer at low cost. A rapid program will also be undertaken to obtain for our country long term concessionary loans for clean energy that are already instituted in the world. (Sirisena, 2015)*

The above makes it clear that any energy policy for Sri Lanka will have to be based on and revolve around the development of Sri Lanka's significantly large renewable resources both in concentrated and scattered geographies. This policy view is reflected in the ten year interim ten year plan which looks at a holistic approach to ensuring Sri Lanka's energy security that has comprehensive strategies in place to develop the supply side through a clean energy paradigm while addressing the demand side through a conservation based usage paradigm. That plan envisages an ambitious strategy for making Sri Lanka energy self-sufficient by 2030, increasing the share of renewable energy from 50% in 2014 to 60% by 2020 and 100% by 2030 while ensuring 100% accessibility, high service quality and excellent service continuity (Ministry of Power and Energy, 2015).

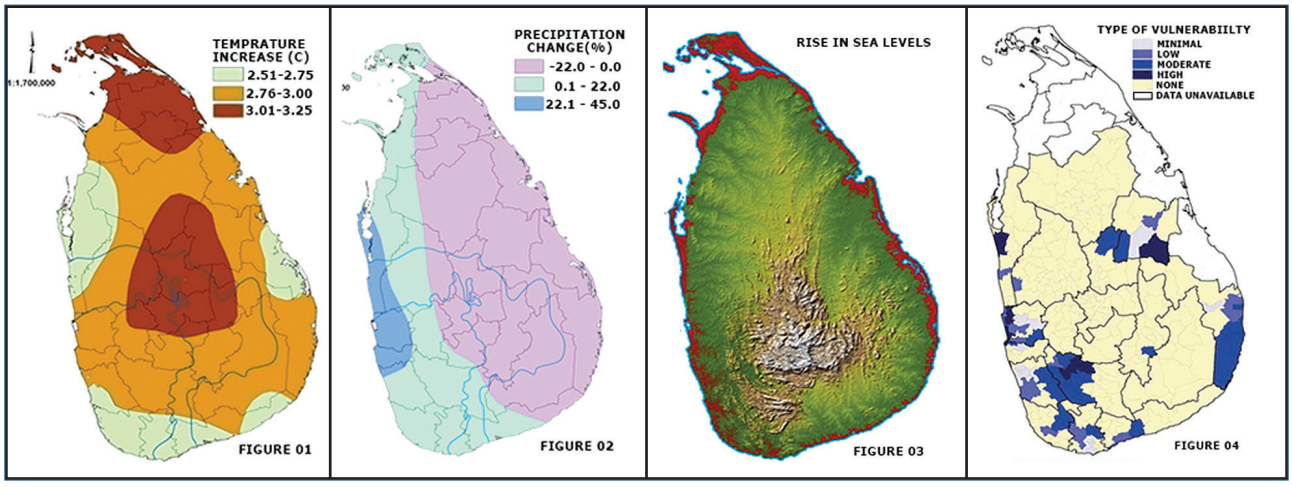
It is pertinent to review Sri Lanka's socio-economic indicators against which such a shift needs to happen. In that respect, Sri Lanka is ranked in the upper mid-range of the United Nations Human Development index, while the Gross Domestic Product (GDP) per capita too is in the upper third in 2016 (66th rank) while its GDP against Purchasing Power Parity (PPP) is slightly higher and ranked 58 (World Bank Group, 2014). Regionally, it scores high in enrollment rates and life expectancy while it scores low in teenage pregnancies and infant mortality. It has low poverty rates and very low extreme poverty rates while its low GENI coefficient is low (Trading Economics, 2016) and indicates better wealth distribution than many developed countries. It ranks among the top five in giving (World Giving Index,2016). Despite comparatively high performance on economic indices, it ranks in the higher-bottom of the Happiness Index coming in at rank 117 (World Happiness Report, 2016) and is one of the least happy among Buddhist majority countries(Brown, 2016). It scores in the middle on corruption as the 95th least corrupt nation (Trading Economics, 2016) with the judiciary, police, public services, land administration, tax administration, public procurement, natural resources legislation, civil society all biased towards bypassing due-process (GAN Integrity, 2015) and despite its claim to be democratic, it is in effect, a feudal system of governance in which democratic spaces are compromised by the degree of alignment of individuals, groups and public and private entities with the rulers of the country (Seneviratne, 2011). Additionally, its per capita public debt is one of the highest in the region standing at USD 2,632.11 and its debt to GDP ratio of 81.4% is one of the highest in the world and ranks in the top 10% in this category (The Economist, 2016). Much of that debt has gone into servicing the energy requirements of the country either through the building of power stations or in the purchase of non-indigenous, fossil fuels. In summary, the social, economic and political intermesh of the country is complex and sustaining any initiative whether it is for the good of the country or not is a challenge.

Against that background, and, given the fact that Sri Lanka has had its fair share of impacts of the combined crises of energy, food, climate and finance and the fact that its socioeconomic stability is tenuous because of its dependence on external energy sources, future-proofing the country would necessitate weaning it away from fossil fuels and quickly and efficiently tapping its vast renewable resources. Ensuring sufficiency and security in the energy sector therefore requires a substantive shift in thinking and an innovative and aggressive paradigm shift in the way Sri Lanka views how it will assure its future generations of socioeconomic stability and necessitates:

a) the committed sociopolitical desire to stabilize climate, reduce cost of energy production and consumption, reduce cost of food production and consumption, and increase foreign exchange savings;
b) the rejection of the idea of continuing to energize Sri Lanka with fossil fuels;
c) the rapid reduction of use and the ultimate decommissioning of all fossil fuel based energy generation facilities, methodologies, instruments, engines and equipment;
d) the aggressive, committed drive towards achieving 100% of energy requirements through indigenous non-fossil alternative fuels;
e) creating the desire in the minds and hearts of Sri Lankan citizens to move swiftly towards a holistic, conservation based, toxin-free consumption paradigm; and
f) creating the enabling environment for consumers to become producers of energy, food and money (Toxin-Free Nation Program, 2016).

The case for renewables

In order to realize points (a) through (f) above and bring about a sustainable shift in thinking, it is pertinent to review the extent to which fossil fuel driven climate instability threatens the country, how rich Sri Lanka is in renewable resources and how ready it is to move towards them.



Source: Dr. B.V.R. Punyawardena, Senior Climatologist, University of Peradeniya, R.D.S. Jayathunga Director Climate Change Secretariat

Figures 1–4: Climate change effects in Sri Lanka

While Sri Lanka is only a marginal contributor to the climate crisis, it is an island nation heavily impacted by its effects. if atmospheric carbon concentration is stabilized at around 700ppm, then Sri Lanka's average temperature will increase by a factor of approximately 2.5°C with the frequency of climate disasters and the number of climate refugees increasing. Already, the effects are seen in the significant increase in natural disasters (Figure 1).

Figure 2 shows that the dry zone (mauve) will get dryer with the percentage drop of up to 22% in precipitation and that the wet areas (dark blue) would get wetter with up to 45% more precipitation. The other areas (light blue) will have a change of up to 22% towards wetness. Since most of Sri Lanka's economic activity is in the coastal zones, sea level rise (Figure 3) will have a significant impact on that area and its populations and livelihoods such as fisheries. Figure 4 shows a significant increase in floods and landslides in the areas marked due to climate change. Clearly, climate change is going to continue to impact Sri Lanka and even with just a 1°C rise, the citizens are suffering floods and droughts on an unprecedented scale, and, with all indications pointing to an increase of 3 degrees, the impact, destruction and trauma would be much worse and it is essential that we adapt to that and if we cannot, we must start thinking of migration (Abeygunawardhana, 2016).

Despite the fact that adaptation is more critical to Sri Lanka than mitigation, the severe negative impact of the use of fossil fuels on the economy, human health, environmental health and overall resilience of the country indicates that there is an urgent requirement to actively explore possibilities for tapping its renewable resources.

Potential for achievement of 100% renewables: Taking global 2050 targets of Business As Usual (BAU) scenarios against Wind, Water, Solar (WWS) scenarios, Sri Lanka ranks 29th among 139 countries in being able to achieve 100% renewables with a total forecast capacity of 50GW of all-purpose WWS against a 6.6% current WWS capacity against 2050 scenarios so it is one of the countries of the world with the most possibility of achieving global targets by 2050 and one of the countries with the greatest potential for achieving at least 60% of the local renewable target by 2030. Additionally, there would be a 36.41% drop in end-user power by 2050 with WWS scenarios according to the 2014 study done by Mark Z. Jacobson and his team from Stanford University USA[1] (Table 1).

The above study has not used biomass electric generation and given the fact that 41% of Sri Lanka's total energy comes from biomass, when this renewable is added to the above, the actual scenario is better than even the above predictions.

Renewable energy generation potential: Sri Lanka has approximately 5700km of windy areas with the potential for a staggering 22,000MW potential installed capacity (Sri Lanka Sustainable Development Authority, 2015). Small scale generation where the consumer becomes a producer plays a crucial role in exploiting scattered renewable resources and in that respect, there is approximately 500MW of micro-hydro and approximately 500MW of micro-biomass-electric (Abeygunawardhana, 2016) through rural electrification utilizing glyrecedia as the primary bio-feed. Additionally, Sri Lanka is in the highest potential zone for exploiting solar irradiance on the ground in terms of Kwh/m^2/day (Jacobson: 2014, pp:21) and according to the same report (pp:35), the potential for small scale generation, calculated via the Utility-scale PV determined with the NREL Global Solar Opportunity Tool (NREL, 2012b) for areas exceeding 4 kWh/m^2/day, is significant as shown in Table 2 and Figure 5.

Table 1: Business As Usual (BAU) scenarios against Wind, Water, Solar (WWS) scenarios for Sri Lanka

Scenario	Total end-user load (GW)	Residential % of total	Commercial % of total	Industrial % of total	Transport % of total	Agri/ Forestry/ fishing % of total	Other % of total	Overall % change in end-use power with WWS
BAU	22.1	30.73	7.06	30.88	28.57	0.05	2.71	-36.41
WWS	14.1	35.08	8.68	38.69	14	0.06	3.49	

Table 2: Potential for small scale solar power generation in Sri Lanka

Residential rooftop PV				Commercial/Government rooftop PV			
Rooftop area suitable for PVs in 2012 (km^2)	Potential capacity of suitable area in 2050 ($MW_{dc\text{-}peak}$)	Proposed installed capacity in 2050 ($MW_{dc\text{-}peak}$)	Percent of potential capacity installed	Rooftop area suitable for PVs in 2012 (km^2)	Potential capacity of suitable area in 2050 ($MW_{dc\text{-}peak}$)	Proposed installed capacity in 2050 ($MW_{dc\text{-}peak}$)	Percent of potential capacity installed
94.6	18,979	11,368	60	52.4	12,787	7,660	60

[1]Jacobson, Delucchi, Bauer et al, Standford University USA, 100% Clean and Renewable Wind, Water, and Sunlight (WWS) All-Sector Energy Roadmaps for 139 Countries of the World, 2015, pp: 9

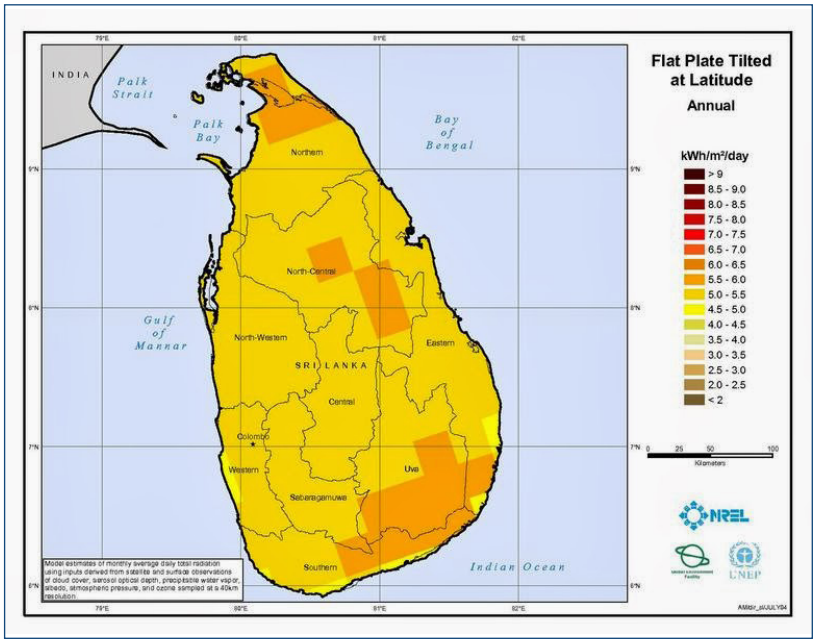
Finance, health and climate cost savings: According to the Jacobson study, in a 100% WWS scenario, each citizen in each of the 139 countries studied will save USD 170/year in energy costs alone. Sri Lanka stands to save significantly in these aspects as show in the Tables 3, 4 and 5 (Jacobson et al, 2015).

Additionally, with a full 41% of the energy requirement of Sri Lanka coming from biomass (mostly used for domestic cooking and low temperature heating), if the potential for biomass-electric is increased, then the above scenarios would become even better. In all, such is the richness of Sri Lanka's renewable resources that with the proper strategic plan, it can meet its entire electricity demand with those sources by the year 2034 even without improving end-user efficiency as seen in Figure 6 (Watson, 2017).

At present, the energy mix in Sri Lanka comprises of 53% renewables, 39% petroleum and 8% coal. However, biomass is inefficiently tapped as fuelwood for hearths and heat. However, if this source, coupled with WWS resources are used to generate the secondary energy source of electricity, the socioeconomic outlook will improve vastly and sustainability potential fully realized.

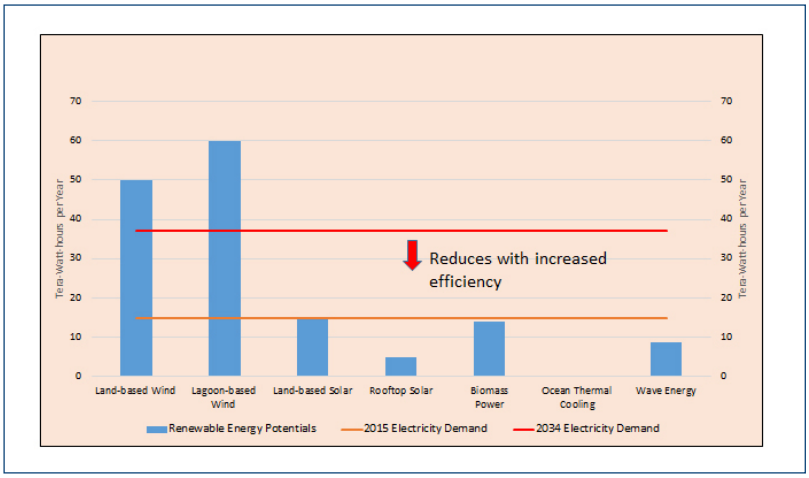
The challenge of changing the mindset

The leader of the country is fully committed to the cause: The President of Sri Lanka, Hon. Maithripala Sirisena has been stronger than most world leaders in his commitment to shifting to indigenous renewable energy resources. This can be clearly seen by the statements in his mandate (pp1) and in his policy statement at the 8th Parliament on September 1st 2015 where he reiterated the fact that he will a) fulfill the basic energy needs of people through renewable energy, b) enhance energy security by protecting against escalating imported fuel prices, c) improve environment by inclusion of environmental factors in decision making, d) build biomass power plant so that rural peasantry supplying fuelwood will benefit, e) remove subsidies for fossil fuel and support renewable energy, and f) obtain long term concessionary loans for clean energy from global funds. These remarks were further bolstered by his statements



Source: NREL Global Solar Opportunity Tool

Figure 5: Potential for small scale solar power generation in Sri Lanka



Source: Asoka Abeygunawardana, Chairman, Strategic Enterprise Management Agency

Figure 6: Renewable energy technical potential compared to electricity demand in Sri Lanka

to the international community at the UN SDG conference in September 2015 where he stated that Sri Lanka will minimize risks of climate-related environmental hazards and study how climate change aggravates Sri Lanka's contemporary development challenges and offer adaptation and mitigation options. His statements at the Paris Climate Agreement in October 2015 where he stated that Sri Lanka will ensure an unconditional 4% reduction by 2030 against 2010 baselines and conditional emissions reduction with external support of 16% by 2030 underscores that commitment. To move policy into practice, he has also appointed a Parliamentary Energy Oversight Sub Committee to prepare a National Electricity Policy, strategies and implementation plan to achieve these policy goals (Watson, 2017).

Table 3: Sri Lanka - Financial savings in terms of energy, health and climate

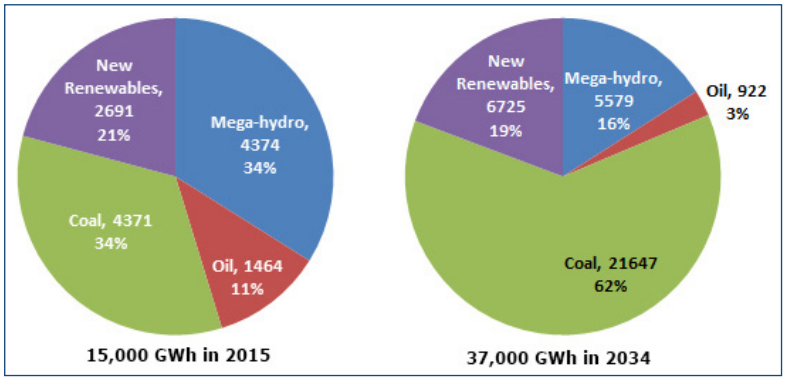
(a)	(b)	(c)	(d)	(e)	(f)	(g)
2013 LCOE of BAU (¢/kWh)	2050 LCOE of BAU (¢/kWh)	2050 LCOE of WWS (¢/kWh)	2050 Average electricity cost savings per person per year ($/person/yr)	2050 Average air quality health cost savings per person per year ($/person/yr)	2050 Average climate cost savings per person per year ($/person/yr)	2050 Average energy + health + world climate cost savings due to WWS ($/person/yr)
8.89	9.86	10.05	20	750	289	1,058

Table 4: Sri Lanka - Avoided air pollution PM2.5 plus ozone premature mortalities by country in 2050 and mean avoided costs (in 2013 USD) from mortalities and morbidities

2050 High avoided premature mortalities/yr	2050 Mean avoided premature mortalities/yr	2050 Low avoided premature morta lities/yr	2014 Mean avoided cost ($2013 mil./yr)	2050 Mean avoided cost as percent of 2050 GDP
5,957	2,568	601	18,863	2.6

Table 5: Percent of 2013 world CO2 emissions for Sri Lanka (GCP, 2014) and low, medium, and high estimates of avoided 2050 global climate-change costs due to converting to 100% WWS for all purposes (in 2013 USD)

2013		2050 avoided global climate cost ($2013 bil./yr)	
Percent of world CO2 emissions	Low	Medium	High
0.043	15.5	7.3	4.1



Source: Ceylon Electricity Board, Long Term Generation Plan, 2015-2035

Figure 7: Generation (GWh) in 2015 and 2034 per Ceylon Electricity Board (CEB) Long Term Generation Plan (LTGB)

The implementing agencies tasked with mapping out the action plan are in opposition: Despite the very powerful and farsighted statements made by HE The President, the Ceylon Electricity Board (CEB), which is the monopoly electricity provider to the nation is still firmly entrenched in fossil fuels and has been aggressively promoting the coal mantra for some time now. Their Long Term Generation Plan (LTGP) from 2015-2034 plans a major shift to coal. There strategies for doubling the share of coal energy by 2034 (a six fold increase in coal electricity) will increase carbon emissions by 500% and will only act to worsen energy security and damage the environment resulting in a highly resistive environment to meeting the INDC targets shown in figure 7 (Watson, 2017).

The regulator has read the ground situation better: Happily, the Public Utilities Commission of Sri Lanka (PUCSL) rejected this generation plan as being inconsistent with national policy and is firm in its directives to the monopoly agent (CEB) that it must substantially harmonize its long term strategy with both the nation's indigenous resource tapping plans as well as Sri Lanka's commitments in the international arena.

The engagement environment is resistive: Against the above mentioned background, it must be understood here that the torque between the state, the regulator and the service provider have resulted in significant delays in energy sector generation planning reforms. While diplomatic, evidence based dialogue is essential, at present, the battle-lines between entrenched positions of the fossil-fuel proponents and the renewable energy lobby have made for a highly toxic and acrimonious engagement environment. While such conditions exist, any diplomacy to bring about a reconciliation towards a common policy-practice methodology aligned with national and international covenants, agreements, stratagems and interests seems remote. Yet, there is hope among the citizens of the country that the establishment of the parliamentary oversight subcommittee on energy will bring about the required align-

ment and place the country on a firmer footing vis-à-vis energy security and sustainable development.

The role of the consumer in eliminating the gap between policy and practice

Closing the gap between the consumer and the regulator: At present, in Sri Lanka, despite democratic processes and oversight agencies being reinstated with the regime change and the investiture of HE Maithripala Sirisena as President, there is a yawning gap between regulators of monopoly services such as energy and the consumer which makes the regulatory task difficult. This critical tie-in was highlighted by the Director General of the PUCSL at the launch of the National Consumer Network of Sri Lanka (NCNSL) where he stated that *"The primary task of a regulator is to strive to even out the power differential between a monopoly supplier and the consumer to the optimal extent possible. Secondarily, the regulator compiles the legislative framework and advices the government on the engagement rubrics between a supplier and a consumer. All of these exercises are driven by the concept of equity and fairness and the entire engagement should be equitable to bot the supplier and the consumer and that all regulatory tasks are highly transparent and that there is regulatory clarity on the price paid for such services, its affordability and its quality during and after the sale of services and, to achieve this, it is critical that there are strong ties between the consumer and the regulator*.

Mr. Kumarasena's views were further underscored by Mr. Asoka Abeygunawardhana, Chairman of the Strategic Enterprise Management Agency (SEMA) at the same gathering where, he, for the first time, gave the public a very clear indication that this particular government is committed to doing something no other regime in the recent past has done and that is to actively woe and convert the citizen of Sri Lanka into a conscious consumer as part of its strategy for aligning the nation with the SDG goal for conscious consumerism (Goal 12).

In that respect, it is pertinent to reproduce a key section of his address where he states *"…the regulators are also helpless and despite efforts being made by them to reach consumers there is no established mechanism through which this is possible. It is because of this that in the past, a few individuals had to shoulder the responsibility of taking the engagement forward. These were the civil society organizations of the country. These groups voiced consumer concerns related to their mandates and operational priorities as and when such issues came up. However these efforts yielded but limited success. Although those efforts were able to address reactive, short-term solutions to problems they were not long-term sustainable where there were more permanent solutions to consumer problems. Our strategy is to gather together civil organizations on common problems and organize them at the village, district and provincial level as an informal consumer voice that has not reached the national level as a strong, durable and high-impact cloud capable of positively impacting consumer affairs and not just as another "organization". The network will act as the intervening body in the future to find permanent resolution to the many consumer problems and issues that vex the Sri Lankan citizen"*.

As both Mr. Abeygunawardhana and Mr. Kumarasena stated to civil actors recently, *"if the energy consumer connects to the energy regulator, almost all policy problems and a substantial number of practice issues can be solved both quickly and easily and in that respect, the role of Civil Society Organizations (CSOs) is critical*[2]. Here, it must be noted that the efforts of such civil organizations as the Energy Forum (EF), The Sarvodhaya Movement and The Center for Poverty Analysis (CEPA) have proven to be crucial since they combined with each other and worked closely with the PUCSL and the Consumer Affairs Authority (CAA) to formulate the people's energy charter that clearly demanded a shift to renewables and stronger ownership of the processes through which monopoly service providers supplied them with essential items (CEPA, EF, 2015). These efforts will, according the SEMA, the PUCSL and the CAA be further consolidated, enhanced and expanded to create a genuine, strong, aware and island wide consumer voice that has strong advocacy capabilities, greater engagement skills and firmer penetration and ownership of the policy process that service providers will find increasingly more difficult to ignore.

The energy consumer as energy producer

Sri Lanka's renewable resources are scattered across the island. Both solar and biomass potential is significantly high due to island wide solar iridescence and island wide gliricidia cultivation possibilities for use as bio-feed into biomass-electricity systems. Additionally, there is untapped potential for micro-hydropower plants in many areas of the country.

Civil actors to the fore in reimagining energy generation strategies: The key problem for energy equity and energy security was rooted in the fact that until 2008, legislature and policy only recognized plants generating more than 1MW of power as eligible to be grid connected. While this did give rise to mini-hydro projects, lack of proper oversight, environment and human damage arising from such projects created a negative idea of such initiatives in the minds of environmental activists and social anthropologists. In was therefore logical for small rural groups to start considering micro-level energy generation for highly localized, off-grid utility and in the late 1990s, a World Bank grant allowed many micro-hydro projects to be built in various parts of the country where such resources were available and where electricity was not. These projects typically generated between 10KW and 100KW and the plants were manned by the beneficiary communities themselves via local electricity consumers' societies. However, a concerted effort of the then regime to provide 100% electrification, grid connections were made available to almost off parts of the country resulting in these micro-hydro projects falling into disrepair.

It was at this stage that the civil organization known as the Energy Forum (EF) consolidated the communities who had previously used locally generated electricity into a collective called the Federa-

[2]Inaugural meeting of the national steering committee of the NCNSL

tion of Electricity Consumers' Societies. The aim was to explore possibilities of restarting local generation and connect to the national grid. The then Minister of Power and Energy Hon. Patali Champika Ranawaka, recognized the importance of such efforts and cleared the required institutional arrangements and policy modifications that allowed these power stations to connect to the grid. The technology for doing this was innovated by local engineers in Sri Lanka and the EF became a key actor engaged in the effort for energy equity and energy sustainability. It also opened the doors wide for other forms of renewables to be connected to the national grid via similar processes and the enabling environment for tapping Sri Lanka's vast water, solar and biomass potential created.

What now remains to be done is to determine a feed-in tariff that will enable the new breed of consumer-producer to be rewarded for providing excess to the grid via a specialized metering system.

Tiny hydro: These technologies were pilot tested at a micro-hydropower plant generating 20KW of power in the village of Athuraliya in the Ratnapura district connected to the grid benefiting approximately 65 families in the village and immediately improving their economic stability, their lives and lifestyles. It was a global first that was lauded by then Minister who personally commissioned the revamped power plant.

Tiny solar: In a first for the region, the present government, going with global sustainable science, has initiated a program to generate 5KW each from one million domestic rooftops for a total of 500MW of electricity through its "Battle for Solar Energy" initiative. The technology has already been pilot tested and the government, working through its project flagship organization SEMA, will work closely with civil actors such as the Energy Form, the Sarvodaya Movement, Sevalanka et al. to make this a reality in both urban and rural settings. Although this is but a tiny part of the potential for rooftop solar it is anticipated that it will provide the critical mass to shift the mindset of the citizen from a consumer to a producer and set the country firmly on the path to energy redemption.

Small biomass: Once again, the government has an ambitious plan to rapidly increase the biomass incidence in the country as a precursor to rural biomass-electricity generation. During the national tree planting day of 2016, HE the President himself inaugurated the one billion gliricidia tree planning initiative through which it is anticipated that Sri Lanka will have the required biomass for generating at least an additional 500MW of rural power and enable him to keep his promise to the people in terms of improving energy security and economic stability. Additionally, while the biomass itself can be utilized for generating electricity, the leaves of the plant will be utilized to manufacturer nitrogen rich organic fertilizer as part of the larger plan of the present government to create a healthy, sustainable nation through its Toxin-Free Nation Program (TFNP).

Resistive forces are arrayed against the consumer becoming a producer

The loss of monopoly: Hitherto, the CEB and its subsidiaries enjoyed a monopoly in providing this service. However, if many consumers turn to producing tiny amounts of electricity then, then on the one side, the CEB stands to lose a substantial chunk of its market while on the other, it will have to significantly modify its distribution strategy to accommodate such consumer intrusion into its generation plans. Given the high levels of resistance seen in the engineers at the CEB who have taken to the media to try to promote its coal intense strategy, there are implications not no direct assertions that they fear that such an intrusion into their power base will eventually make them redundant.

The lack of a conservation mindset in the consumption patterns and habits of the consumers: A key issue with reducing the cost of utilities to consumers is that they view this reduction as a path to use more of the utility until they reach the cap purchase price they are used to. A case in point is what happened in 2015 when the newly established government dropped the price of petroleum where it was seen that there was an immediate rise in vehicular traffic with citizens using their private vehicles more because of the price relief. Instead of going to conservation of financial and energy resource, the scenario had the opposite effect to the one intended, fuel purchases increased as did road congestion leading to waste of both time and fuel with the reciprocal increase in time spent on the roads. A similar scenario might occur with tiny solar with consumers increasing the use of appliances to reach their purchase power despite the potential for reducing their energy bill with their own generated electricity[3].

In terms of the above issues, the CEB must reimagine its role within an innovation economy that is indicated in realizing the SDGs and understand that it is the only organization currently capable of establishing and operating large renewable WWS plants and that such large scale generation should be utilized to power the transport sector which is the largest consumer of fossil fuels.

The way forward

It is imperative that going on into a future where there is distributed, tiny energy generation factored into the national generation plan and economic outlook. However, this mandates that the CEB shifts its own strategies away from a coal-intense future. At present, they do not seem to be aware of the massive technological gains in the renewables sector, believing that grid-connecting these technologies is fraught with many problems founded on their intermittency[4]. To combat renewable variability, Mr. Asoka Abeygunawardhana pointed out the fact that the pumped water storage power plants recommended in the CEB's LTGP could be used precisely for this purpose[5]. Additionally, and more importantly, the CEB can and should position

[3]Gonesekera, H.N., General Manager, Lanka Electricity Company, Personal Communication, SLFI,
[4]Edirimuni, Chamil: Personal communique, June, 2016
[5]Abeygunawardhana, Asoka: Report to the Parliamentary Energy Oversight Committee, October, 2016

itself and its large renewable generation plants to service the transport sector in a scenario where all transport is powered by the clean, secondary source of Electricity.

On the demand side, the consumer should become more attuned to a conservation mindset. The Toxin-Free Nation Program, the SAHASARA transport initiative, the Battle for Solar Power initiative and the National Consumer Network, all implemented by SEMA under the Presidential Secretariat are the perfect game changer vis-à-vis demand side management and resource conservation and all of these programs will in the future come under the president's directive for a sustainable era for Sri Lanka and create the enablers to make Sri Lanka a global role model in the use of sustainable trends, emerging technology and far-sighted government policy to reboot the country first and the planet next in the course of the next 15 years.

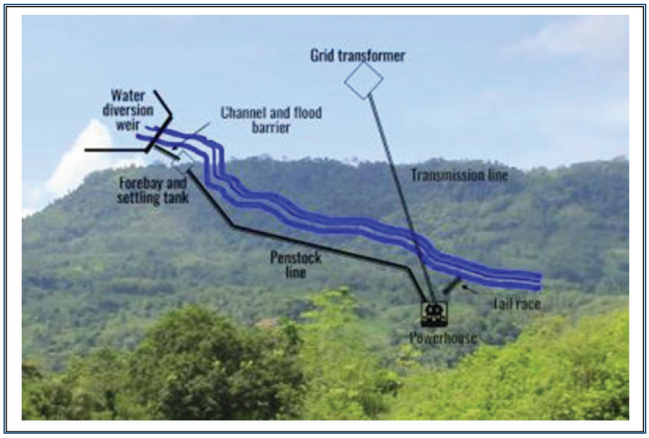
Case study: The victory at athuraliya – the consumer as producer

The Background

The Energy Forum (Guarantee) Limited (EF), as part of its ongoing work to ensure sustainable, affordable, environment friendly energy to rural communities created and implemented an innovative exercise for assuring financial viability of vulnerable rural micro hydropower projects via grid connectivity through a nationally replicable model piloted at three village power plants. The intervention benefited a total of 150 families (1114 individuals) through a uniquely modified set of technical innovations as well as mandatory policy changes that modified existing power purchase agreements for small scale electricity generation operations to connect to the grid.

The project enabled continued operational viability for thee micro hydropower plants generating 68KW of electricity that were in danger of closing down as a result of the penetration of fossil fuel based national grid connectivity to those rural communities.

The exercise was a first in Asia where such small sources were grid connected and resulted in a heightened awareness at the policy level of the potency of such exercises while also providing the communities an additional income that they could use to improve their living standards as well as the opportunities available to them with new ability to use electrical items such as televisions, computers and nighttime lighting that were impossible to consider before the intervention where even the off-grid power plant could only provide limited power services to the communities.



Athuraliya: Diagrammatic representation of the 20KW micro-hydro project

Athuraliya: Power station viewed from the stream

The direct environmental impact has been strong with a comparative reduction in the rural carbon footprint at the pilot level and a much large national potential for overall significant emission reductions. Additionally, the collateral social impacts have increased the time of study of children, increased the use of technology for information and learning and reduced health hazards of wood burning for cooking and heating and use of bottle kerosene lamps for lighting.

The process was comparatively complex since it had never been tried before and required the Energy Forum to address a) Administrative framework for each rural micro hydropower plant, b) The national policy framework, c) The profit model, d) Installation of the plant and e) Maintenance of equipment.

The action

a) **Administrative framework for each rural micro hydro plant:** The Energy Forum (EF) created the Federation of Electricity Consumers' Societies (FECS) as a network of the 200 micro hydro plant owning communities in 2003 to address the technical, social and financial issues associated with village micro-hydro schemes. The Village Elec-

Athuraliya: Rural youth trained to maintain the station

tricity Consumers' Society(VECS) could not do business with the utility so the EF converted them into registered companies. A tripartite governing structure for each plant was established as a rural entrepreneurship with two directors from the community, two from the FECS and one from the EF. The partners of these entrepreneurship were the families who contributed to the running and upkeep of the original off-grid plant.

b) **Policy framework:** This was by far the most difficult to establish. While a power-purchase agreement(PPA) tariff was announced for biomass, wind and hydro, these were tailored to suite larger projects such as mini-hydro and above which connected to the 33kv overhead line. There was no system outlined for micro-hydro or lower which connect to the 230v side of a transformer. The EF suggested an innovative application of net metering to a small scale PPA to which the regulator acceded.

c) **Profit model:** The VECS, FCES and EF are in partnership. The equity share is between 40-60% to the villagers and the rest goes to the FCES and EF for their investment in new machinery, grid-connection technology, domain expertise. The PPA is designed to let the VCES credit an equal share of the equity stake of all the participating (partner) families after subtracting maintenance, manpower and after subtracting the equity stake of FCES and EF. At present, a family enjoys between Rs.300-Rs.500 income per month.

d) **Installation:** The EF provided all technical expertise to either set up new plants or revamp existing plants.

e) **Maintenance of equipment:** The EF provided technical training to at least 2 plant operations on maintenance of the equipment to ensure that the organization did not require external inputs.

The technology

There was no technology available to connect hydro plants in the rage of 10KW-100KW to the national grid in Sri Lanka. Therefore, the following was done:

The induction generators in the village hydro schemes were connected to the grid by modifying the winding, IGC and adding necessary protection for main failure condition. The Induction Generator in a village hydro scheme was used in a 230 V Delta connection, therefore, the winding was rearranged in a 400 V Delta or 400 V Star for the grid connected operation. The existing IGC was used to match the frequency before synchronizing and the acceleration power at the grid trip condition to avoid over speed. The Synchronizing Relay was introduced to monitor the grid and generator frequency and to adjust the generator frequency close to grid value by adjusting the IGC's operating point. The mains failure relay detected mains failures and tripped the contactor.

The World Bank who were the original force behind the small hydro power projects accepted this technology as a valid and viable mechanism that could be standardized.

The innovation

1. The connection of micro hydropower to the national grid is an Asian first according to World Bank sources. In Sri Lanka,
2. The creation of the policy framework which redesigned existing net metering metrics to a PPA through the intervention of the EF and FCES is unique in the region.
3. In many entrepreneurial exercises aimed at tapping renewable sources in Sri Lanka, the entrepreneurs are not the original users of these sources. The practice hitherto was that these business ventures would pay the communities a pittance for the use of the resource (in some cases, with political pressure, not even that) and then exploit the resource. The EF, FCES model insists on strong community ownership, community entrepreneurial engagement for running and upkeep and a profit model optimized for community benefit and targeting expansion and growth of their venture as well as their collective economies.
4. The technology to connect to the grid was locally innovated as a low cost, high performance solution to the problem that could be easily absorbed by the community entrepreneurship itself. The design of the control panel by local engineers to fit the specific conditions of electricity supply in Sri Lanka is unique.

The benefits

The intervention benefited a total of 1114 individuals (approximately 150 families) including 572 women and girls by: a) mobilizing communities, b) establishing the village level profit models, c) Creating the necessary policy environment, and d) Providing required technology.

While the intervention was primarily aimed at rural economic empowerment and environmental resource conservation, it has collateral social benefits as well.

Economic benefits: The intervention of the part of the Energy Forum provided 68KW of

hydropower from the target communities to the national grid and the three power plants generated a total of LKR 506,696.38 in 2014, LKR 534,072.00 in 2015 and LKR 118,583.00 in 2016 for each Rural Electricity Consumer's entrepreneurship indicating LKR 300 – LKR 500 for each family.

Policy benefits: The project enabled thee micro hydropower plants that were in danger of closing down as a result of the penetration of fossil fuel based national grid connectivity to those rural communities. With the Energy Forum intervention which was a first in Asia, the policy environment changed dramatically with a modified PPA based on rural net metering enabling the continuation of small scale electricity generation projects.

Environmental benefits: The three power plants enabled a total 557.42 tons of CO2 emission savings each year. It also reduced the amount of fuel wood use for cooking and heating by 30%.

Social benefits: The social impact has been profound for the people who are now able to use some of their generation income to increase use of electricity through use of more electrical appliances that increased the time of study of children from ½ hour in the evening to 3 hours, reduced the incidence of lung infections in women and girls due to smoke inhalation from cooking fires and reducing the number of accidents among both children and women from the use of bottle-kerosene lamps for lighting purposes.

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Asia Sustainable and Alternative Energy Program

The Asia Sustainable and Alternative Energy Program (ASTAE) is a global partnership created in 1992 to scale up the use of sustainable energy in the Asia-Pacific region in order to reduce energy poverty and protect the environment. Achieving this objective rests on promoting ASTAE's three pillars for sustainable development: renewable energy, energy efficiency, and access to energy. Activities that support countries in adapting to and mitigating the impacts of climate change cut across these three pillars.

ASTAE's focus dovetails with the objectives of the global Sustainable Energy for All (SE4ALL) initiative, which aims to ensure universal access to modern energy services and double the rate of improvement in energy efficiency and the share of renewable energy in the global energy mix by 2030. ASTAE programs help design, implement, monitor and evaluate World Bank investment projects and provide technical assistance in 23 East Asia and Pacific (EAP) and South Asia (SAR) countries.

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Support on renewable energy and case of solar PV in Viet Nam

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Abstract

The article discusses the Vietnamese governmental support on renewable energy, with focus on financial mechanisms including feed in tariffs, tax exemption, establishment of renewable energy market and other incentives. A case study of solar PV is introduced in the article, with updated information on the draft mechanism on the feed in tariff for solar energy project, including rooftop solar and grid-connected solar project. It is indicated that the mature establishment of supportive mechanism at the very first stage, which will be followed by the formation of a competitive renewable energy market, is crucial factor to encourage the development of renewable energy and solar PV.

Overview

Renewable energy plays an important role in ensuring energy security and combating climate change. Investments in renewable energy contributes to the diversification of energy technology. At the same time, the development of renewable energy reduces energy import and protects the economy from the fluctuation of the global fuel price.

To encourage the development of renewable energy, it is necessary to shape the supporting mechanisms financially and economically, which will help to reduce production costs and encourage the transfer and application of technology, improve production lines, increase the number of piloting projects and encourage the technology deployment at a larger scale.

Vietnam is currently active in developing the policies and mechanisms to support the development of renewable energy. This article will analyse policies and financial mechanisms for renewable energy in Vietnam, focusing specifically on the case of solar PV. Through the analysis and assessment of the effectiveness of the policy and the existing mechanisms, the article indicates some remarks for promoting renewable energy and solar power in Vietnam.

Incentives for renewable energy

In order to support the development of renewable energy, some supportive policies, incentives and financial tools such as feed-in-tariff; renewable energy market; renewable energy standard portfolio; investment insurance; investment, loan and public finance; funding; tax exemption and tax incentives; net metering and environmental fee; have been proposed (Table 1).

Feed-in tariffs

Feed-in-tariff is the most common form of financial support to promote renewable energy. Feed-in-tariffs, actually, is the subsidy for renewable energy to ensure that renewable energy can be competitive to conventional energy. In Vietnam, the feed-in-tariff was established for biomass cogeneration and wind power at 5.4 US cent/kWh and 7.2 US cent/kWh, respectively (excluding value added tax). The feed-in-tariffs are calculated based on the avoided cost tariff, i.e. the hydropower generation cost. The hydropower is the type of renewable energy which has been developed from the very early days, and has completely developed so far; therefore, the hydropower generation cost is quite low.

According to the renewable energy developers, at the current feed-in-tariffs, it is not feasible for most renewable energy power generation projects. The average production costs of electricity from renewable energy are in the range of 5.8 to 27 US cent/kWh (Pham, 2012). Bio-electricity prices range from 5.8 to 13 US cent/kWh, due to the large differences in raw material costs. Cost for electricity from bagasse and rice husk are the lowest among different types of renewable electricity. Wind power has a slightly higher price, in the range of 6 to 8 US cent/kWh. Solar power has the highest production costs, at 13 to 27 US cent/kWh.

With the existing feed-in-tariffs, the renewable energy projects are economically feasible if it is invested in small hydropower, at the production cost of 1.3 to 4.5 US cent/kWh (Pham, 2012). This also explains why only biomass power and wind power projects are deployed at a moderate scale. The other types of renewable electricity have not yet been favored as the selling price is insufficient to cover its production costs.

Renewable energy market

The government of Vietnam expected to establish and promote the renewable energy market by prioritizing investment in renewable energy. Organizations and individuals under private or public ownership will be encouraged to participate in the development and use of renewable energy. Rights and their legitimate interests will be protected in accordance with law and regulations. So far Vietnam has not yet formed renewable energy market.

Renewable energy portfolio standard

Renewable energy portfolio standard requires renewable energy shall account for a minimum part of the national electricity system. The government planned to apply

Table 1: Financial support, incentives to develop renewable energy

Duty	Regulation	Incentives
Renewables		
Tax	Import tax	Exempted from import tax for imported goods Exempted from import tax for fixed asset
Corporate income tax	25% - 50% (depending on types of energy and location)	Exempted from corporate income tax 10% in 15 years for newly established renewable energy enterprises, may extend to 30 years exempted from corporate income tax in the first 4 years, reducing 50% of tax in the next 9 years.
Loan	Loan from commercial sources at the market interest rate	Loan at 80% of investment capital at the prioritized interest rate within 5 years
Environmental protection fee	Depending on types of waste and quantity of pollutants in wastewater	Exempted from environmental protection
Depreciation	Depending on types of fixed asset	Depreciation period is 1.5 times faster than normal depreciation
Land lease	Depending on location	Exempted from land use and land lease
Bio-electricity		
Feed in tariff		Regulation power purchase price for the project cogeneration is VND1,220 / kWh (excluding value added tax), equivalent to US $ 0.058 / kWh, the price is adjusted according to the fluctuation of the exchange rate VND / USD
Wind power		
Feed in tariff		Support electricity price for wind power projects through, the buyer is obliged to buy the entire production of electricity from wind power projects with power purchase price at delivery point power is 1,614 VND / kWh (excluding VAT increase), equivalent to US $ 0.078 / kWh), electricity purchase prices were adjusted according to the fluctuation of the VND / USD

(Extracted from Decision number 24/2014/QD-TTg dated 24/3/2014 and Decision number 37/2011/QD-TTg dated 29/6/2011, Circular number 96/2012/TT-BTC dated 08/6/2012)

renewable energy portfolio standard on energy users, producers and distributors. Specifically, all distribution, generation companies, and consumers shall meet a certain amount of electricity from renewable energy. For companies with an installed capacity of over 1,000 MW (excluding BOT power projects) must have at least 3% of electricity from renewable energy sources by 2020, 10% by 2030 and 20% by 2050 (not including hydropower plants with a capacity of over 30 MW). Companies generating, purchasing, selling power and power consumers shall buy electricity from renewable energy sources at least 5% by 2020, 10% by 2030 and 20% by 2050 (excluding hydropower sources with a capacity of over 30 MW).

Renewable energy portfolio standard usually allows the commercialization of renewable energy certificates. However, this has not been applied in Vietnam. In other words, although the government of Vietnam has made clear goals in renewable energy development roadmap, but the market for buying / selling renewable energy certificates has not been established.

The implementation guidelines and policies to support the renewable energy portfolio standard has not been studied and developed. Recently, international donors such as USAID and GIZ have indicated the need for technical support to assist the development of regulations and guidelines for implementing renewable energy portfolio standard in Vietnam. Therefore, it can be predicted that in the near future the policies relating to renewable energy portfolio standard would not yet formed and completed.

In parallel with the regulations on renewable energy portfolio standard, penalties should be established for not complying the regulations. This penalty can be used for financial support for renewable energy production units. However, there is currently no specific fine or penalty for non-compliant facilities.

Investment insurance

Investment insurance for renewable energy requires power facility to buy all renewable power generated and connected to the grid. The purchasing/selling price should be compatible with the location of the project and the applied technology, and include the production cost and a suitable amount of profit for the investor.

Investment, loan and public finance

Investors can mobilize capital from a variety of funding sources as prescribed by laws from domestic or foreign individuals and organizations and have access to loans from the State to invest. In addition, the re-

newable energy projects are granted with the governmental support to borrow 80% of the investment capital at a preferential interest rates for 5 years.

Funding support

The Vietnam energy system as well as the power system are under the management of the State. To date, it is now at the stage of preparation for competitive energy market in Vietnam. Therefore, all investments in renewable energy projects are funded by the State, which means that funding support is inevitable for sustainable energy project.

Tax exemption and/or reduction

The renewable energy projects are exempted and / or deduced from the corporate income tax under the provisions of the Investment Law, Corporate Tax Law and other legislative documents. Moreover, the newly establish enterprises operating in the field of renewable energy are entitled to 10% of tax rates for 15 years, which can be extended to 30 years. Other enterprises operating in the field of renewable energy are entitled to tax exemption during the first 4 years, and 50% of tax rate for the next 9 years.

Other incentives

Investors are exempted from import duty for goods which are imported to made up fixed assets and commodities used as raw material, input material or semi-finished products; are not available on the market in Vietnam; and serve for the production activities of the enterprises operating in the field of renewable energy, as stipulated in the Import Tax Law, Tax Law and other regulations on the import and export responsibilities

In addition to the above-mentioned incentives, the projects installing generators, transmission lines, substations for grid-connected wind power to the national electricity system is exempted or reduced from land lease fee as stipulated in applicable laws.

According the power development plans at all levels, the provincial People's Committees are responsible for allocating land so that investors can deploy their wind power projects. The recommended compensation and assistance for clearance shall comply with the provisions of the Land Law.

Net metering

End users of power purchasing from the national power system, who generate power from renewable energy sources, for their own needs, can use net meters. The payment of their electricity bills will be calculated based on the principle of net metering. Electricity from renewable energy sources generated by end users will be accounted in their renewable energy portfolio and that of their electricity distributor.

Similar to renewable energy portfolio standard, so far, this mechanism has yet to be established in Vietnam. When the renewable energy market will be formed, it will attract more private investment and household invested projects in renewable energy, especially solar energy and rooftop solar PV. At that time, the net metering mechanism will be essential to encourage the development of renewable energy in general and solar energy in particular, at household scale.

Environmental protection fee

The users of fossil fuels shall pay the environmental protection fees corresponding to the consumed amount of fuel. The environmental protection fee will be used to encourage the development and use of renewable energy. Enterprises operating in the field of renewable energy will be exempted from the environmental protection fee.

Mechanism to support solar energy

Current incentives

Although renewable energy development strategy was ratified in 2015, and accompanied with a list of proposed policies and supportive mechanisms, not many supportive policies have been implemented to support the formation of renewable energy market. Renewable energy market, including solar power market has not formed. Renewable energy portfolio standard and net metering are not applicable. Feed in tariff was approved by the Government for wind energy, biomass energy, but has yet to be applied for solar energy. The developers and investors of solar energy projects only benefit from the same tax incentives, public loan and land use incentives, etc. renewable energy (Table 1).

Incentives under pipeline

MOIT has also prepared a support mechanism for solar projects and submitted to the Prime Minister for consideration and approval. Under this mechanism, investors and developers of solar farm, rooftop solar PV, solar PV on the island and off-grid solar projects will benefit from the preferential price and guaranteed investments.

All electricity from the solar energy projects and the net metering projects shall be purchased by the Vietnam Electricity. Power purchase contract must comply with the standards issued by the Ministry of Industry and Trade and will be valid for at least 20 years. After that period, the seller and the buyer can negotiate to renew the contract or sign a new contract under the provisions of law.

Investors of the solar projects will benefit from investment credit, import tax, corporate income tax and land use tax, land lease fee as prescribed by laws and existing regulations.

Investors of the solar projects will be entitled to reduction of land use and land lease fees. Besides, the provincial People's Committee will be responsible for arranging land use plans to develop solar projects.

Power purchase price is 11.2 US cents / kWh. This price will be applicable to projects using solar PV cells with efficiency more than 16% and an installed capacity of less than 100 MW.

For rooftop solar projects and net metering project, the net amount of the power will be purchased at 15 US cents / kWh (excluding VAT) (Table 2). Power purchase price will be adjusted according to the exchange rate of USD and VND. Net amount of power output will be sold at the (ladder typed) power price in accordance with law.

At the end of 2016, the Vietnamese government has principally agreed with the solar support mechanisms proposed by the Ministry of Industry and Trade, with

some reviews. The solar power purchase price for grid-connected projects will be temporarily applied within the next three years (2016-2018). Besides, only those projects, which have been listed in the national or provincial Power Development Plans, will be eligible to enjoy the preferential tax rate. For rooftop solar project, the Government required the Ministry of Industry and Trade to update the (declining) price of solar PV components and equipment; and propose the appropriate price.

In addition, the government has required the Ministry of Industry and Trade to:

- Prepare and provide specific rules on solar power development planning in Vietnam (e.g. promoting the development of projects according to the solar radiation maps, supplementing solar projects in the Power Development Plan);
- Update and adjust the price of solar equipment to provide consistent power purchase price;
- Conduct research and supplement the provisions on transparent bidding of solar projects to reduce solar power purchase prices;
- Supplement the provisions on Certified Emission Reductions (CERs) of solar power projects;
- Supplement and complete the provisions on exemption of business registration and fees, taxes for rooftop solar projects (with an installed capacity of below 50 kW); and
- Supplement regulations and mechanisms to promote the domestic production of solar components and equipment; increase the localization rate in solar energy projects to reduce the solar power purchase price.

Remarks

The policy framework to support the development of solar PV is underdeveloped. So far, there have been two documents to support for the development of solar PV, including Renewable Energy Development Strategy and Power Development Plan VII-Revised. The lack of action plans to implement this strategy is the biggest drawback in the development process of solar PV projects in Vietnam. Due to the lack of specific action plans as well as guidance on the construction, installation, and development of rooftop solar, off-grid solar, grid-connected solar and solar farm projects, the developers and investors of solar PV projects questioned the feasibility of the solar projects and hesitate to invest in these projects.

Table 2: Incentive under pipeline to support solar PV

	Regular	Feed in tariff for solar power
Power purchase price	5.8 US cent / kWh	• For solar PV project with efficiency more than 16% and an installed capacity of less than 100MW, the power purchase price is 11.2 US cents / kWh. • For the rooftop solar projects or net metering projects, the power purchase price is 15 US cents / kWh.

After the Renewable Energy Development Strategy and Power Development Plan VII- Revised were issued, there has been no mechanisms promulgated to promote solar projects. Although the draft mechanism to support solar PV has been prepared by the Ministry of Industry and Trade, and submitted to the government, the contents of the draft mechanism has not been approved. The government has basically agreed with the draft and required the Ministry of Industry and Trade to review the draft mechanism. The (preferential) power purchase price of solar PV is only applicable to the approved projects (the solar power projects listed in the power development plans) and available within 3 years from 2016 to 2018. The power purchase price of the solar rooftop projects has not been approved by the government and required to be adjusted according to the market price of solar PV components and equipment.

The lack of the policy framework as well as the supportive mechanism indicates the Government's reluctance to support the development of solar PV. On the one hand, the government desires to support the development of solar PV due to its social and environmental benefits. On the other hand, the supportive mechanisms are limited, and the financial incentives for power purchase price will be applicable to a certain number of projects and in very short time period. The existing mechanisms and the draft mechanism are not attractive enough to compensate for the high investment on solar projects.

According to investors on solar PV, one of the barriers to the promotion of solar PV projects in Vietnam is the lack of supportive policies. Many investors and manufacturers of solar PV components and equipment such as the VietTan, Solar BK, Solar Vu Phong confirmed that once the support mechanisms for solar energy is ratified, it will encourage the investment on solar energy projects at all levels, from household-sized rooftop solar projects to solar farms.

Orientations for supportive policies

Policies to support renewable energy showed its positive impacts on the investment and deployment of renewable energy projects, contributing to the national energy security and ensuring the energy supply. However, the legal framework and policies, particularly financial mechanism, is immature at the stages of setting goals, developing action plans and monitoring the implementation of policy.

Experience from developed countries indicated that the support from government is essential for to attract investment on sustainable energy. Although there are opportunities to promote renewable energy in the rural and isolated areas, which are favourable place for implementing small projects for the poor community. In that case, the local people are normally incapable of invest into renewable energy themselves. Development of renewable energy in these areas not only bring benefits of ensuring the energy supply, but also contribute to tackle social issues such as implement and income generation.

Moreover, the environmental and social benefit of sustainable energy has not reflected in the energy price on the competitive market. Price competitiveness

becomes more difficult if there is no intervention of the government. The number of renewable energy project will reduce. A lot of research indicates that if the environmental and social benefit is included in the renewable energy price, many types of renewable energy will be economically competitive to the conventional energy.

As being indicated in the previous part, the Vietnam government has established the feed-in-tariffs for some types of renewable energy. However, the existing feed-in-tariffs are not attractive enough to renewable energy developers. Except from small hydropower, the renewable energy developers would not get any profit if they invest on renewable energy. Therefore, Vietnam should make more efforts in the development and promulgation of relevant legislation, improve and enhance the efficiency of the organizational structure and management methods in the field of renewable energy, as follows:

It is essential to develop a completed legislative framework and a focal institution for renewable energy. This will reduce the complexity in management and development of renewable energy, and eradicate administrative barriers so that the renewable energy developer can be accessible to information and supportive mechanism.

In the context that the competitive market has not been established in Vietnam, the regulatory tool should be exploited to promote sustainable energy in Vietnam. For renewable energy promotion, it is essential to develop the renewable energy portfolio standard. The standard shall be applied for energy producers and consumers. It requires the energy producers and consumers that a minimum part of their produced/ consumed energy shall come from renewable energy. This mechanism support the government in achieving the target for renewable energy, especially targets of increasing installed capacity, total power generation and share of renewable energy in the national power system. Moreover, the renewable energy price will eventually be regulated on the basis of the market price, thanks to the competitiveness among renewable energy technologies.

In line with the regulatory tools, it is crucial to create a market for sustainable energy. With regards of renewable energy, the suitable prices for renewable energy must be proposed. The price should be adjustable to different types of renewable energy. The renewable energy price should be higher than the price of electricity produced from fossil fuels, so will encourage renewable energy and ensure economic benefits for renewable energy. This mechanism minimizes the risks for investors in renewable energy. At the same time this policy also helps the development of different types of renewable energy, regardless of their production costs.

The energy price can be regulated by adjusting the current power price. If the current power price includes the externalities of the fossil fuel and GHG emission, the differences between renewable power price and existing power price will be smaller. This, on one hand, will encourage the development of renewable power. On the other hand, the higher power price will induce the awareness of power saving and power efficiency.

In addition, the preferential mechanism should be clear, transparent and accessible for the developers. This will ensure that they can access to the supportive sources, whether it is financial or non-financial if needed. The assess to information and supportive mechanism is crucial as the support will be useless unless the beneficiaries can access them.

Conclusion

Renewable energy is defined as the effective measures aimed at developing a sustainable electricity system, with the objective of minimizing the environmental impact of burning fossil fuels and ensuring the national energy security. To achieve these objectives, legal framework and financial policies to support renewable energy development in Vietnam should be promoted in terms of implementation and adjustment to fit the technical and economic characteristics each type of renewable energy. In addition to the establishment of the focal institution on renewable energy, completion of financial mechanism as well as the monitor of the policy implementation should be taken attention.

It is also appropriate in the case of solar energy. So far, solar energy has only supported in the Renewable Energy Development Strategy and Power Development Plan VII- Revised. Although these documents have initiated a range of supportive measures such as preferential corporate income tax and import duty, exemption and reduction on land use and land lease fee, etc., the financial mechanism is, in fact, incomplete, especially solar PV feed in tariff. When the solar PV feed in tariff will be applicable to all approved grid-connected and rooftop solar projects, the solar energy markets are expected to be blooming at different scale from households' rooftop solar project to solar farms.

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Tech Events

2017

Jun 7–9
Shanghai, China

AQUATECH CHINA 2017
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HQ525 Rm.A401 No.55 Jin Yu Lu
MinHang District
Shanghai 201103
China
Tel: +86 21 33231319
Fax: +86 21 33231366
E-mail: colin@chcbiz.com

Jun 7–9
Seoul, Rep. of Korea

ENVEX 2017
Contact: KEPA (Korean Environmental Preservation Association)
Seoul CCI Bldg., 497-66, Dapsimni 5 Dong
Dongdaemun-Ku
Seoul
Rep. of Korea
Tel: +82 2-2249-5265
Fax: +82 2-2249-5267
E-mail: dkepa@chollian.net

Jun 8–11
Kobe, Japan

The Asian Conference on Sustainability, Energy & the Environment 2017
Contact: The International Academic Forum
Sakae 1-16-26 – 201
Naka Ward, Nagoya, Aichi,
Japan 460-0008
Web: http://iafor.org

Jun 23–24
Kuala Lumpur, Malaysia

15th International Conference on Envirotech, Cleantech and Greentech (ECG)
Contact: World Association for Scientific Research and Technical Innovation (WASRTI)
SF-45, JTM, Manglam, Jaipur - 17, Rajasthan, India
Tel: +91-9001087697
E-mail: info@wasrti.org
Web: http://wasrti.org

Jul 13–15
Bangkok, Thailand

Sustainable Development Conference 2017: Green technology, renewable energy and environmental protection
Contact: Tomorrow People Organization
Dusana Vukasovica 73,
11000 Belgrade, Serbia
Tel/Fax: + 381 62 680 683
E-mail: contact@tomorrowpeople.org
Web: http://www.sdconference.org

Jul 14–16
Colombo, Sri Lanka

SOLAR SRI LANKA 2017
Contact: CEMS Bangladesh
House # 119, Unit- A3
Road-1, Banani Block-F
Dhaka-1213
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Tel: +880 2-55040848
Fax: +880 2-55040031
E-mail: cems@cemsbangladesh.com

Aug 16–18
Guangzhou, China

ASIA-PACIFIC BIOMASS ENERGY TECHNOLOGY & EQUIPMENT EXHIBITION - APBE 2017
Contact: Guangdong Grandeur International Exhibition Group Co., Ltd
Room 202
Meijing Garden
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China
Tel: +86 20 2918 8160
Fax: +86 20 8257 9220
E-mail: grand.gz@grahw.com

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Guangzhou, China

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Sep 1–30
Gwangju, Rep. of Korea

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Seogu
Gwangju-si 502-828
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Sep 13–16
Jakarta, Indonesia

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Singapore 339510
Tel: +65 6233 6777
Fax: +65 6233 6768
E-mail: fiona@iemallworld.com
Web: http://electricindonesia.com

Sep 20–22
Noida, India

RENEWABLE ENERGY INDIA EXPO 2017
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Times Square Unit No.1 & 2
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Fax: +91 22 66122626

Oct 5–8
Kuala Lumpur, Malaysia

IGEM 2016 (International Greentech & Eco Products Exhibition & Conference Malaysia)
Contact: Secretariat
Tel: + 603 4041 0311
Fax: + 603 4043 7241
E-mail: enquiry@mesallworld.com
Web: http://www.igem.my

Oct 26–28
Dhaka, Bangladesh

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E-mail: cems@cemsbangladesh.com

Nov 1–4
Jakarta, Indonesia

FOOD PROCESSING & PACKAGING INDONESIA 2017
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Global business services of Malaysia

MSC Malaysia

http://www.mscmalaysia.my

Global Business Services (GBS) is an integration of services that make with the best competitive strategy that utilizes Information and Communication Technology (ICT), Finance and Accounting, Human Resources, and Engineering Design and Services. It has become an essential tool in accelerating and complimenting global business services approaches as more companies are leveraging on global business services strategies to align their business objectives and obtain economies of scale.

As part of the Business Services projects of the National Key Economic Areas (NKEA), GBS is an industry that is fast gaining momentum in Malaysia, being one of the focuses in the country's Economic Transformation Plan. In transforming Malaysia into a "high income" economy, MDEC is the driving force that enhances the Capability, Capacity and the Credibility (3Cs) of this industry to develop a "world-class" GBS hub.

With a vibrant ICT and an international standard service industry, the global management consulting firm, AT Kearney has consecutively ranked Malaysia third in their Global Services Location Index since 2004, which measures financial attractiveness, people skills and availability, and business environment. Malaysia is also ranked Number 18 in World Bank's Ease of Doing Business Report & Number 14 in IMD World Competitiveness Ranking 2015.

Whether it's the workforce, competitive cost, outsourcing infrastructure, ICT facilities or world-class business infrastructure, Malaysia has the best resources to accommodate to the demands of enterprises today. To date, there are more than 350 foreign and multinational companies who have set up regional and global shared services and outsourcing centres in Malaysia, bringing along billions of Ringgit worth of investments and thousands of jobs opportunities. These companies are currently performing various GBS activities within these 6 industry verticals:

a) Banking, Financial Services & Insurance (BFSI)

b) Information & Communication Technology (ICT)

c) Pharmaceutical & Health (P&H)

d) Logistics & Transportation (L&T)

e) Energy, Chemical & Resources (ECR) f) Fast Moving Consumer Goods (FMCG)

These GBS activities are categorized into 3:

The bulk of activities conducted in an GBS environment are business processes that can be either the back-end or front –end operations. The activities include consolidation of internal business functions such as human resource, finance and accounting, and customer service that includes call centres and technical support.

1. Business Process Outsourcing (BPO)

   Transactional-type internal (back-office) business functions such as human resources or finance & accounting and front-office functions which include customer-related services such as marketing and contact center services.

2. Information Technology Outsourcing (ITO)

   Transactional-type IT and IT-related functions such as programming,technical support, desktop and server support, network and security systems etc.

3. Knowledge Process Outsourcing (KPO)

   Value-added processes which are highly complex and require the talent of professionals with widespread educational backing. The profile essentially requires specific and advanced knowledge of a particular domain or specialty. In the KPO context, the emphasis will be far more on talent than on physical infrastructure. Therefore, it will be more knowledge centric rather than capital centric.

High value services - moving up the value chain

The Malaysia Digital Economy Corporation (MDEC) is set to drive the industry's next phase of development and subsequently move Malaysia up the value chain with its focus on the high-yield KPO sector. KPO types of activities and services are highly encouraged with new investments and further develop niche areas such as expanding the Engineering and Design services to Oil and Gas industry, and beyond.

Meanwhile, the cluster is facilitating the growth of local outsources under the Entry Point Projects 2 (EPP2) programme. Incentives and initiatives are provided to allow smaller local players to flourish, and the benchmark for these EPP2 companies is set against the International Association of Outsourcing Professionals (IAOP).

Programmes that facilitate market expansion in terms of funding needs such as private equity and venture capitals, as well as to nurture the local companies with respect to growth, market expansion, market access, and the promotion of industry dialogue were formulated and implemented.

Guidelines for preparing a detailed project report

Small Industries Development Bank of India (SIDBI), India
http://smallb.sidbi.in

Your company seeking financial assistance for implementation of its business idea is required to prepare a Project Report covering certain important aspects of the project are: Promoters background/experience; Product with capacity to be built up and processes involved; Project location; Cost of the Project and Means of financing thereof; Availability of utilities; Technical arrangements; Market Prospects and Selling arrangements; Environmental aspects; and Profitability projections and Cash flows for the entire repayment period of financial assistance

Management evaluation

- Memorandum and Articles of Association : Object, authorised and paid-up share capital,promoter's contribution, borrowing powers, list of directors on the Board, terms of appointment of directors
- Your company as the Promoter : Corporate plan of the Company, projects promoted/implemented/under implementation, Bankers' report on dealings and repayment of past loan assistance, details of group companies, operations, balance sheet and profit & loss account of the promoter company
- New Promoters : Educational background, any industrial experience, family background, sources of income, details of personal properties, banker's reference, income tax/ wealth tax returns
- Management and Organisation set up : Broad composition of the Board, details of full time directors and their responsibilities, details of Chief executive and functional executives including qualification, experience, organisation set-up for existing company and during project implementation for new company.

Technical feasibility

- Technology and manufacturing process : Proven/new technology, basis of selection of technology, competing technologies, performance data of plants based on the technology, details of licensor of technology, process flow chart and description
- Location of the Project: Locational advantage, availability of raw material and other utilities, infrastructure facilities, availability of labour, environmental aspects
- Plant and Machinery: List of machinery & equipment, details of suppliers, competitive quotations, technical & commercial evaluation of major equipment
- Raw material, Utilities and Manpower: Details of raw materials and suppliers, electricity and water supply, basis of manpower estimates, details of manpower eg. managerial, supervisory, skilled/unskilled, training needs
- Contracts: Agreement with contractors detailing on know-how, engineering, procurement, construction, financial soundness and experience of contractors
- Project monitoring and implementation: Mode of implementation, details of monitoring team, detailed schedule of implementation.

Commercial viability

- Existing and potential market demand and supply for the proposed product in respect of volume and pattern
- Share of the proposed product of the company in the total market through marketing strategy
- Selling price of the product and export potential, if any.
- Buy-back arrangements, if any.

Financial appraisal

- Cost of the Project: This includes the cost of land & site development, building, plant & machinery, technical know-how & engineering fees, miscellaneous fixed assets, preliminary & preoperative expenses, contingencies, margin money for working capital.
- Means of Financing: Means of financing shall have to conform to proper mix of share capital and debt. This includes share capital, unsecured loans from Promoters/associates, internal accruals, term loans, Government subsidy/grant. Reasonableness of Promoters' contribution in the form of equity and interest-free unsecured loans, if any, is ascertained in view of commitment to the Project.
- Profitability Projections: Past records of financial performance of Your company will be examined. Your company needs to submit profitability estimates, cash flow and projected balance sheet for the project and for the Company as a whole.

Economic viability

- Your company will have to take real value of input as against the value accounted in financial analysis for the purpose of economic evaluation of the project.
- Your company should carry out social cost benefit analysis as a measure of the costs and benefits of the project to Society and the Economy.
- Economic analysis is therefore aimed at inherent strength of the Project to withstand international competition on its own.

Licensing of intellectual property rights

World Intellectual Property Organization (WIPO)

http://www.wipo.int

You may be interested in starting a new business, expanding an existing business (extending your territory or the nature of business) or improving the quality of the goods or services of your SME and thereby its market position. In many situations, licensing of intellectual property rights is an effective tool for achieving these business goals.

A licensing agreement is a partnership between an intellectual property rights owner (licensor) and another who is authorized to use such rights (licensee) in exchange for an agreed payment (fee or royalty). A variety of such licensing agreements are available, which may be broadly categorized as follows:

- Technology License Agreement
- Trademark Licensing and Franchising Agreement
- Copyright License Agreement

In practice, all or some of these agreements often form part of one single contract since in transfers of this nature many rights are involved and not simply one type of intellectual property right. You may also come across licensing agreements in other circumstances, such as, during a merger or acquisition, or in the course of negotiating a joint venture.

All of these mechanisms either on their own or in combination will provide your SME, as a licensor or licensee, a wide variety of possibilities in conducting business in your own country or elsewhere. As an intellectual property owner and a licensor, your SME can expand its business to the frontiers of your partners' business and ensure a steady stream of additional income. As a licensee, your SME can manufacture, sell, import, export, distribute and market various goods or services which it may be prevented from doing otherwise.

In the international context, a formal licensing agreement is possible only if the intellectual property right you wish to license is also protected in the other country or countries of interest to you. If your intellectual property is not protected in such other country or countries then you would not only not be able to license it, but also you would have no legal right to put any restriction on its use by anyone else.

Technology licensing

If your SME is interested in:

- improving the quality of your product or manufacturing a new product by using the rights owned by others in the form of a patent, utility model, or know-how protected by a trade secret, then acquiring such rights through a technology licensing agreement may be the right solution, or
- entering a market or extending your existing market for a product for which your SME owns the rights to a patent, utility model or know-how protected by a trade secret, then authorizing another to use your process or product through a technology licensing agreement may be the right solution.

By a technology licensing agreement the **licensor** authorizes the **licensee** to use the technology under certain agreed terms and conditions. It is, therefore, a contract freely entered into between two parties and contains terms and conditions so agreed.

Franchise or trademark license agreements

If your SME is interested in:

- marketing a product or service and the brand (trademark) of that product is owned by others, or
- entering or expanding the existing market for your product or service for which your SME owns the rights conferred by a trademark, you may consider a trademark license agreement or a franchise agreement.

Through a franchise agreement the owner of certain technical or other expertise who has usually gained a reputation in connection with the use of a trade or service mark (the franchiser) may team up with another enterprise (franchisee) who will bring in expertise of his own or financial resources to provide goods or services directly to the consumer. The franchiser will ensure, through the supply of technical and management skills, that the franchisee maintains the quality and other standards in relation to the use of the trade or service mark which often require certain standardized features like, for example, a uniform trade dress.

Copyright license agreements

If your SME is interested in:

- manufacturing, distributing or marketing the results of the literary and artistic efforts of creators, or
- entering a market or expanding or extending your existing market for the literary and artistic efforts of your enterprise

You may consider a copyright license agreement. Many owners find it difficult to manage their rights on their own and they have formed collective management organizations that represent them and manage their rights for them. If you are interested in acquiring these rights you may have to address yourself to the appropriate collective management organization that will be authorized to license the various rights of their members.

IP Assignment and Licensing in Thailand

ASEAN IPA
http://www.aseanipa.org

The assignment, or license agreements, of IP objects must be made in writing, contain minimum requirements, and not be contrary to specific prescriptions in regard to the related rules. Most types of IP objects shall be registered with the related authorities in order to make them valid and enforceable in Thailand.

Trademark

Trademark Assignment – the assignment must be made in writing and registered with the Trademark Office, in order to make it valid and enforceable. The Trademark Office accepts the registration assignment for any pending and registered trademarks, and there is no specific deadline for registering the assignment in Thailand. An important rule relating to trademark assignment is prescribed under Section 50 of the Trademark Act, whereby all associated trademarks shall be transferred, or inherited, only as a whole. The assignment cannot be registered only for some associated trademarks, and partial assignment is not allowed. In addition, the cancellation of filed/registered license agreements relating to assigned trademarks is always a prerequisite, before the assignment is granted in Thailand.

Trademark Licensing – the license agreement and any sub-license agreement must be made in writing and registered with the Trademark Office, in order to make it valid and enforceable. To register a sub-license agreement, the main license agreement must also be registered. If the license agreement is subject to a renewal, such renewal must be re-registered in order to maintain its validity.

A registrable license agreement, according to Section 68 of the Trademark Act, shall at least provide the following: 1) conditions and terms of the agreement between the trademark proprietor and the person applying to be an authorized licensee, which must actually enable the former to control the quality of the goods manufactured by the latter; and 2) the goods on which the licensed trademark is to be used.

The license agreement can include all pending and registered trademarks in Thailand. However, the Trademark Office will only register the licenses of registered trademarks. The license agreement for pending trademarks can be registered, only after it is granted registration, and without the requirement to enter into a new license agreement. There is no deadline for registering a license agreement in Thailand.

Patent

Patent Assignment – the assignment must be made in writing and registered in compliance with the requirements, procedures and conditions as prescribed by the relevant Ministerial Regulations, in order to make it valid and enforceable. The Patent Office registers the assignment for any pending and registered patents, and there is no specific deadline for registering the patent assignment in Thailand. The application to register the assignment must be separately submitted with the Patent Office, together with the agreement which transfers the patent for each assigning patent.

Patent Licensing – the license agreement must be made in writing, and registered in compliance with the requirements, procedures and conditions as prescribed by the Ministerial Regulations, in order to make it valid and enforceable.

In granting a license, according to Section 39 of the Patent Act: 1) the patentee shall not impose upon the licensee any condition or restrictions, or any royalty term which unfairly limits competition. Conditions, restrictions or terms which tend to unfairly limit competition are prescribed in the Ministerial Regulation No. 25 (B.E. 2542), issued under the Patent Act B.E. 2522, and these include for example: a) prescribing the licensee to provide material, for use in the production, from the holder of the patent, or from the distributor, which the holder of the patent has prescribed or permitted, except where it can be proved that it has to be prescribed so that the product produced gives the result as stipulated under the patent, or it is a material which cannot be acquired from another source; b) prescribing conditions or restrictions of the licensee concerning the hire of persons for the production of the invention, except where it can be proved that such has to be prescribed, so that the product produced gives results which are in accordance with the patent; c) prescribing that the licensee sells, or distributes more than half of the product produced, to the holder of the patent; d) prescribing that the licensee limits the quantity of production, sale or distribution; e) prescribing that the licensee discloses the invention, which the licensee has improved, or to allow the patent holder to seek interest from the said invention without prescribing a suitable remuneration for the licensee; f) prescribing that the licensee exercise the rights under the patent to pay remuneration for the use of the invention according to the patent, after the patent expires, etc.; and 2) the patentee shall not require the licensee to pay royalties for use of the patented invention after the patent has expired. Conditions, restrictions or terms concerning royalties, which are contrary to this provision, are null and void.

Guidelines on equity policy in Malaysia

Malaysian Investment Development Authority (MIDA), Malaysia

http://www.mida.gov.my

Equity policy in the manufacturing sector

Malaysia has always welcomed investments in its manufacturing sector. Desirous of increasing local participation in this activity, the government encourages joint-ventures between Malaysian and foreign investors.

Equity policy for new, expansion, or diversification projects

Since June 2003, foreign investors could hold 100% of the equity in all investments in new projects, as well as investments in expansion/diversification projects by existing companies, irrespective of the level of exports and without excluding any product or activity.

The equity policy also applies to:

- Companies previously exempted from obtaining a manufacturing licence but whose shareholders' funds have now reached RM2.5 million or have now engaged 75 or more full-time employees and are thus required to be licensed.
- Existing licensed companies previously exempted from complying with equity conditions, but are now required to comply due to their shareholders' funds having reached RM2.5 million.

Equity policy applicable for existing companies

Equity and export conditions imposed on companies prior to 17 June 2003 will be maintained. However, companies can request for these conditions to be removed and approval will be given based on the merits of each case.

Protection of foreign direct investment

Malaysia's commitment in creating a safe investment environment has attracted more than 8,000 international companies from over 40 countries to make Malaysia their offshore base.

Equity ownership

A company whose equity participation has been approved will not be required to restructure its equity at any time as long as the company continues to comply with the original conditions of approval and retain the original features of the project.

Investment guarantee agreements

Malaysia's readiness to conclude Investment Guarantee Agreements (IGAs) is a testimony of the government's desire to increase foreign investor confidence in Malaysia. IGAs will:

- Protect against nationalisation and expropriation
- Ensure prompt and adequate compensation in the event of nationalisation or expropriation
- Provide free transfer of profits, capital and other fees
- Ensure settlement of investment disputes under the Convention on the Settlement of Investment Disputes of which Malaysia has been a member since 1966.

Malaysia has concluded IGAs with the following groupings and countries (in alphabetical order):

Groupings

- Association of South-East Asian Nations (ASEAN)
- Organisation of Islamic Countries (OIC)

Convention on the Settlement of Investment Disputes

In the interest of promoting and protecting foreign investment, the Malaysian government ratified the provisions of the Convention on the Settlement of Investment Disputes in 1966.

The Convention, established under the auspices of the International Bank for Reconstruction and Development (IBRD), provides international conciliation or arbitration through the International Centre for Settlement of Investment Disputes located at IBRD's principal office in Washington.

Kuala Lumpur Regional Centre of Arbitration

The Kuala Lumpur Regional Centre for Arbitration was established in 1978 under the auspices of the Asian-African Legal Consultative Organisation (AALCO) - an inter-governmental organisation cooperating with and assisted by the Malaysian government.

A non-profit organisation, the Centre serves the Asia Pacific region. It aims to provide a system to settle disputes for the benefit of parties engaged in trade, commerce and investments with and within the region.

Any dispute, controversy or claim arising out of or relating to a contract, or the breach, termination or invalidity shall be decided by arbitration in accordance with the Rules for Arbitration of the Kuala Lumpur Regional Centre for Arbitration.

Methods of raising capital in India

Business Portal of India
http://www.archive.india.gov.in

A company may raise funds for different purposes depending on the time periods ranging from very short to fairly long duration. The total amount of financial needs of a company depends on the nature and size of the business. The scope of raising funds depends on the sources from which funds may be available. The business forms of sole proprietor and partnership have limited opportunities for raising funds. They can finance their business by the following means:

- Investment of own savings
- Raising loans from friends and relatives
- Arranging advances from commercial banks
- Borrowing from finance companies

Companies can Raise Finance by a Number of Methods. To Raise Long-Term and Medium-Term Capital, they have the following options:

Issue of shares

It is the most important method. The liability of shareholders is limited to the face value of shares, and they are also easily transferable. A private company cannot invite the general public to subscribe for its share capital and its shares are also not freely transferable. But for public limited companies there are no such restrictions. There are two types of shares:

- **Equity shares:** the rate of dividend on these shares depends on the profits available and the discretion of directors. Hence, there is no fixed burden on the company. Each share carries one vote.
- **Preference shares:** dividend is payable on these shares at a fixed rate and is payable only if there are profits. Hence, there is no compulsory burden on the company's finances. Such shares do not give voting rights.

Issue of debentures

Companies generally have powers to borrow and raise loans by issuing debentures. The rate of interest payable on debentures is fixed at the time of issue and are recovered by a charge on the property or assets of the company, which provide the necessary security for payment. The company is liable to pay interest even if there are no profits. Debentures are mostly issued to finance the long-term requirements of business and do not carry any voting rights.

Loans from Financial Institutions

Long-term and medium-term loans can be secured by companies from financial institutions like the Industrial Finance Corporation of India, **Industrial Credit and Investment Corporation of India (ICICI)** , State level Industrial Development Corporations, etc. These financial institutions grant loans for a maximum period of 25 years against approved schemes or projects. Loans agreed to be sanctioned must be covered by securities by way of mortgage of the company's property or assignment of stocks, shares, gold, etc.

Loans from Commercial Banks

Medium-term loans can be raised by companies from commercial banks against the security of properties and assets. Funds required for modernisation and renovation of assets can be borrowed from banks. This method of financing does not require any legal formality except that of creating a mortgage on the assets.

Public deposits

Companies often raise funds by inviting their shareholders, employees and the general public to deposit their savings with the company. The Companies Act permits such deposits to be received for a period up to 3 years at a time. Public deposits can be raised by companies to meet their medium-term as well as short-term financial needs. The increasing popularity of public deposits is due to:

- The rate of interest the companies have to pay on them is lower than the interest on bank loans.
- These are easier methods of mobilising funds than banks, especially during periods of credit squeeze.
- They are unsecured.
- Unlike commercial banks, the company does not need to satisfy credit-worthiness for securing loans.

Reinvestment of profits

Profitable companies do not generally distribute the whole amount of profits as dividend but, transfer certain proportion to reserves. This may be regarded as reinvestment of profits or ploughing back of profits. As these retained profits actually belong to the shareholders of the company, these are treated as a part of ownership capital. Retention of profits is a sort of self

financing of business. The reserves built up over the years by ploughing back of profits may be utilised by the company for the following purposes:

- Expansion of the undertaking
- Replacement of obsolete assets and modernisation.
- Meeting permanent or special working capital requirement.
- Redemption of old debts.

The benefits of this source of finance to the company are:

- It reduces the dependence on external sources of finance.
- It increases the credit worthiness of the company.
- It enables the company to withstand difficult situations.
- It enables the company to adopt a stable dividend policy.

To Finance Short-Term Capital, Companies can use the following Methods:

Trade credit

Companies buy raw materials, components, stores and spare parts on credit from different suppliers. Generally suppliers grant credit for a period of 3 to 6 months, and thus provide short-term finance to the company. Availability of this type of finance is connected with the volume of business. When the production and sale of goods increase, there is automatic increase in the volume of purchases, and more of trade credit is available.

Factoring

The amounts due to a company from customers, on account of credit sale generally remains outstanding during the period of credit allowed i.e. till the dues are collected from the debtors. The book debts may be assigned to a bank and cash realised in advance from the bank. Thus, the responsibility of collecting the debtors' balance is taken over by the bank on payment of specified charges by the company. This method of raising short-term capital is known as factoring. The bank charges payable for the purpose is treated as the cost of raising funds.

Discounting bills of exchange

This method is widely used by companies for raising short-term finance. When the goods are sold on credit, bills of exchange are generally drawn for acceptance by the buyers of goods. Instead of holding the bills till the date of maturity, companies can discount them with commercial banks on payment of a charge known as bank discount. The rate of discount to be charged by banks is prescribed by the Reserve Bank of India from time to time. The amount of discount is deducted from the value of bills at the time of discounting. The cost of raising finance by this method is the discount charged by the bank.

Bank overdraft and cash credit

It is a common method adopted by companies for meeting short-term financial requirements. Cash credit refers to an arrangement whereby the commercial bank allows money to be drawn as advances from time to time within a specified limit. This facility is granted against the security of goods in stock, or promissory notes bearing a second signature, or other marketable instruments like Government bonds. Overdraft is a temporary arrangement with the bank which permits the company to overdraw from its current deposit account with the bank up to a certain limit. The overdraft facility is also granted against securities. The rate of interest charged on cash credit and overdraft is relatively much higher than the rate of interest on bank deposits.

Translation tool for patent documents

The World Intellectual Property Organization (WIPO) has developed a ground-breaking new "artificial intelligence"-based translation tool for patent documents, handing innovators around the world the highest-quality service yet available for accessing information on new technologies. WIPO Translate now incorporates cutting-edge neural machine translation technology to render highly technical patent documents into a second language in a style and syntax that more closely mirrors common usage, out-performing other translation tools built on previous technologies. WIPO has initially "trained" the new technology to translate Chinese, Japanese and Korean patent documents into English. Patent applications in those languages accounted for some 55% of worldwide filings in 2014.

The high level of accuracy of the Chinese-English translation is the result of the training of the neural machine translation tool, which compared 60 million sentences from Chinese patent documents provided to WIPO's PATENTSCOPE database by the State Intellectual Property Office of the People's Republic of China with their translations as filed at the United States Patent and Trademark Office. WIPO plans to extend the neural machine translation service to French-language patent applications, with other languages to follow. The PATENTSCOPE database integrates with other translation engines freely available on the internet and continues to use existing statistical-based translation technology for languages where it performs well. WIPO has shared its translation software with other international organizations, including the United Nations conference management service, Food and Agriculture Organization, International Telecommunication Union, International Maritime Organization, World Trade Organization, and The Global Fund to Fight AIDS, Tuberculosis and Malaria.

Neural machine translation is an emerging technology. It is based on huge neural network models that "learn" from previously translated sentences. The specificity of neural machine translation (compared to previous "phrase based" statistical methods) is that it produces more natural word order, with particular improvements seen in so-called distant language pairs, like Japanese-English or Chinese-English.

For further information, contact:

Media Relations Section
World Intellectual Property Organization (WIPO)
Tel: (+41 22) - 338 81 61 / 338 72 24
Fax: (+41 22) - 338 81 40
Web: http://www.wipo.int

India Innovation Growth Programme 2.0

IIGP 2.0 Secretariat, India
http://www.indiainnovates.in

The India Innovation Growth Programme (IIGP) launched in 2007, is a public-private partnership between Government of India's Department of Science & Technology (DST) and Lockheed Martin Corporation. The goal of the Programme is to build an innovation pipeline in India. The Programme successfully completed its 10th year in 2016 and has been one of India's longest standing public-private partnerships. In line with Government of India's push towards start-ups, the program has been revamped to address specific challenges faced by innovators and entrepreneurs in terms of scaling their innovations. Tata Trusts has joined the new program, branded as IIGP 2.0, with a focus on innovations that have strong societal impact and cutting edge industrial innovations.

The Programme has provided mentoring and handholding assistance to over 400 innovators coming from diverse sectors from across the country during the past decade with the help of partners including Federation of Indian Chambers of Commerce and Industry (FICCI), Indo-US Science and Technology Forum (IUSSTF), IC2 Institute at the University of Texas at Austin , Stanford Graduate School of Business and TiE Silicon Valley. The Programme has generated over 350 commercial agreements, and over $900M of economic value for India during the past decade. (Source: Second Impact Analysis Report by Ernst & Young in 2015).

IIGP 2.0 includes several new partners including the Tata Center for Technology and Design at the Massachusetts Institute of Technology (MIT), Center for Innovation Incubation and Entrepreneurship (CIIE) at Indian Institute of Management - Ahmedabad (IIM-A) and Indian Institute of Technology – Bombay (IIT-B).

IIGP 2.0 continues to nurture the Indian innovation ecosystem and contribute to the Government of India's missions of "Make in India" and "Startup India" through a new tripartite partnership between Government of India's Department of Science and Technology, Lockheed Martin and Tata Trusts. Tata Trusts through its Foundation for Innovation and Social Entrepreneurship (FISE) will accelerate and innovate selected innovators, to implement social innovations and provide infrastructure assistance to scale up. It aims to enable entrepreneurs to develop technology-based solutions for the betterment of society, as well as to accelerate innovative Indian technologies into the global marketplace through assisting incubation, teaching excellent commercialization strategies and providing elite business development assistance.

IIGP 2.0 now has two separate tracks viz. University Challenge and Open Innovation Challenge, each focusing on identifying and supporting both industrial and social innovations. Two annual parallel challenges will be run supporting innovations through:

- Phase A: Ideation
- Phase B: Innovation
- Phase C: Acceleration

Programme benefits

Ideation phase

Top 30 University teams will receive mentoring by IIT-Bombay on presenting ideas to a panel and an opportunity to pitch ideas at an IIGP Innovator Showcase event.

Top 10 selected teams will receive research grants of INR 10 Lacs for developing a concept/prototype, an opportunity to participate in a Design Thinking workshop, mentorship and periodic feedback.

Innovation phase

Top 10 teams will participate in an IIM-Ahmedabad boot camp and receive further mentoring by IIGP partners.

Top 4 teams will be awarded research grants of INR 25 Lacs each enabling them to advance to Phase C: Acceleration where they will work in parallel with teams from the Open Innovation Challenge.

- The top 50 innovators will get an opportunity to participate in a rigorous boot camp conducted by IIM, Ahmedabad.
- The top 10 innovators will undergo an incubation process. Companies in incubation will receive seed funding as well as mentoring support to enable them to accelerate market penetration and scale-up operations. They will also get an opportunity to travel and interact with scientists, technology experts, entrepreneurs, and investors from our partner ecosystem in Silicon Valley and MIT.
- Access to network of sponsors, mentoring, hands on support in building the enterprise from people who have done it before, and support for pilots/tests in India.
- Participate at Demo Days organized under the Programme to showcase your technologies to investors.

Acceleration phase

The top 4 teams will receive additional funding to accelerate their entry to market. They also have access to the network IIGP 2.0 programme offers as described above.

Strategic-based innovation in Thailand

National Innovation Agency, Thailand

http://www.nia.or.th

Innovation for kitchen to the world

Thai food is popular in more than 93 countries and ranked as one of top four cuisines in the world. However, it is found that taste and flavors are deviated from the authentic ones. To solve these problems and promote Thai food industry, Thai Delicious is established with the integration of Home Economics, Food Science and Technology, and Sensory Evaluation. It will also provide food innovative services and generate its own business models and networks. The National Innovation Agency (Public Organization) (NIA) has bee assigned by the Ministry of Science and Technology to manage this project with its goals as follows:

1. Develop Thai recipes with authentic tastes to be standard recipes. Be the center of these standardized recipes.
2. Develop the biosensor equipment to analyze and evaluate taste and flavors.
3. Develop the institutional food (ready-to-cook products) based on the standardized recipes to serve the demand of Thai food in foreign countries.
4. Provide food certification service and the training hub for local and foreign chefs working in Thai restaurants worldwide

Organic agriculture business

"Organic Agriculture" as defined by the International Federation of Organic Agriculture Movements (IFOAM) means the production system that focuses on the sustainability to the health, soil, ecosystems and human by using the ecological processes, biodiversity and natural cycles that have different characteristics of each area instead of using inputs that have negative impact on the organic agriculture system. Organic Agriculture is the combination between fold wisdom, innovation and scientific knowledge base on environmental conservation as well as the promotion of fair relationships and the quality of living organism within such environment.

NIA has initiated innovative agriculture business which is the important strategic projects since 2005. The project has started as the project-oriented agriculture policy of Thailand that received support from international commerce under the UNCTAD/WTO in project titled "Strengthening the Export Capacity of Thailand's Organic Agriculture" during 2005-2006. Meanwhile, NIA has supported innovative projects titled "The production of organic asparagus" to confirm the strategic framework of organic development and be practical operated in term of business. From this operation, the Ministers has acknowledge the results from NIA performance, on August 7, 2007 and assigned to the Office of National Economic and Social Development Board (NESDB), responsible for the establishment the "National Organic Agriculture Development Committee" and the establishment had been approved by the Cabinet on October 16,2007. On 2008-2011, NIA was assigned by the "Board of Directors of the National Organic Agriculture Development" to be the subcommittee and secretary for the management of knowledge and innovation in organic agriculture. The National Organic Agricultural Development has developed a draft strategic plan for the National Organic Agriculture Development years 2008-2011 and has approved by the Cabinet on January 22, 2008. The cabinet has approved the national budget for 4,326.80 million baht on May 6, 2008 by assigning the various departments place the plan and project under this action plan within 4 years plan.

Biomedical industry

"Biomedical Industry" is an industry that involves development of medical technology and devices including software and any other services that intended for use in the diagnosis, treatment, prevention and monitoring of disease in patient, disabled person or elderly. It is an interdisciplinary fields of medical science, engineering and any other health related fields. NIA has set up the framework to support the innovation projects in 3 programs as follows:

- **New product design support:** This project involves designing new medical products to meet different user requirements.
- **Clinical trial:** This project involves safety and efficiency testing of medical products which are in clinical trial phase.
- **International standard accreditation support:** This project involves the international standard accreditation process of the available products that aim for export.

Clean energy industry

NIA has cooperated with the Energy Policy and Planning Office (EPPO), under the Ministry of Energy, in accordance with the Memorandum of Understanding to develop and support Thai alternative energy companies. Under this MOU, the "Biomass Gasification Pilot Plant for Community" was established and implemented under NIA's management. The project objective is to incentivize Thai companies to invest in the biomass-to-energy business, using gasification technology, through a funding mechanism. In addition, this project conforms to the National Strategy and the AEDP (2012-2021).

Green ratings in India

Small Industries Development Bank of India (SIDBI), India
http://smallb.sidbi.in

Green rating is an estimate of an industry's environment friendliness. It assesses the adverse impact on environment caused by an industry's activities and methods adopted by an industry to minimize the damage. This assessment is done by a credible third party evaluator. The rating is arrived at after considering industry's current processes and technology and their impact on the environment, adoption of clean technology and various processes adopted for mitigating adverse impact on environment.

Green rating in India

Green Rating initiatives in India are spread across various sectors ranging from buildings to manufacturing industries.

Green building initiative

In order to create more energy efficient and eco-friendly buildings, the Ministry of New and Renewable Energy in collaboration with The Energy and Resource Institute (TERI) initiated Green Rating for Integrated Habitat Assessment (GRIHA), the National Rating System for Green Buildings in India. GRIHA rating system consists of 34 criteria categorized under various sections such as site selection and site planning, conservation and efficient utilization of resources, building operation and maintenance, and Innovation points. For further details, visit GRIHA.

Green rating project

It is a non-government initiative launched by Centre for Science & Environment (CSE) in 1995 to guide Indian industries to improve their environmental performance. The project mainly relied on voluntary participation of companies and depended up on the company's eagerness to avoid bad publicity as these ratings are released for public. Along with the assignment of Green Rating, the initiative charted out steps need to be taken by each industry to improve their performance. In majority of the cases, the companies have implemented the road map provided by CSE. The industries covered in this project are paper and pulp, cement, automobile and the chlor alkali sector. For further details visit Green Rating Programme. A larger proportion of companies rated for green credentials under this programme are large enterprises.

SMERA green ratings

In India Green Rating of enterprises is offered by SME Rating Agency of India Limited (SMERA). Green Rating is a joint initiative of SMERA and SIDBI. The Energy and Resource Institute (TERI) acts as a Knowledge Partner. SIDBI promotes and facilitates the process by offering credit at concessional rate to Green Rated companies. The Government of India (GoI) has urged lending institutions to encourage borrowing MSMEs to go for "Green Rating".

SMERA is only agency that exclusively caters to Indian MSMEs' "Green Rating" needs. Read extract on Green Ratings from OPTIMiSM (SIDBI bi-monthly magazine).

Benefits of green rating

- **An independent third party evaluation about environment friendliness:** It indicates that the MSME is conscious about its duty towards environment and society at large
- **Credit at concessional rate:** It will help a MSME to obtain credit at a concessional rate from lenders like SIDBI
- **Mitigation of environmental risk:** It reduces the risk associated with the stringent environmental norms that is becoming stricter
- **Confidence among value chain partners:** The rating assures lenders, buyers, collaborators, JV partners that the MSME is a responsible corporate citizen and does not adversely impact ecology
- **Self-assessment tool:** Green Rating is a self-assessment tool that can be used to identify areas of improvement
- **Creating awareness:** Green Rating awarded by an independent agency improves the visibility of MSME in the eyes of various stakeholders like buyers, suppliers, collaborators/JV partners etc

Green rating process

A typical Green Rating process is described in the below diagram. Typically the entire process starting from information receipt to assignment of rating takes 15 business days (Source: SMERA). The cost of Green Rating conducted by SMERA is Rs. 50,000 (Service tax extra).

1. Request for Rating by MSME
2. Submission of Financial and Managerial Information
3. Finalising the Assignment and Detailed Questionnaire
4. Site Visit and Discussion with Management
5. In-Depth Analysis, Industry Research and Draft Report
6. Proposed Rating before Rating Committee
7. MSME Advised on Rating
8. Appeal before Rating Committee
9. Publishing of Final Rating

SME-type promising green technologies

APEC SME Innovation Center, Republic of Korea

http://www.apec-smeic.org

The Small and Medium Business Administration (SMBA) of the Republic of Korea has identified and announced 117 'SME-type Promising Green Technologies' as a first step to nurture green-specialized SMEs that will assume production of core pars and materials and R&D in the green industry field. The green technologies forwarded this time were established after having undergone a six-month discussion process by experts from industry, academia and research institutes, including the Korea Institute of Science and Technology Information (KISTI).

Based on the nation's existing overall 'Green Technology Roadmap,' SMBA suggested the 117 technologies that encompass eight industrial fields and 50 strategic products requiring a growth strategy focused on short-term commercialization potential, etc. from the perspective of SMEs. SMBA pursued identification of the promising green technologies as part of its medium and long-term R&D support strategy to single out and grow green industryspecialized SMEs that have secured key technological power, the core of its SME green growth dissemination initiative.

When converting domestic green industries into growth engines, it a prerequisite to cultivate domestic technologies that can replace imports of core pars and materials to support the technological competitiveness of green products. In reality, however, the environment for green SMEs is still weak. Therefore, the latest promising green technology information by field is expected to enhance SMEs' understanding of green technologies as well as their strategic green technology planning capability so as to accelerate development of high value-added green technologies.

In the case of photovoltaic and wind power, in particular, although these are representative fields of the new & renewable energy industry, the core of green industries, the nation's dependence of imported key parts and materials is high and participation by SMEs is weak. But based on the 'SMEtype promising green technologies' program, SMBA plans to grow technology-intensive SMEs that have secured core technologies and to enhance their global competitiveness.

SMBA identified the SME-type Promising Green Technologies based on an analysis of data from other ministries, research institutes and specialist enterprises, while taking into consideration the characteristics of the SMEs in terms of R&D investment scale, R&D stage, existence of basic technologies, commercialization potential, etc.

The SMBA move followed the Ministry of Knowledge announcement that the nation would invest a total of 3 trillion won(US$ 2.7 billion) over the next give years to develop green technologies in nine areas including solar cells and light-emitting diodes.

The green energy development strategy consists of four core fields -- nurturing nine new growth-engines, development of market-oriented energy technologies, support for market creation and fostering the necessary infrastructures. In consideration of marketability, technological viability and urgency, the government plans to select and nurture nine areas as national growth engines.

Under the plan, the government intends to convert four fields -- Photovoltaic, Wind Power, LED and Electric IT, with rapidly growing global markets and highly developed related domestic industries, into growth engines with priority. It also decided to intensively support five additional fields -- IGCC, CCS, Energy Storage, GTL/Ctl and Hydrogen Fuel Cell, for which securing of a comparative technological advantage is urgently required due to the high potential in global markets.

The government and private sector will jointly invest a total of three trillion won (government: 1.7 trillion won, private: 1.3 trillion won) in the nine fields over the next five years with the goal of securing advanced country-level technological prowess. To achieve this, the government decided to establish technology development goals by field and prepare a 'Mid- and Long-Term Green Energy Technology Development Strategy and Roadmap' by March next year.

The government plans to achieve its established goals by field. For example, in the solar energy area, it intends to secure fossil fuel-level economic viability by 2020, and for hydrogen fuel cells, it aims to develop mass production technology for kW-class householduse cells by 2015.

Taking into consideration the existing technological level by field, in particular, the government decided to promote efficient technology acquisition methods with such strategies as 'independent development.''technical alliance & joint research,''inducement of technology' and 'foreign investment.'

Home-grown innovation

The Network for Drugs, Diagnostics, Vaccines and Traditional Medicines Innovation (ASEAN-NDI) brings together researchers from 10 ASEAN countries to create products that combat diseases like tuberculosis (TB), malaria, dengue, and parasitic infections.

For more information, contact:

Bernadette Ramirez
World Health Organization
E-mail: ramirezb@who.int

CHINA

Glass wool production line

We can offer Glass Wool Production Line / Glass Wool Machine with the following specifications:

- Workshop area: 3,000m^2
- Natural gas wastage: 252 x 104Nm
- Compressed air: 20m/h, 0.8MPa
- Product spec:
  1) Dia. of fiber: =0.8um
  2) Heat conductivity: 0.042W/mk
  3) Working temperature: 400oC (max.)
  4) Density: 15-50kg/m^3
  5) Standard: GB/T13350-2000
  6) Product series: glass wool board and glass-wool belt, pipe and so on.

Area of Application

Construction and Insulation

Advantages

Main advantages are as follows:

- Good thermal insulation performance
- Incombustible material
- Sound absorption performance and excellent noise reducing effect
- Low moisture absorption rate
- Low aging rate
- Excellent handling characteristics

Environmental Aspects

- Cleaner production
- Waste utilization

Development Status

Idea

Legal Protection

Trade Mark

Technical Specifications

HIM-GW-3, HIM-GW-5, HIM-GW-6, HIM-GW-8, HIM-GW-10, HIM-GW-15

Transfer Terms

Turnkey

Contact

HiSuccess International
Room 1909, Aviation Tower
No.18, Xin Jin Qiao Road, PuDong District
Shanghai, China 201206

HUNGARY

Transdermal medical gas delivery technology

The technology is capable of delivering all kinds of noble and medical gases through non-invasive means. The company's first application of this technology is with CO_2 gas. The physiological change with dry CO_2 balneotherapy naturally occurs in the human body when CO_2 is delivered into the microcirculation in the skin. In the blood stream CO_2 enables hemoglobin in red blood cells to release more oxygen and automatically deliver the O_2 to tissues where the body needs it. This well-known and studied naturally occurring process was discovered in 1908 by Christian Bohr (the father of the 1922 Nobel Prize winner quantum physicist Niels Bohr) and it is called the Bohr-effect.

The delivery of medical gases is used for treating high blood pressure, non-healing wounds such as critical limb ischemia, and other arthritic and micro circulatory conditions.

Area of Application

- Spas, skin care and wellness centers, bath houses, and alternative treatment centers, with limited therapeutic claims
- Medical clinics, home healthcare service providers, nursing homes, elder care centers, retirement homes, etc., with targeted medical claims.
- Mass end user market, targeted medical claims.
- Sport centers, teams, sport medical centers and sports related service providers, with targeted medical claims.
- Veterinary products, professional veterinary and home veterinary markets with targeted medical claims.

Advantages

The technology is completely mechanical and no electricity is needed for operation, has no moving parts and therefore requires almost no maintenance. The device provides treatment at the point of care (effected body parts) or full body treatment. It is small (size of a shoe box) and portable, completely safe and user friendly. It is fast, requiring only about 3 minutes for preparation for a first time user and 20 minutes for the treatment. Absolutely no training or special knowledge is needed to operate it. The technology has "instant" measurable health effects after the first treatment. It costs quarter of the price of rival technologies.

Development Status

Commercial prototype

Transfer Terms

1. Technology Licensing
2. Research Partnerships

Target Countries

Worldwide

Contact:

Laser Consult Ltd (Hungary)
H-6701 PO Box 1191.
Szeged
Hungary

Nanogold-loaded sharp-edged carbon bullets as gene carriers

National Chemical Laboratory (NCL) scientists have developed a process for the preparation of carbon embedded nano gold particles with sharp edges which can be used as gene carriers. The bullets are sharp enough to penetrate hard material, with less damage (a comparatively lower force of 0.1-0.2 nN required for penetration) and can be delivered with a convenient delivery gun. Intracellular gold particles (biogenic) synthesized by a fungus in situ, embedded on a carbonaceous matrix.

Area of Application

- Gene therapy/ improved gene delivery for research and other applications
- DNA based immunization, to study gene function and its regulation, to establish various disease models, metal ion removal, fuel cells, anti-bacterial applications, catalysis

Advantages

- Preparation process is very simple and easy to implement
- The carbon matrix forms 95% of the carrier reducing the amount of gold needed and the plasmid used per transformation
- Advantages of usage of gold particles- High DNA packing density, better transformation efficiency, low nuclease degradation, being in nano scale, higher surface area is obtained- more gene cargo handled
- Advantages of usage of carbon support- Inert and less damage causing- wound caused due to penetration healed faster, better piercing capacity, for example, can effectively pierce hard plant cell walls, less force required to penetrate the plasma membrane as compared to silver nano needles

Development Status
Laboratory model

Legal Protection
Patent

Transfer Terms
Technology licensing

Contact:
National Chemical Laboratory, CSIR
A208, PAML Building,
National Chemical Laboratory
Dr Homi Bhabha Road,
Pune 411007
India

Microfine ginger powder

Microfine ginger powder has wide applications in pharmaceutical, brewery, soft drink, meat canning, pickle processing, curry and confectionery industries. The microfine ginger powder can be directly added in soda water for removal of certain throat irritation and similar affections. The product has high domestic and export potential. From 5 kilogram of peeled ginger, around 700 grams of microfine powder can be produced. The process of production is free from pollution.

Area of Application

- Domestic and industrial kitchen
- Foof processing industries
- Brewery and confectionery industries

Advantages

- Microfine
- Free from presence of ash.
- Produced without generating temperature at the pulverizing point.
- The product maintains high drug and spice values.
- The process of production prevents evaporation of oil during pulverization.

Environmental Aspects
Cleaner production

Development Status
Commercial prototype

Transfer Terms
Turnkey

Target Countries
India

Contact:
Innova Reserach Centre Pvt Ltd
Ochanthuruth, Kochi, 682508, India
Cochin 682508
India

Bioherbicide formulation

We have developed an innovative bioherbicide formulation which is 100% free from chemicals. We are interested in transferring the technology to potential clients.

Area of Application
Agriculture

Advantages

- The formulation is 100% chemical free
- Weeds dry within 30 minutes after application
- Both terrestrial and aquatic plants are controlled
- No residue is found
- Not harmful for the microbes and soil
- Easy method of preparation using cheap waste plants

Environmental Aspects
Waste utilization

Development Status
Laboratory model

Legal Protection
Filed

Technical specifications

- The formulation is 100% chemical free
- Weeds dry within 30 minutes after application
- Both terrestrial and aquatic plants are controlled.
- No residue is found
- Not harmful for the microbes

Transfer Terms

1. Joint Venture
2. Technical services
3. Technology licensing
4. Research partnerships

Target Countries
Worldwide

Herbal formulation for leucoderma

It is well known that these diseases have property of recurrence and most of the medicines used for cure have various side effects and also the disease is also not fully cured. Our formulation is quite effective in curing all the above three diseases in short period of time. In case of leucoderma after application of the formulation there starts formation of patches (natural colour of skin) within a week. The patch increases and gradually covers the whole affected area

Area of Application
Herbal heath formulations for skin diseases

Advantages:

- In case of leucoderma after application of the formulation there starts formation of patches (natural colour of skin) within a week
- The patch increases and gradually covers the whole affected area
- The disease is completely cured within few months.
- Formulation can be prepared without sophisticated instrument.

Development Status
Pilot plant

Legal Protection
Filed

Technical Specifications

- In case of leucoderma after application of the formulation there starts formation of patches (natural colour of skin) within a week
- The patch increases and gradually covers the whole affected area

Transfer Terms

1. Joint Venture
2. Technology Licensing
3. Research Partnerships

Target Countries
Worldwide

For the above two offers, contact:
Hiran Biotech, Research and Developemnt Division, 66 Turner Road Cantt., Kanpur 208004, U.P., India
Kanpur 208004, India

Sensor for detecting nitrogen dioxide gas

A novel nitrogen dioxide gas detecting film has been developed. The detecting film is based on light emitting conjugated polymer Poly [2-methoxy-5-(3′,7′ –dimethyloctyloxy) -1,4-phenylenevinylene (MDMO-PPV). It has been demonstrated for the first time that a thin film of MDMO-PPV deposited on glass substrate or filter paper can be used to sense NO_2 gas by just change in color at room temperature. It has been observed that the bright orange fluorescence of MDMO-PPV is quenched to yellow in color in the presence of NO_2 gas above 150 ppm level in few seconds. The quenching time is proportional to the concentration of the NO_2 gas. The quenching of the fluorescence of the detecting film after exposure to NO_2 is also studied by absorption and emission spectroscopy.

Area of Application
The technology is useful for monitoring nitrogen dioxide in:

- Factories
- Environmental monitoring
- Medical applications

Advantages

- Easy detection procedure in the form of color code in few minutes above 150 ppm.
- A sensor based on conjugate polymer on various substrate such as glass, plastic or paper.
- No change in color of the sensor is observed on exposer to any other gases and chemical vapors like LPG, ammonia gas, hydrogen peroxide and alcohols.
- Process is very cheap and hence can be used as disposable strips.

Environmental Aspects
Security purpose

Development Status
Laboratory model

Legal Protection
Patent

Technical Specifications
A conjugate polymer polyp[2-methoxy-5-(3′,7′-dimethyloctyloxy) -1, 4-phenylene-vinylene (MDMO-PPV) based NO2 gas sensor film.

Transfer Terms

1. Consultancy
2. Technical services
3. Technology Licensing
4. Research Partnerships

Target Countries

Worldwide

Novel compound with leishmanicidal activity

One new unsaturated amide named as Piplamide, N-isobutyl-19-(3',4'-methylenedioxyphenyl)-2E,4E-nonadecadienamide, was isolated from the fruits of the Indian medicinal plant Piper longum by bioassay guided fractionation and isolation, using an in vitro promastigotes assay against of *Leishmania donovani*. The structure was elucidated on the basis of spectroscopic analysis.

Area of Application

- Piplamide could be evaluated as prospective enzyme inhibitor and could provide lead structure for further optimization of activity for use in antileshmanial drug developement.
- Piperlongimin A and piperlongimin B could provide lead structures for the development of novel anticancer therapeutics.

Advantages

- Piplamide shows a very good antilesihmanial activity against Leishmania donovani promastigotes.
- Piperlongimin A (2E-N-isobutyl-hexadecenamide) and piperlongimin B (2E-octadecenoylpiperidine) inhibited cell proliferation of human leukemia, HL-60 cell lines, and displayed major apoptosis-inducing effects.

Environmental Aspects

Environment-friendly

Development Status

Laboratory model

Legal Protection

Patent

Technical Specifications

One new unsaturated amide named as Piplamide, N-isobutyl-19-(3',4'-methylenedioxyphenyl)-2E, 4E-nonadecadienamide, was isolated from the fruits of the Indian medicinal plant Piper longum by bioassay.

Transfer Terms

1. Consultancy
2. Technical services
3. Technology Licensing
4. Research Partnerships

Target Countries

1. Chile
2. China
3. India
4. Malaysia
5. Sri Lanka
6. Thailand
7. United States of America (the)
8. United Kingdom

For the above two offers, contact

Amity University, Sector-125, Noida
Distt Gautam Buddha Nagar 201303
Uttar Pradesh, India

THAILAND

Vacuum sealer and gas injection machine

We can provide technology for preserving and extending shelf life of food products. Proper packaging is critical in avoding food spoilage. The vacuum sealing and gas injection technique prevents contaminating microbes to enter the container, thereby increasing the shelf life of the product.

Area of Application

Food-processing industry, Agro-based industry

Advantages:

- Very effective in preserving foods and extending shelf life
- General purpose, energy saving , low cost domestic technology.

Transfer Terms

Technology licensing

Contact:

Engineering Department
Thailand Institute of Scientific and Technological Research
Ministry of Science and Technology
Bangkok, Thailand

Irradiation of food and agricultural products

This technology uses Co-60 as the source of irradiation and very effective in insect control and disinfestation, Sprout inhibition, reduces microbial load and destroys pathogenic microorganisms.

Area of Application

Food and agriculture industry

Environmental aspects

Cleaner production

Development Status

Fully Commercialized

Transfer Terms

Technical services

Contact:

MOST Thailand
Public Relation of Thailand Institute of Nuclear Technology (TINT)
Bangkok
Thailand 662

BANGLADESH

Proper utilization of CO2 from gas fields

Description

We need epc contractor and also investment to utilize properly a silent derivative from the oil and gas field (4% derivative), assumed a remarkable printing ink will be possible to produce from this wastage and also indirectly help to make a green environment.

Area of Application

Environment

Studies Available

Environmental Impact Studies (EIA/EIS)

Project Type

Start-up

Contact:

Seek Investor
Mirpur, Dhaka, Bangladesh 1216
Tel: 008801710962792
E-mail: seekinvestor2007@yahoo.com

INDIA

Post-harvest techniques for spirulina

An Indian firm is interested to acquire the technical know-how on post-harvest Techniques such as harvesting, drying and packing through machines. The firm is proposing to cultivate Spirulina using Open Pond Type method in 1080 Square Meters. They would like to have assistance on technical know how and also in installing machinery for post-harvest processing of Spirulina.

Area of Application

Food processing, Agro industry

Project Type

Start-up

Contact:

Mr. K.P. Ganesan
E-mail: kpg030567@yahoo.com

Manufacturing of bio-coal

We are interested in manufacturing bio-coal. We have 5 acres of agricultural land in Bareilly (Uttar Pradesh, India) and wish to establish a business related to coal. We are looking for consultancy / technical assistance in setting up a bio-coal manufacturing plant in our premises.

Area of Application

Energy sector

Studies

1. Feasibility report
2. Environmental Impact Studies (EIA/EIS)

Project Type

New idea

Target Countries

India

Contact:

Nitish Chandra
129/3 D Civil Lines, Balwant Singh Marg,
Bareilly 243001, Uttar Pradesh
India

ISLAMIC REPUBLIC OF IRAN

Cotton seed oil extraction

An Iranian company is planning to establish a cotton seed oil extraction and refining plant. It is looking for help of established Indian company in this field. It will decide about the contribution of each side for manufacturing part of the project after negotiations.

Area of Application

Agriculture, Agro-industry

Transfer Terms

- Technology Transfer

Project Type

New idea

Contact:

Iranian Research Organization for Science and Technology (IROST)
Contact Person: Dr. M. Molanejad (Acting President and Director of the International Cooperation Bureau)
No. 71 Forsat St. Enghelab Ave. P.O. Box 15815 Tehran, Islamic Republic of Iran - 15819
Tel: +982188280517; Fax: +98218838340; Web: www.irost.org

THAILAND

Biotechnology for wastewater treatment system

Description

We are wastewater service provider, we also research and develop the new technology for water, wastewater and waste treatment. We need new idea of technology to develop our strenght in this watewater field, include cleaning canel, remove sediment in waterway, biogas, microbiology detecter and treated system quality.

Area of Application

Biotechnology, Engineering, New technology

Studies

Environmental Impact Studies (EIA/EIS)

Project Type

Expansion/Modernisation

Estimated cost (US$)

86000

Target Countries

World Wide

Assistance From Partner

Any kind of new technology to develop on the waste

Contact:

Utility Business Alliance
21 Tst Tower 16th floor., Viphavadee-rangsit rd., Jompol, Jatujak
Bangkok
Thailand 10900

PUBLICATIONS from APCTT

PERIODICALS

(Free access at www.techmonitor.net)

- ❑ Asia Pacific Tech Monitor (4 issues/year) (e-version)
- ❑ VATIS Update (4 issues/year)
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