Microgrid Service Solution (MSS)

"The zero net energy concept: 24 hr RENEWABLE-POWERED"

September 15, 2022

Yodthong Mensin, PhD

Deputy-Director for Research and Academic Affairs
SGtech, Naresuan University
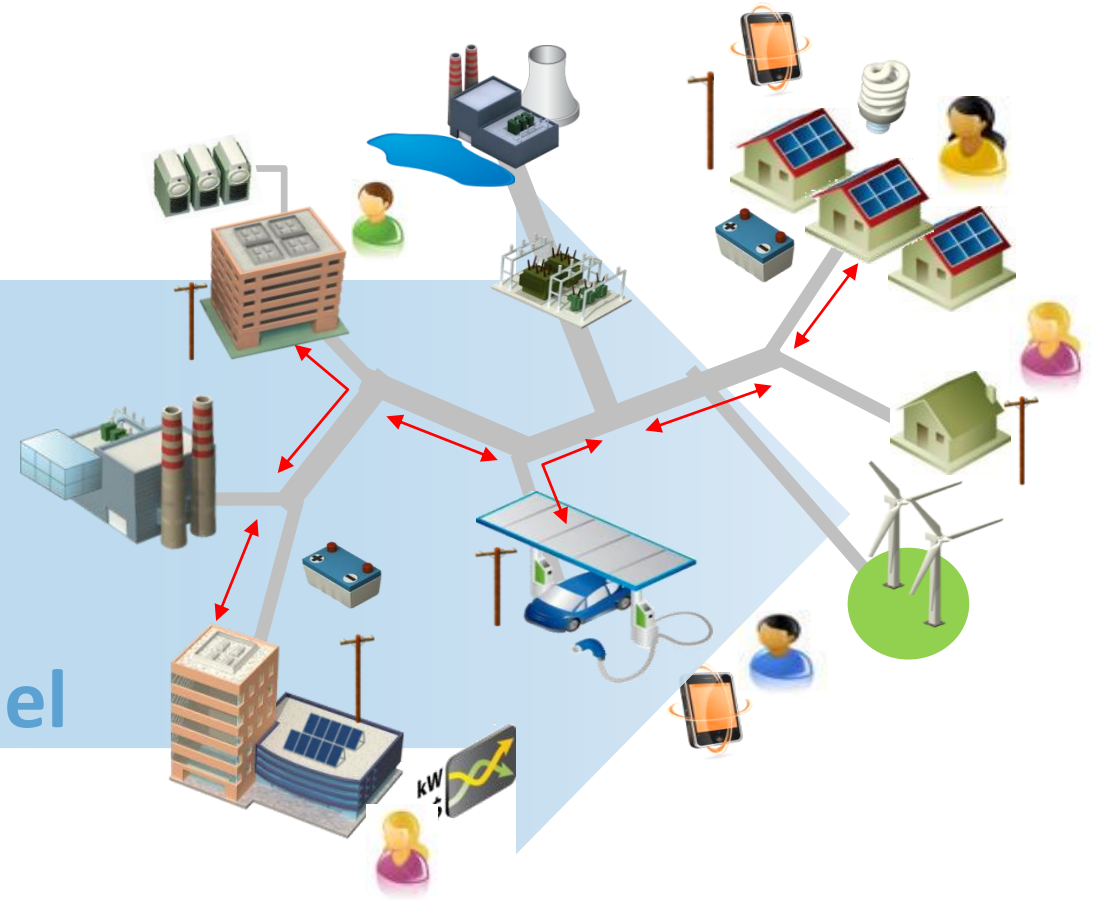
Power Sector Transformation

5 Disruptive Trends and Technologies

(1) **Decarbonization**
(2) **Decentralization**
(3) **Electrification**
(4) **Digitalization**
(5) **Deregulation**

4D1E model
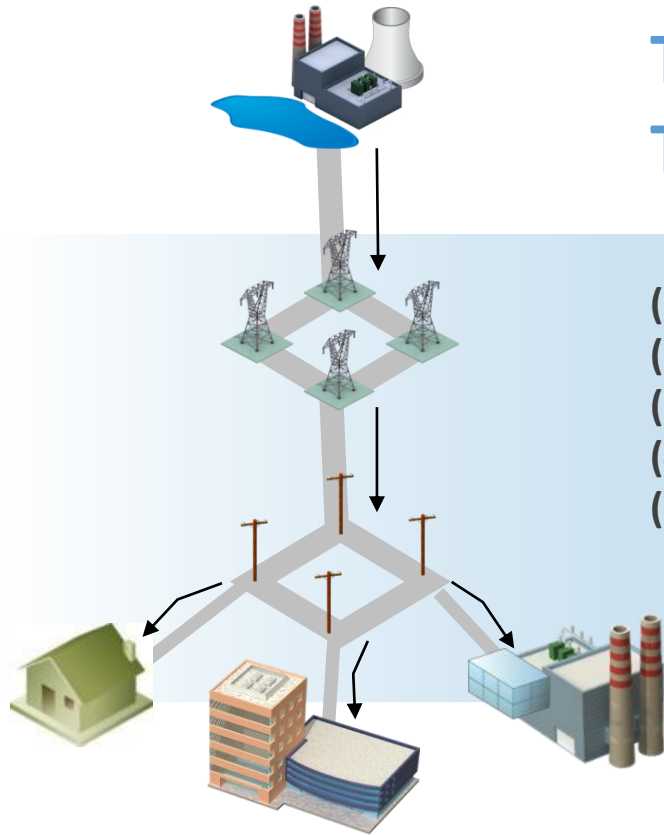
Grid for today

Grid for tomorrow

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Global energy demand supplied with hydrogen, EJ
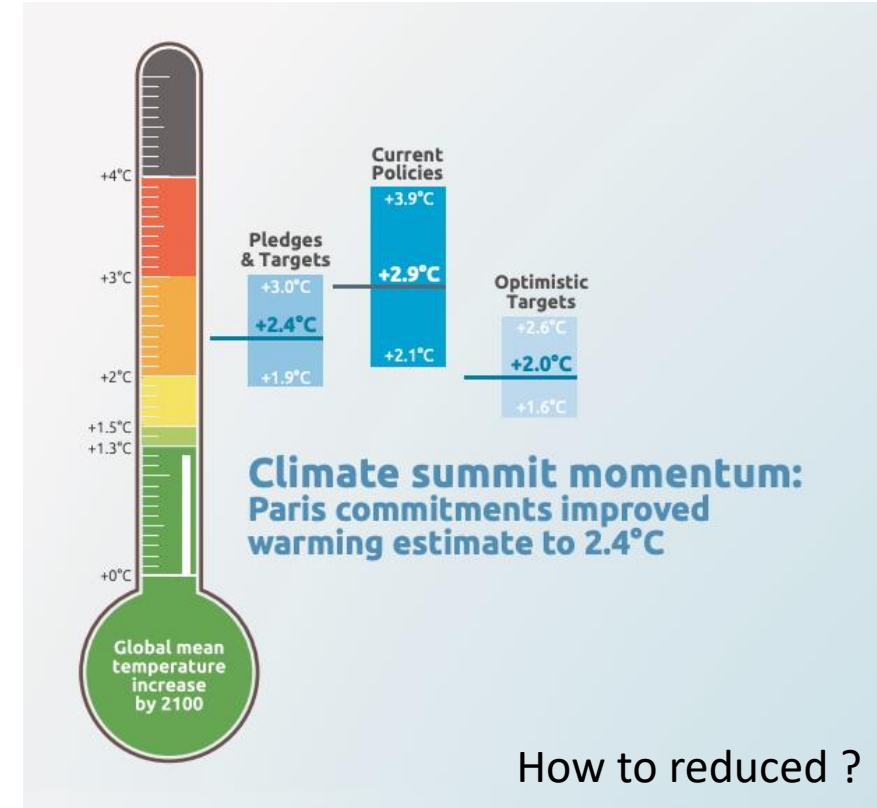
Increasing of energy consumption
(Oil, Gas and Electricity)

1 Power generation, buffering

4 Transportation

5 Industrial energy

6 Building heat and power

7 New feedstock (CCU, DRI)

Existing feedstock uses

Source: https://www.cleantech.com/the-role-of-green-hydrogen-in-global-decarbonization/

Lead to

Climate summit momentum:
Paris commitments improved
warming estimate to 2.4°C

How to reduced ?

Source: https::/virta.global/blog/decarbonisation

DERs: (PV-intermittent supply + BESS-firm) with grid parity

1. Increasing of DERs with low cost of the energy units (kWh) implementation
2. Change from centralize to decentralize and two-way power flow (upstream gen.)
3. Rapidly development of Lithium-ion and "**COE decreasing of battery lithium-ion**"

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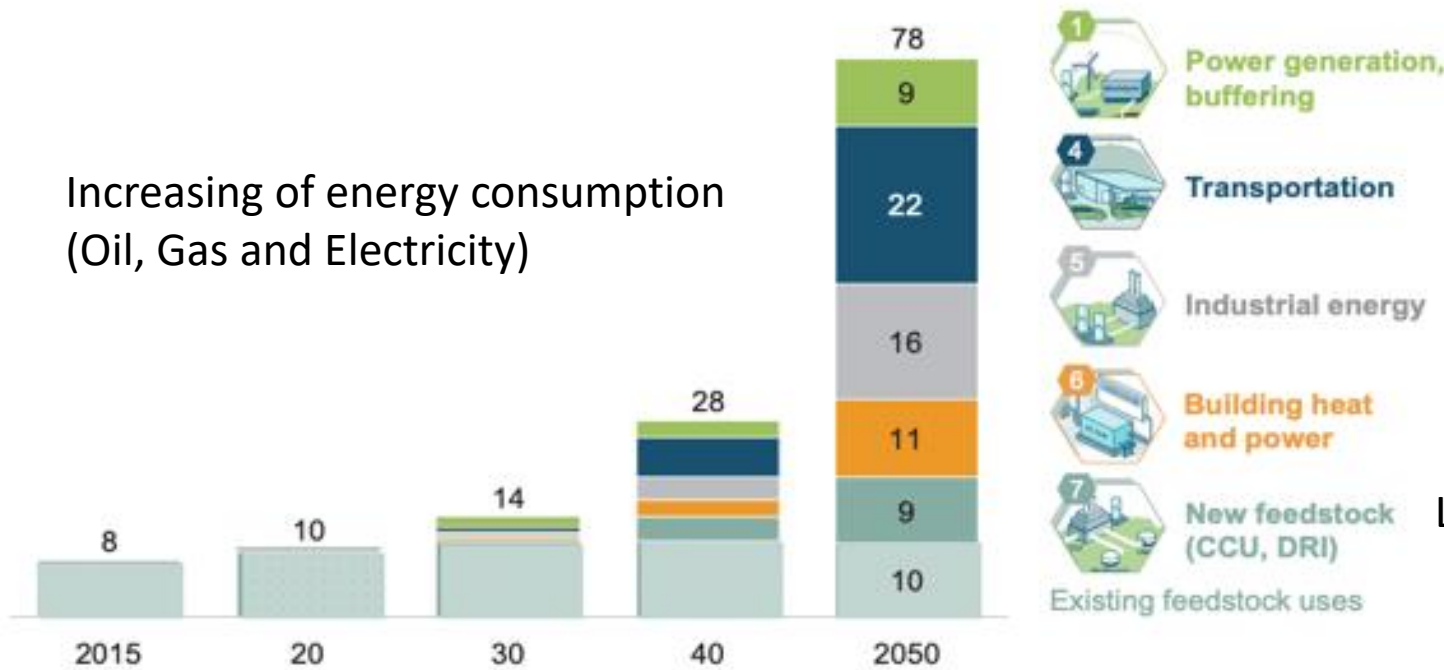
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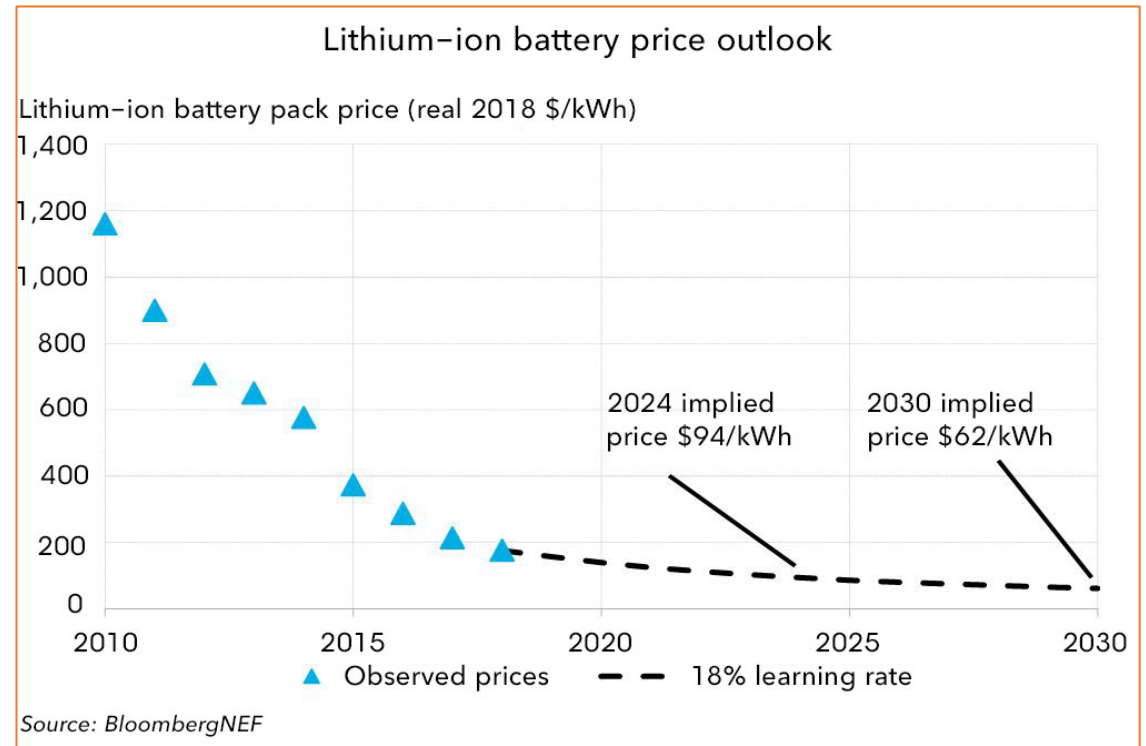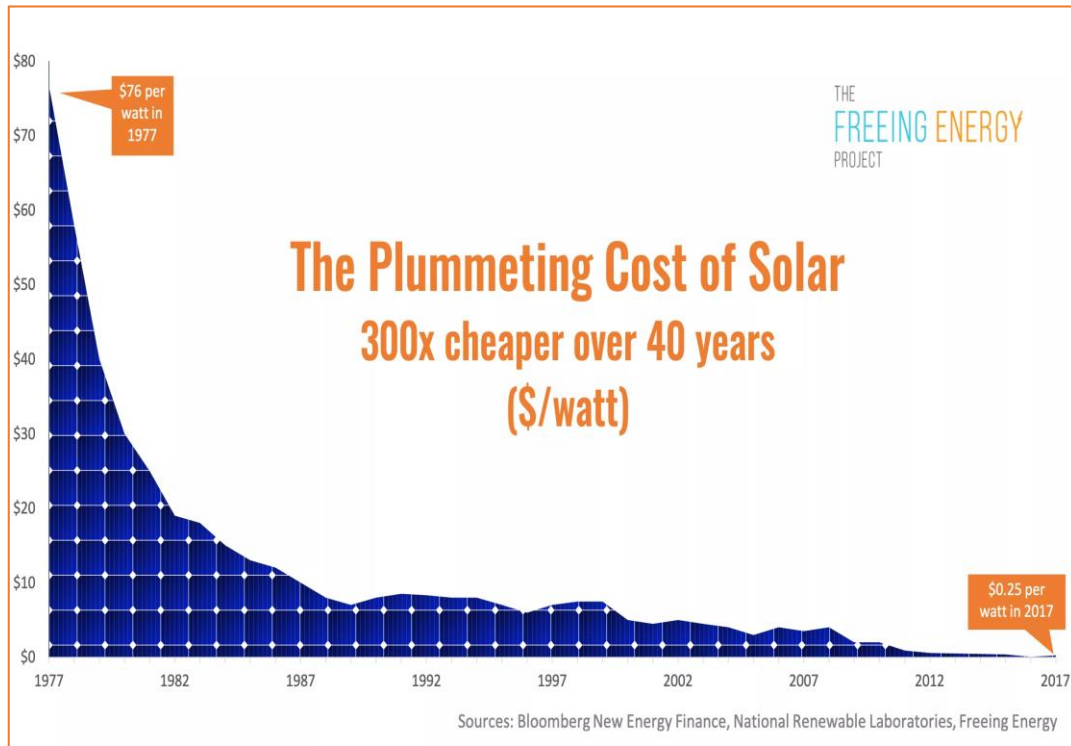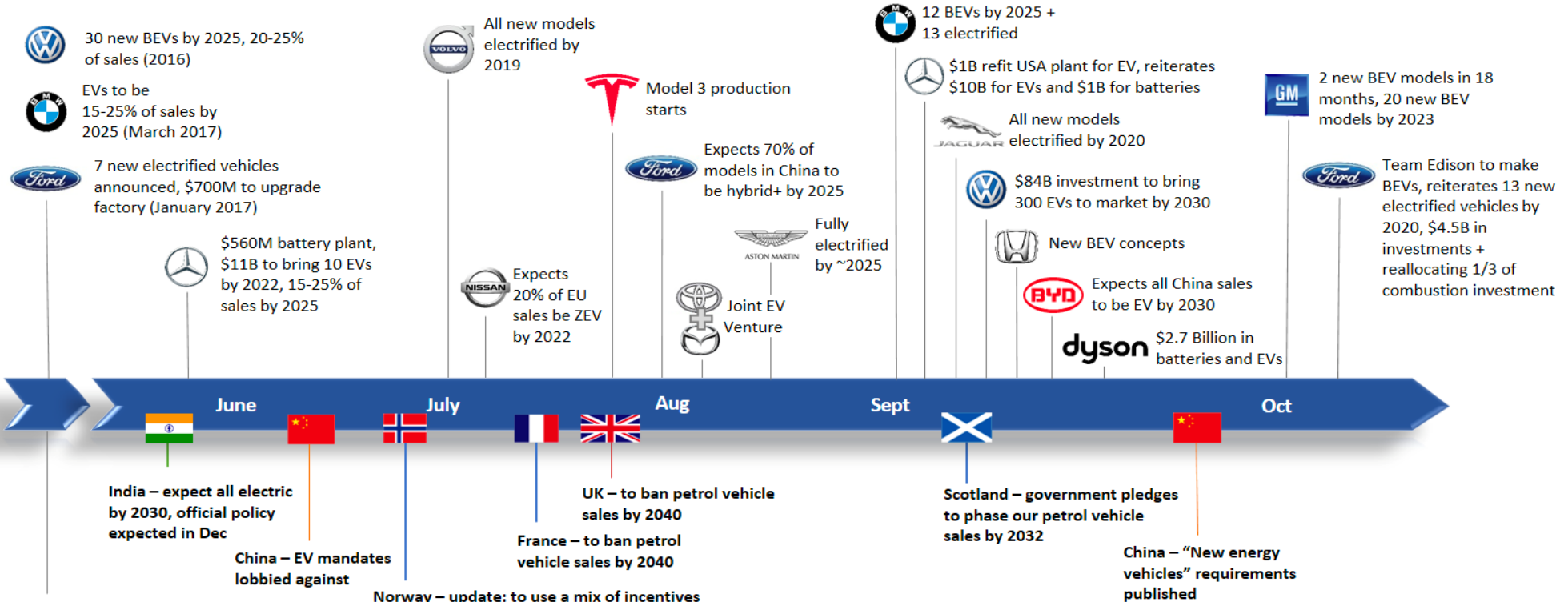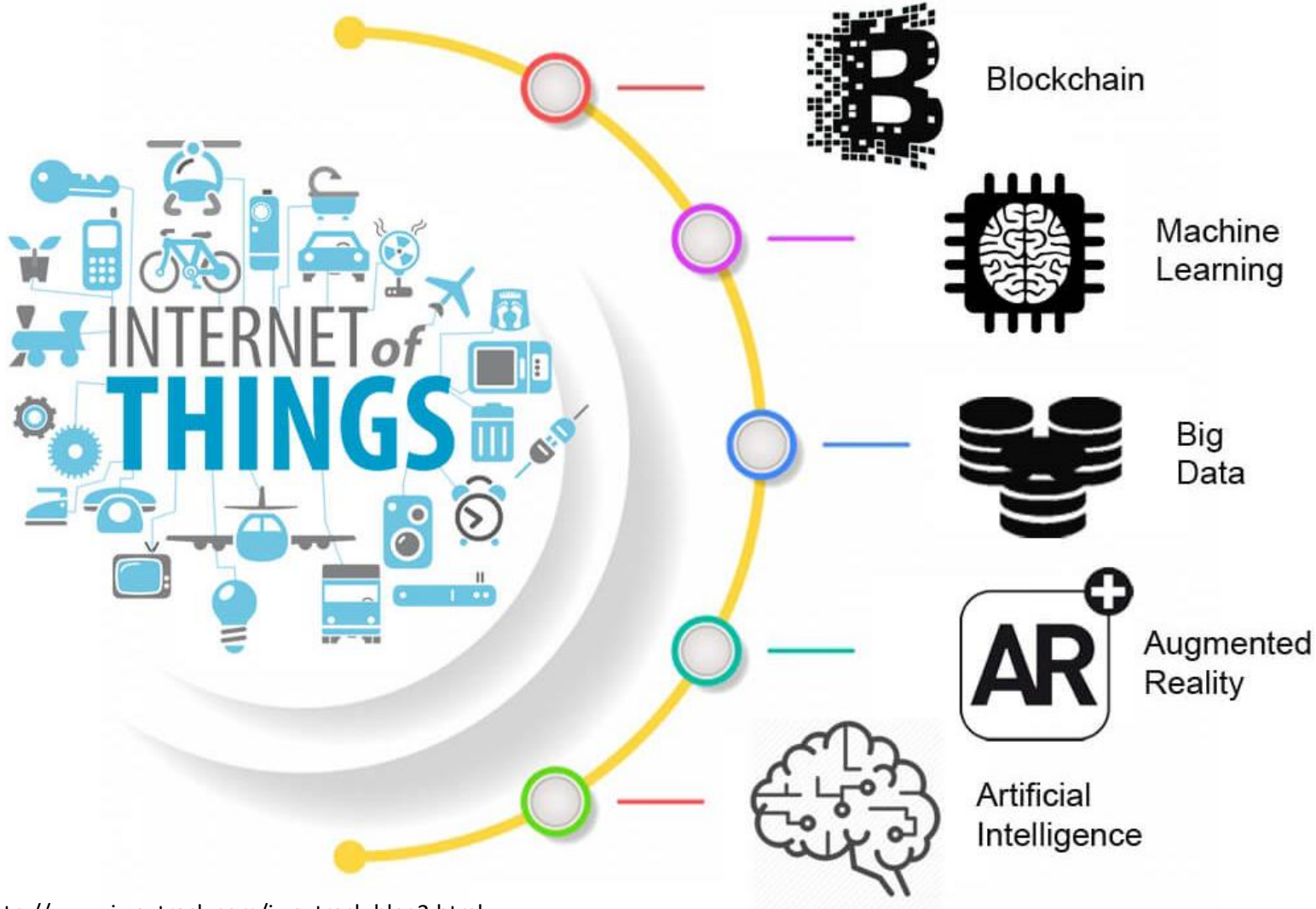055-963182

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Distributed EV + DERs -> VPP with aggregator model

VW — 30 new BEVs by 2025, 20-25% of sales (2016)

BMW — EVs to be 15-25% of sales by 2025 (March 2017)

Ford — 7 new electrified vehicles announced, $700M to upgrade factory (January 2017)

Mercedes — $560M battery plant, $11B to bring 10 EVs by 2022, 15-25% of sales by 2025

VOLVO — All new models electrified by 2019

NISSAN — Expects 20% of EU sales be ZEV by 2022

Tesla — Model 3 production starts

Ford — Expects 70% of models in China to be hybrid+ by 2025

ASTON MARTIN — Fully electrified by ~2025

Toyota/Mazda — Joint EV Venture

BMW — 12 BEVs by 2025 + 13 electrified

Mercedes — $1B refit USA plant for EV, reiterates $10B for EVs and $1B for batteries

JAGUAR — All new models electrified by 2020

VW — $84B investment to bring 300 EVs to market by 2030

Honda — New BEV concepts

BYD — Expects all China sales to be EV by 2030

dyson — $2.7 Billion in batteries and EVs

GM — 2 new BEV models in 18 months, 20 new BEV models by 2023

Ford — Team Edison to make BEVs, reiterates 13 new electrified vehicles by 2020, $4.5B in investments + reallocating 1/3 of combustion investment

Timeline: June — July — Aug — Sept — Oct

India – expect all electric by 2030, official policy expected in Dec

China – EV mandates lobbied against

Norway – update: to use a mix of incentives and fees to reach goal of no petrol vehicles sold by 2025. June 2017

France – to ban petrol vehicle sales by 2040

UK – to ban petrol vehicle sales by 2040

Scotland – government pledges to phase our petrol vehicle sales by 2032

China – "New energy vehicles" requirements published

Netherlands – lower house passes motion to ban petrol vehicle sales by 2025 (March 2016)

Norway – Norway discussing ban of petrol vehicles by 2025 (June 2016)

Germany – passes resolution seeking to approve ZEV only by 2030 (October 2016)

Dynamics demand with EV penetrations

»

BEV = Battery Electric Vehicle
PEV = Plug-in Electric Vehicle
ZEV = Zero Emission Vehicle
EV or "electrified" = hybrid, plug-in hybrid, or BEV

Source: https://www.teslarati.com/automakers-come-acceptance-ev-revolution-begun

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Blockchain

Machine Learning

Big Data

Augmented Reality

AR+

Artificial Intelligence

INTERNET of THINGS

Key technologies

- 5G Board Band Cellular Network
- IOT with M2M communication
- Quantum Computing Technology
- Business Innovation for Energy sector

4D1E with Energy Sector ???

(Decentralized Digital Platform)

Source: http://www.iwaytrack.com/iwaytrack-blog2.html

Microgrid Service Solution (MSS)

(Net Zero Import Energy from the Grid)
Key driving force: COE of PV & BESS
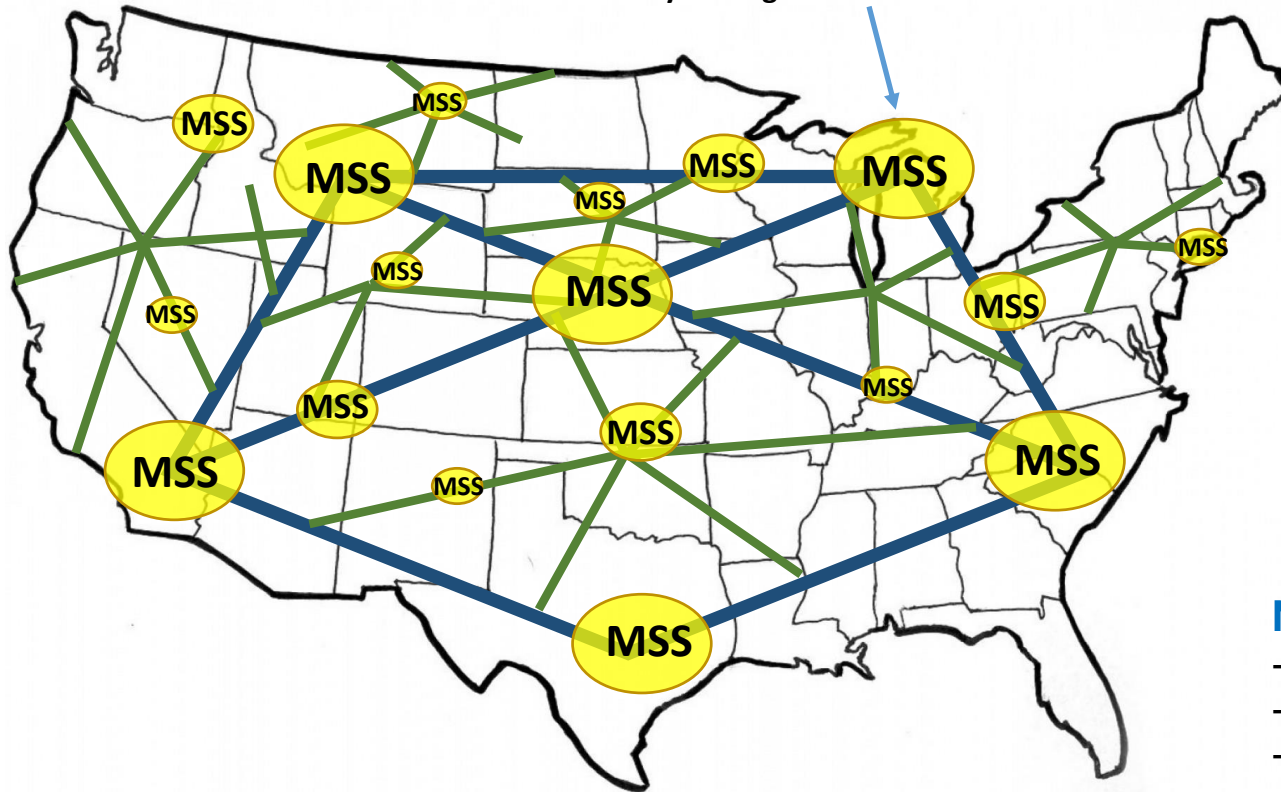
Micro-Grid (Low Voltage)
-Distributed Generation (DG)
-Customer Electrification (Prosumer)
-Almost PV on ground and rooftop (< 1 MW)
-Microgrid, Prosumer and P2P: Utilities, Private
 and Customer

Community Grid (Medium Voltage)
-Small Power Producer transmission
-Community Electrification (IPP, SPP and VSPP)
-PV and Wind farm, Waste to Energy
 Biomass Gasification (1 – 90 MW)
-ESB, DR and VPP: Utilities and Private

National Grid (High Voltage)
-High Capacity transmission
-Nation balance of supply & Demand
-Centralize Generation (> 100 MW)
-Enhanced Single Buyer (ESB)

Free Market

Market Design Transition

ESB: Monopoly

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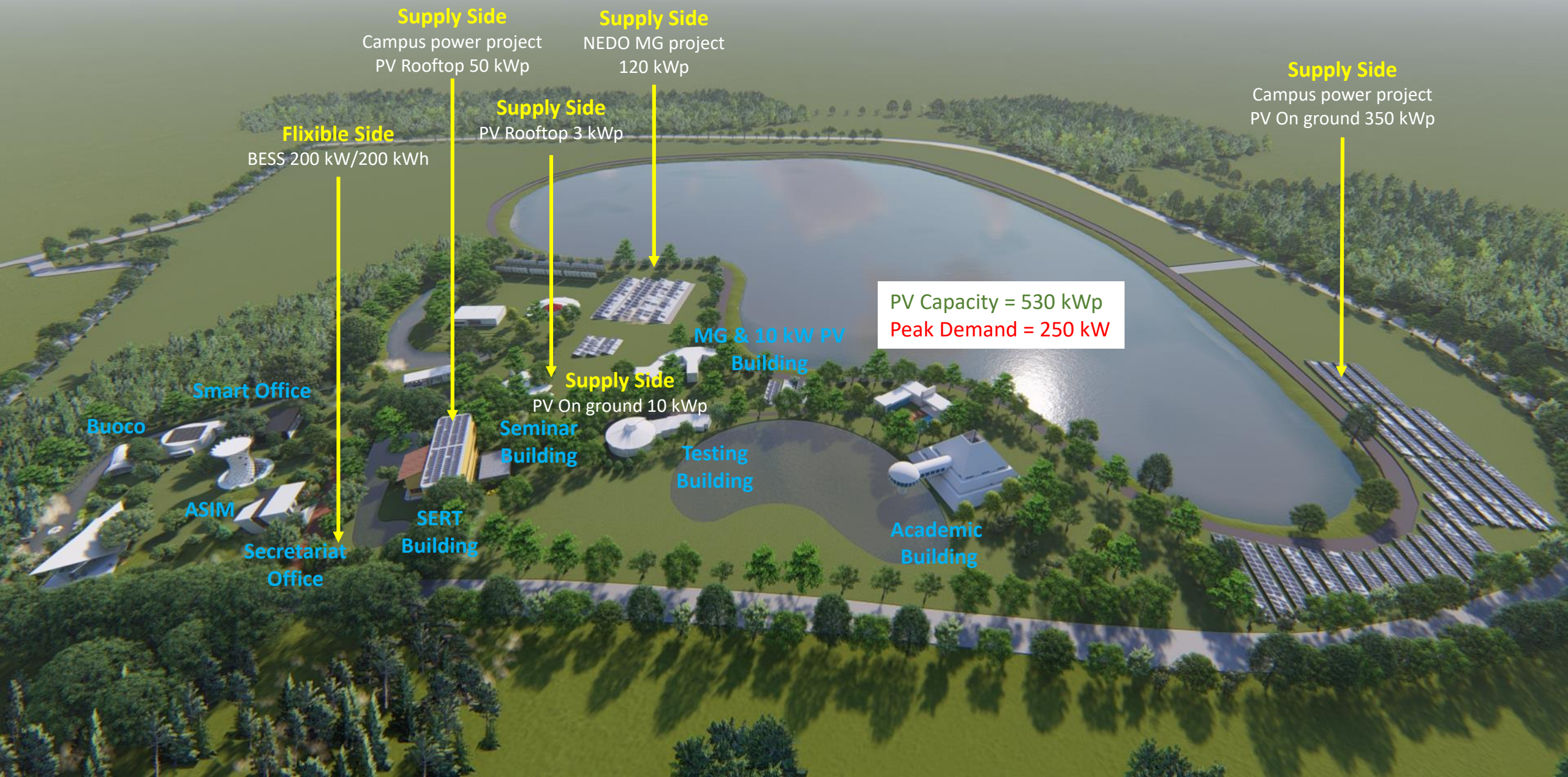
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120 kW PV Micro-Grid System

Central Control Panel | Diesel Generator:100kW | Storage Battery:200kWh

1. Microgrid-NEDO

- PV : 120 kW on ground
- Diesel Generator: 100 kW

2. PV Campus Power

- PV : 350 kW on ground
- PV: 50 kW rooftop

350 kW PV campus power

3. Automated Demand Response (DLC function)

4. BESS for Microgrid-ZNE

- BESS: 200 kW / 200 kWh
- LiFePO4 Technology

Smart Meter / Controller Load Switch

EV with V2G charging station

(Optional)

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Energy Management System (EMS) + **Energy Trading Platform (ETP)**

BUSINESS & FUNCTION LAYER

BIG DATA / ANALYTICS / BLOCKCHAIN / AI FORECASTING / POWER FLOW CONTROL
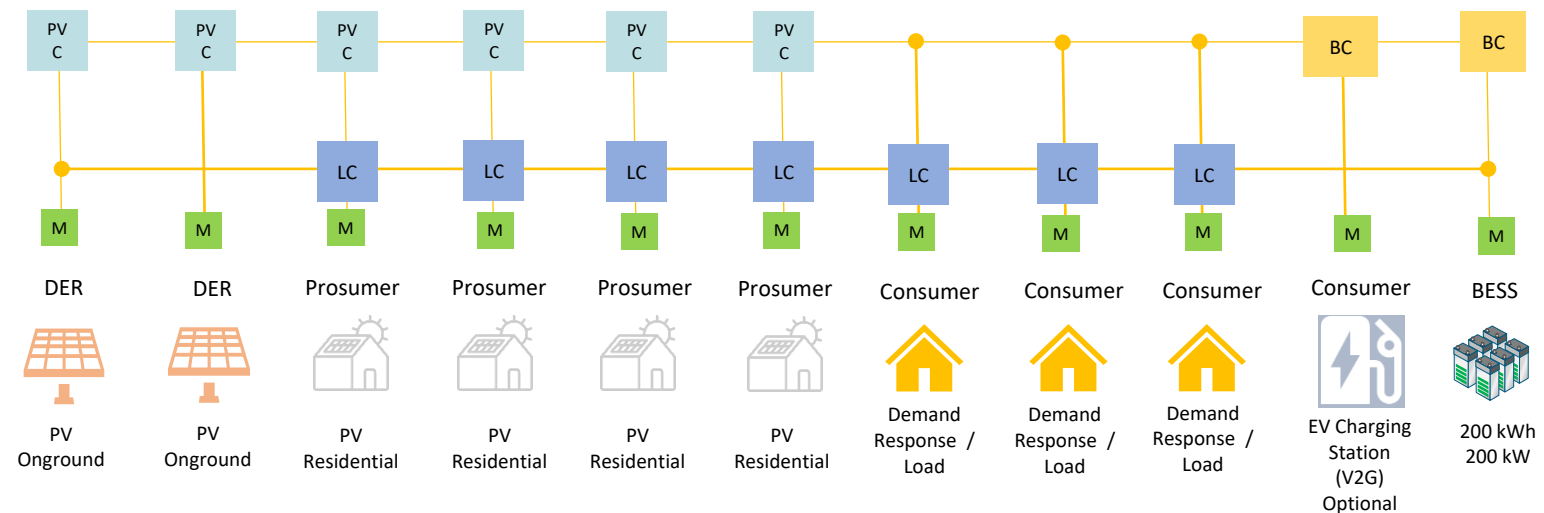
INFORMATION LAYER

Multi-protocol / CIM / Standard Data (Json)

COMMUNICATION LAYER POWER FLOW CONTROL (PV & BESS, EV)

COMMUNICATION LAYER POWER FLOW CONTROL (Load)

| PVC | PVC | PVC | PVC | PVC | PVC | | | | BC | BC |

| | | LC | LC | LC | LC | LC | LC | LC | | |

| M | M | M | M | M | M | M | M | M | M | M |

COMPONENTS LAYER

| DER | DER | Prosumer | Prosumer | Prosumer | Prosumer | Consumer | Consumer | Consumer | Consumer | BESS |
| PV Onground | PV Onground | PV Residential | PV Residential | PV Residential | PV Residential | Demand Response / Load | Demand Response / Load | Demand Response / Load | EV Charging Station (V2G) Optional | 200 kWh 200 kW |

Legend:

PVC — **PV (INV/Controller)**

LC — **Load (DLC & Protection & Relay)**

BC — **BESS,EV (INV/Controller)**

M — **Smart Meter**

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Key Point: Monitoring, Protection and Control (Stability)

Result form Forecasting
Microgrid Controller (MGC)

ESS-VPP-Signal

Protection-Signal

MG_mode Signal

DR-Signal

Node

Breaker (IED)   Breaker (IED)

Distributed Generation
(DG+BESS+EV)

IEC61850
Intelligent Electronic Devices (IED)
POC (Grid-Islanding Mode)

Energy Consumption
(DR)

Microgrid Concept Design
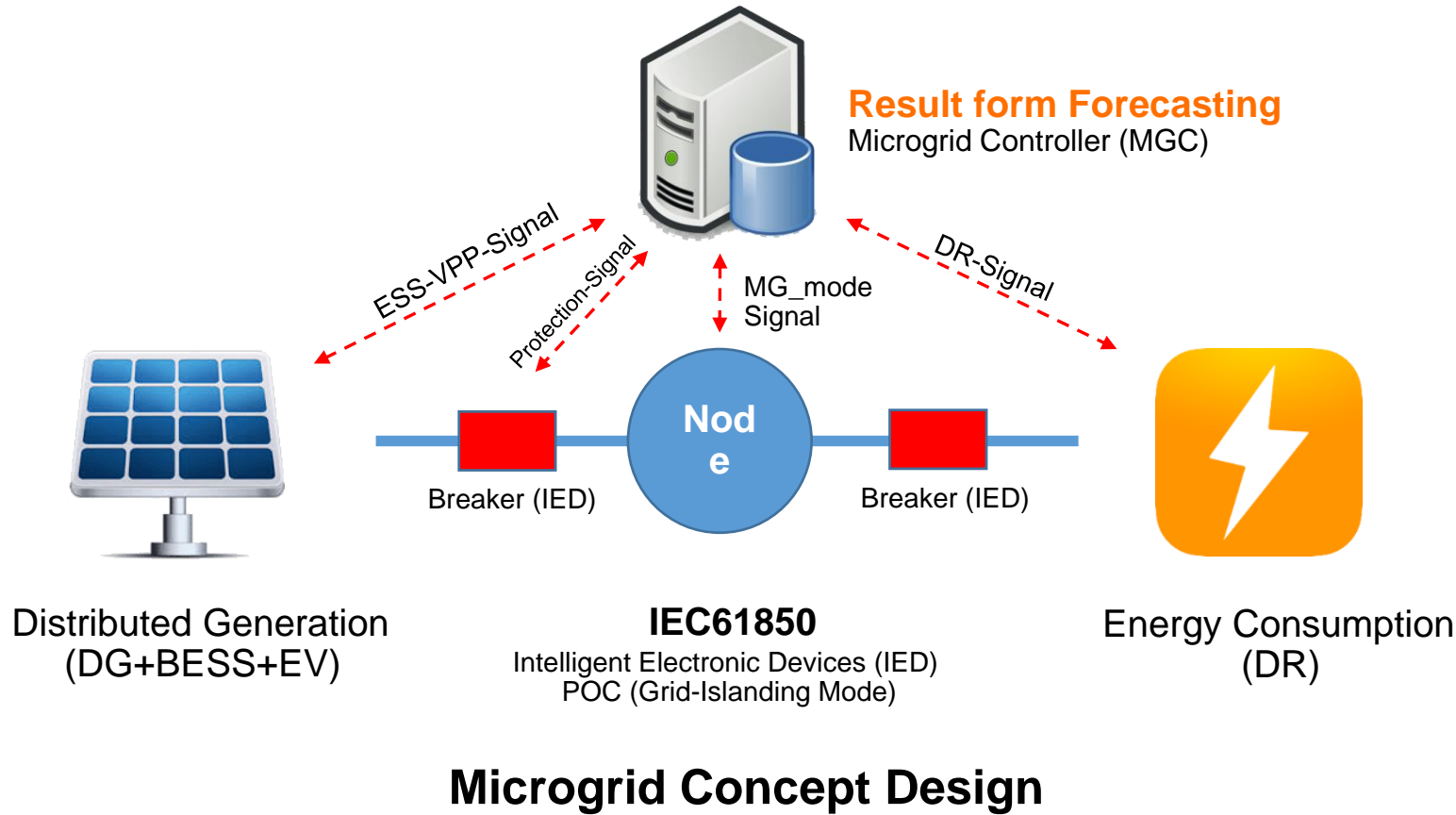
Net zero import energy from the grid

1. RE and Load Forecasting
2. Dispatch Efficiency (Daily Scheduling & Planning)
3. Daytime (PV+BESS) and Nighttime (BESS+EV)
4. Cost optimization with Reserve Capacity (DR+VPP)
5. P2P Energy Trading Platform with blockchain technology

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P2P ETP with Blockchain Concept

Locational marginal pricing (LMP) Grid Parity

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PV Capacity = 530 kWp
Peak Demand = 250 kW

Grid Connected

650 kVA

PEA Distribution Line

LCOE: 3.25 – 3.75 Baht/kWh with merit order (LMP Concept)

Priority 1: Supply & Demand Ratio (DERs) (3.25 - 3.75 Baht/kWh) -> Self Consumption
Priority 2: BESS / V2G (Optional) (Peak & Nighttime) ~ 3.80 Bath/kWh -> Dispatch Efficiency
Priority 3: DR / VPP (Operating Reserve) ~ 3.85 Bath/kWh -> Reserve Capacity
Priority 4: PEA Utility Grid (External sources) ~ 4.00 Bath/kWh

4.72 Baht/kWh (Last update)

Thailand: 0.13 $/kWh
Germany: 0.35 $/kWh

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Full Demonstrate of SGtech P2P ETP Platform with Blockchain Technology

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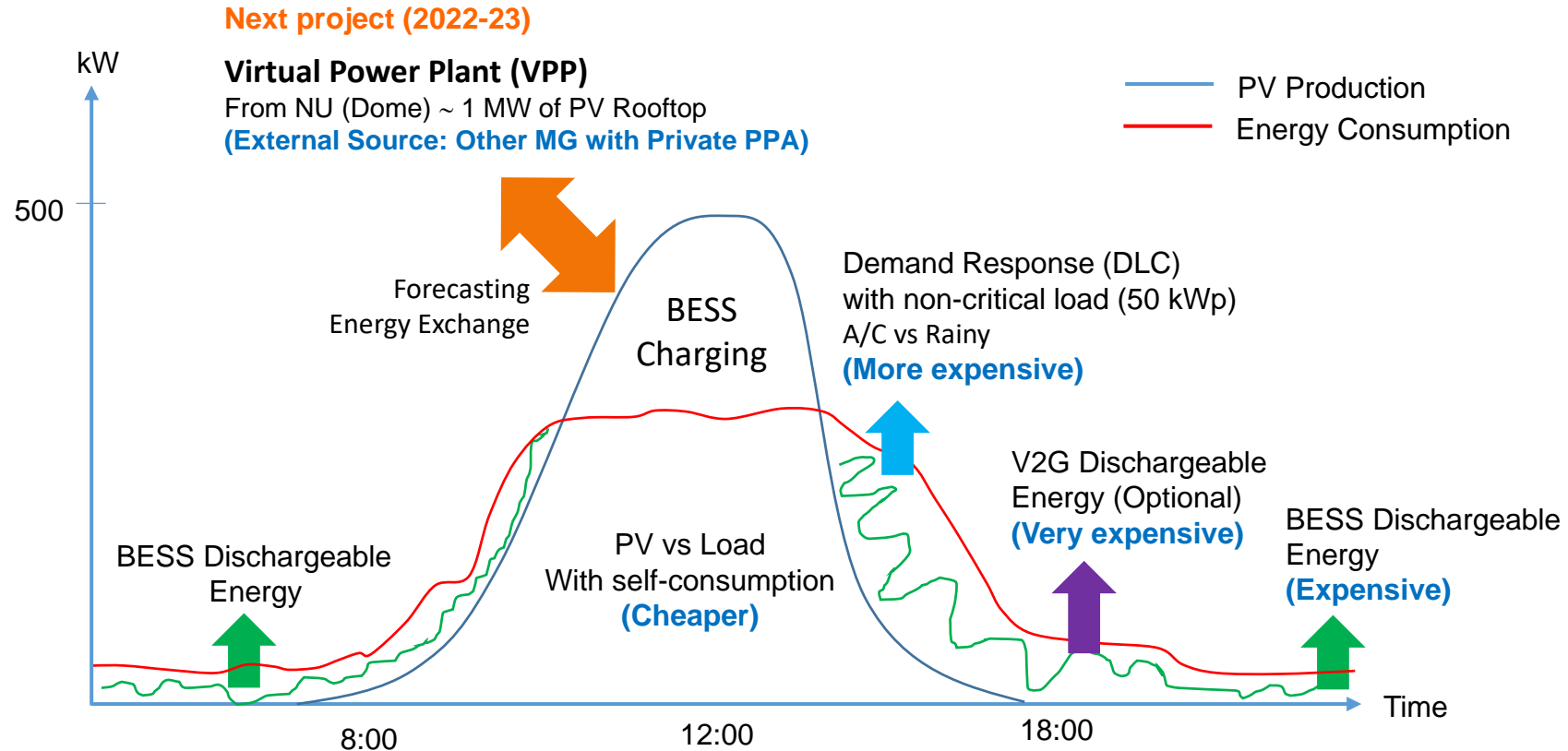
Year 2022: Microgrid Service Solution (MSS)

The completely microgrid functional implementation system in Thailand

"Net Zero import energy from the grid"

All areas of smart grid technology implementation

Thank you