# Renewable Energy for NAMA

OECC
Masayoshi Futami

# Outline

- Introduction
- Proposal of MRV
- Additional technology proposal

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# Introduction

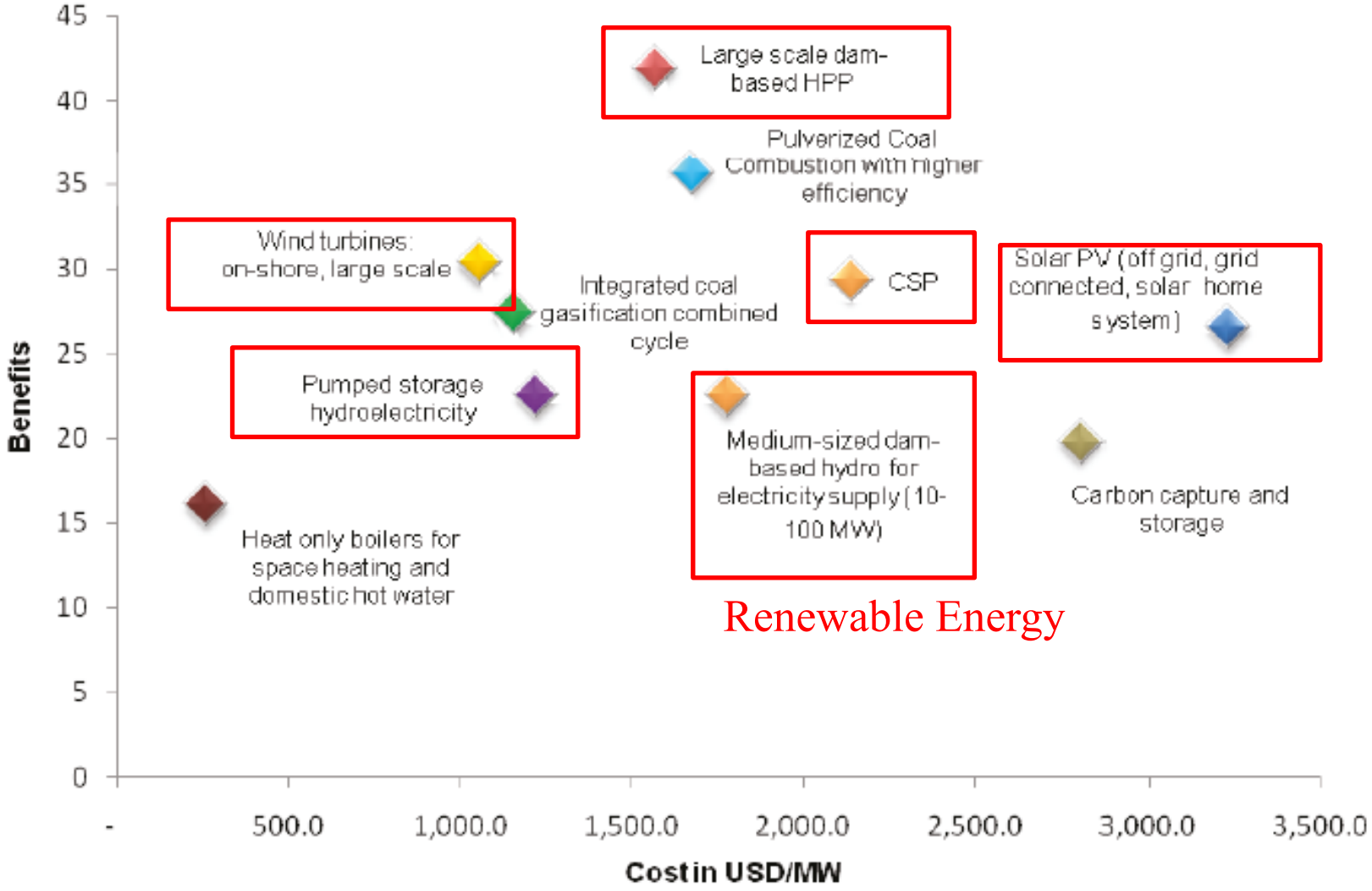
Salkhit Wind park
(Gobitec and ASG for RE)

- NAMA submission (2010)
  1-a: PV and Solar heating
  1-b: Wind power generators and wind farms
  1-c: Hydropower plants

- Technology Needs Assessment
  (1) Concentrated Solar Power (Electricity and Heat)
  (2) Pumped storage hydroelectricity
  (3) Wind turbines  etc

- Law of Mongolia on Renewable Energy
  (1) License for RE provider
  (2) Stipulation of Feed In Tariff

- National Renewable energy program
  RE share in the total generation to 20-25 percent by 2020




Cost benefit comparisons of the energy industry subsector technologies for climate change mitigation (TNA 2013)

# Near renewable term projects (2014-2017) Ministry of Energy

| Grid | Project location | Capacity | Annual electricity generation | Project implementing company | Feasibility study |
|---|---|---|---|---|---|
| **HYDRO POWER PLANT** | | | | | |
| CES | Khutag-Undur soum, Bulgan province (Egiin HPP) | 220 MW | 500 mil kWh | (Ministry of energy) | Yes |
| CES | Tsagaannuur soum, Selenge province (Shuren HPP) | 300 MW | 1’100 mil kWh | (Ministry of energy) | Ongoing |
| CES | Songinokhairkan district, Ulaanbaatar city | Pumped storage HPP, 100 MW | 82 mil kWh | “Morit impex”LLC | Yes |
| **SOLAR POWER PLANT** | | | | | |
| CES | Sainshand city, Dornogovi province | 30 MW | 52 mil kWh | “M&P international” LLC | Yes |
| CES | Bayanteeg bag, Nariinteel soum, Uvurkhangai province | 8 MW | 13 mil kWh | Hyosung group, South Korea | Yes |
| **WIND POWER PLANT** | | | | | |
| CES | Choir city, Govisumber province | 50 MW | 123 mil kWh | “Aydiner global”LLC | Yes |
| CES | Khanbogd soum, Umnugovi province | 102 MW | 300 mil kWh | “Qleantech”LLC | Yes |
| CES | Sainshand city, Dornogovi province | 50 MW | 130 mil kWh | “Sainshand wind park”LLC | Yes |

# Long term renewable term projects (2018-2025) Ministry of Energy

| Grid | Project location | Capacity | Annual electricity generation | Project implementing company | Feasibility study |
|---|---|---|---|---|---|
| **HYDRO POWER PLANT** | | | | | |
| CES | Erdenet city, Orkhon province | Pumped storage HPP, 100 MW | - | (Ministry of energy) | Pre-FS |
| CES | Darkhan city, Darkhan province | Pumped storage HPP, 100 MW | - | (Ministry of energy) | |
| **SOLAR POWER PLANT** | | | | | |
| CES | Khurmen soum, Umnugovi province | 30 MW | - | “Clean energy asia” LLC | Pre-FS |
| WES | Taishir soum, Govi-Altai province | 10 MW | - | Japanese company | |
| CES | Dalanzadgad city, Umnugovi province | Concentrated SPP, 10-20 MW | - | (Ministry of energy) | Preparing Pre-FS |
| **WIND POWER PLANT** | | | | | |
| CES | Bulgan soum, Umnugovi province | 100 MW | - | “Clean energy asia” LLC | Preparing Pre-FS |
| CES | Tsogttsetsii soum, Umnugovi province | 50 MW | | “Clean energy asia” LLC | Preparing Pre-FS |
| CES | Argalant soum, Tuv province | 50 MW | - | “Khiimori salkhi” LLC | Preparing Pre-FS |

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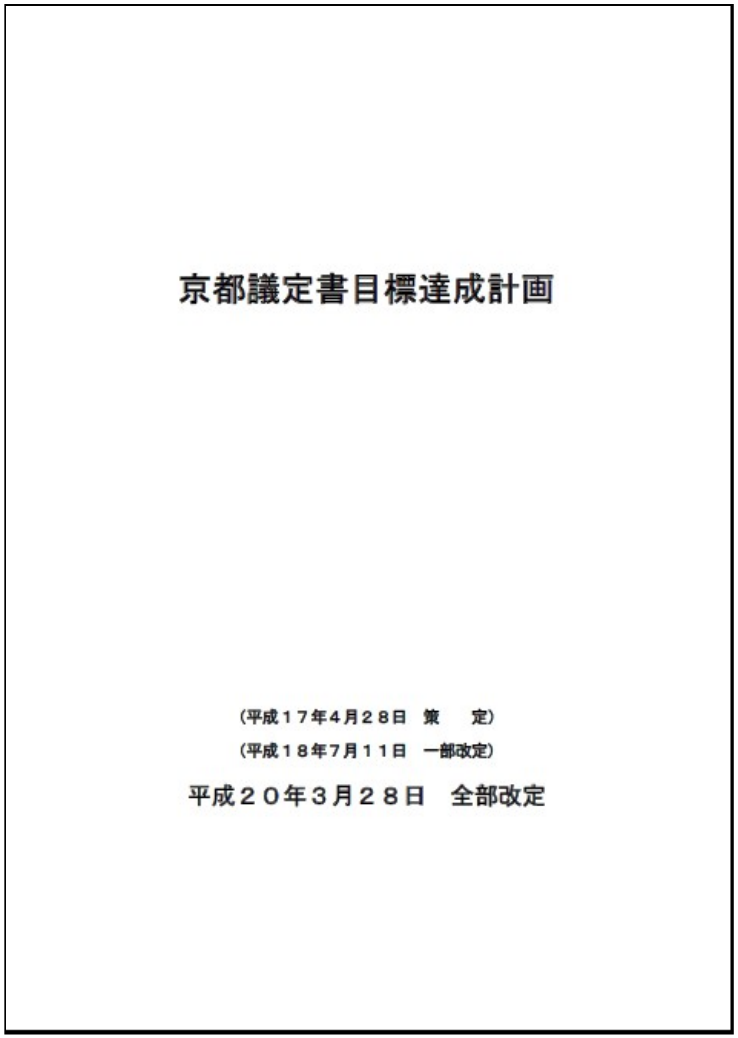
# Proposal of MRV

MRV= Measure, Report, Verification

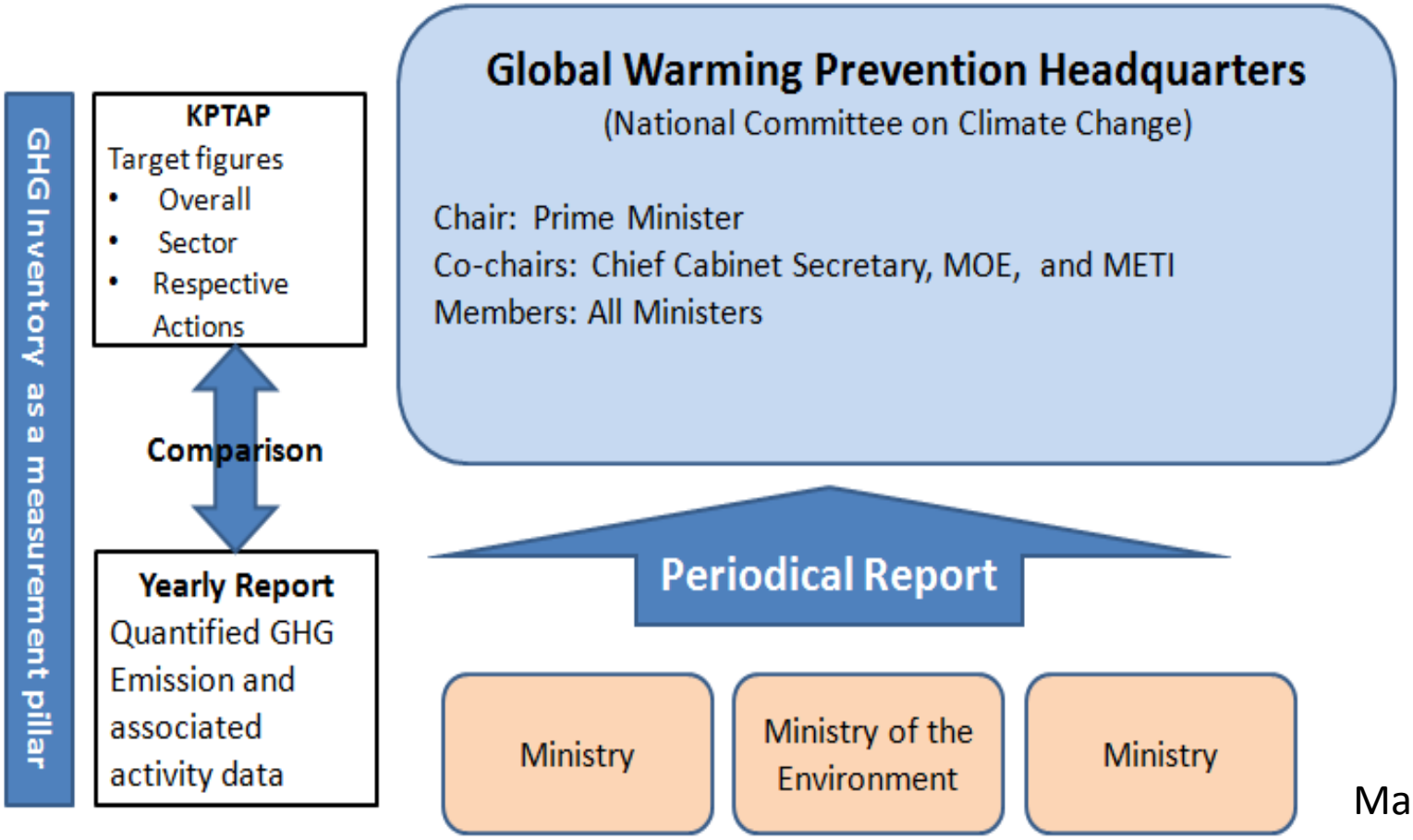

京都議定書目標達成計画

（平成１７年４月２８日　策　　定）
（平成１８年７月１１日　一部改定）
平成２０年３月２８日　全部改定

“Kyoto Protocol Target Achievement Plan (KPTAP)” was formulated which carries on the Outline in order to stipulate the measures necessary by Japan under the Kyoto Protocol. KPTAP considers what to measure, how to measure, when to measure and who should measure, report and verify ex-post effect of the measures.

NAMA ≒ KPTAP

Every year (2008-2012) the Global Warming Prevention Headquarters (GWPH) under the cabinet of Japan have evaluated the progress of countermeasures and considered the policies as necessary with reference to the evaluation indicators.




Makoto Kato

# Components of KPTAP

KPTAP provides mitigation measures information in a tabular format by responsible ministries.

- Individual countermeasures
  = Planed RE project (capacities)

- Their evaluation indicators
  = Total introduced capacity in target year

- Expected GHG emissions reduction
  = Electricity generation × EF

- Policies of the government
  = Renewable Energy low, National Action Program on Climate Change, National Renewable Energy Program, Mongolia's Strategy Low of Mongolia on Energy etc

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# Case study

- Individual countermeasures = Planed RE project (capacities)

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| CES | Songinokhairkan district, Ulaanbaatar city | Pumped storage HPP, 100 MW | 82 mil kWh |
| **SOLAR POWER PLANT** | | | |
| CES | Sainshand city, Dornogovi province | 30 MW | 52 mil kWh |
| CES | Bayanteeg bag, Nariinteel soum, Uvurkhangai province | 8 MW | 13 mil kWh |
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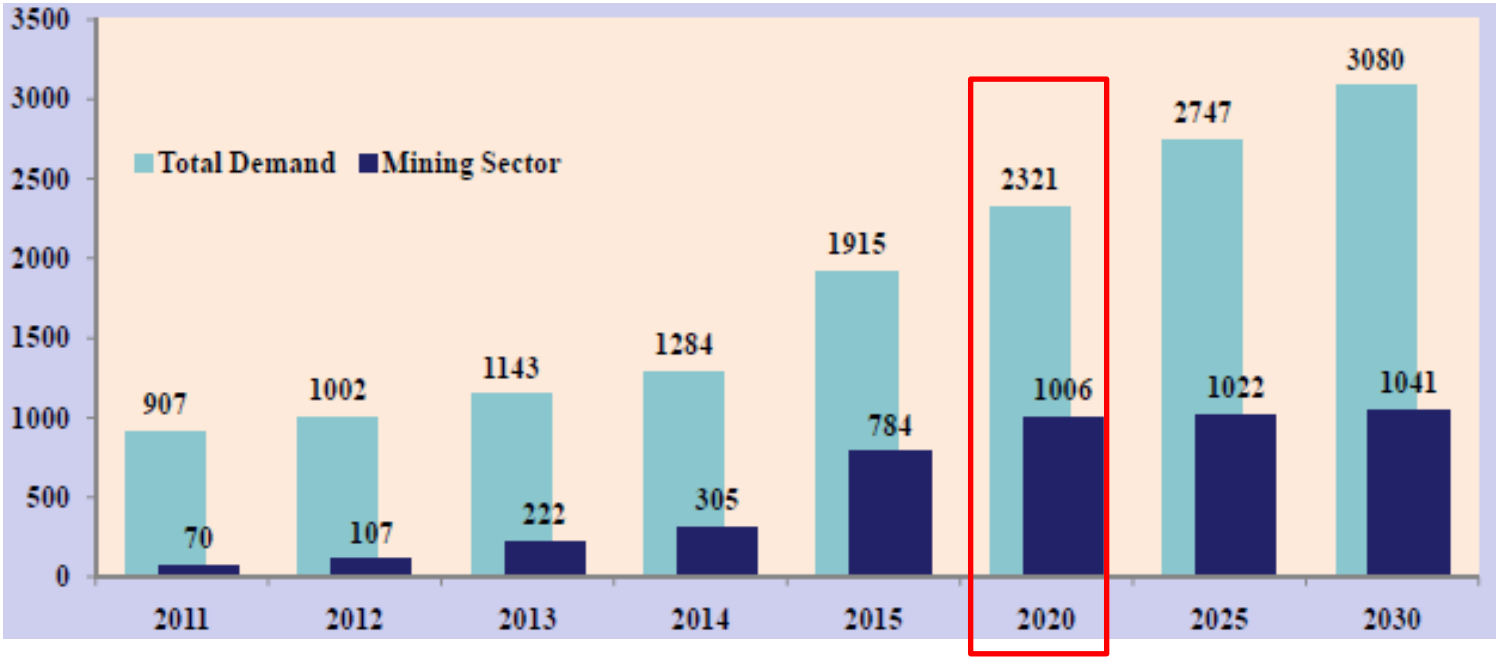
- Their evaluation indicators= Total introduced capacity in target year

National overall target for the share of Renewable Energy in 2020 is 20-25% according to the National Renewable Energy Program

| | |
|---|---|
| Target of electricity from renewable sources in total electricityproduction in 2020 | 20-25% |
| Expected total electricity consumption in 2020 (million kWh) | 7800.0 |
| Expected amount of electricity from renewable sources corresponding to 2020 target (million kWh) | 1560.0 |

(TNA 2013)




Energy demand MW (Ministry of Energy)

| | |
|---|---|
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(TNA 2013)

Evaluation Indicator

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2300 million kWh

Planed RE project attain the target if it will be constricted and generated by 2020

2300 million kWh > Target (1560 million kWh)

It should be reviewed by Mongolia government (in cross cutting manner) comparing with evaluation indicators in target year or break down of EI in planed initial year of the facilities

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# Case study

- Expected GHG emissions reduction= Electricity generation × EF

Emission Factor (EF)

| Regional Grid | 2009-2010 | |
|---|---|---|
| | OM* | BM* |
| Central Energy System | 1.1501 | 1.0559 |

*(unit: tCO2/MWh)

CDM National Bureau, Mongolia

Combined Margin (CM) is used by MEGD for the estimation of project

EF=CM={OM (Operating Margin) + BM (Build Margin)}/2
=(1.1501+1.0559)/2=1.103 (tCO2/MWh)

Expected GHG emissions reduction
= 2300 million kWh /year×1.103 tCO2/MWh
= 2,536,900 tCO2/year

# Components of KPTAP

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# Case study

- Policies of the government

## Renewable Energy low

- Article 11.3 Feed in Tariff

US$/kWh

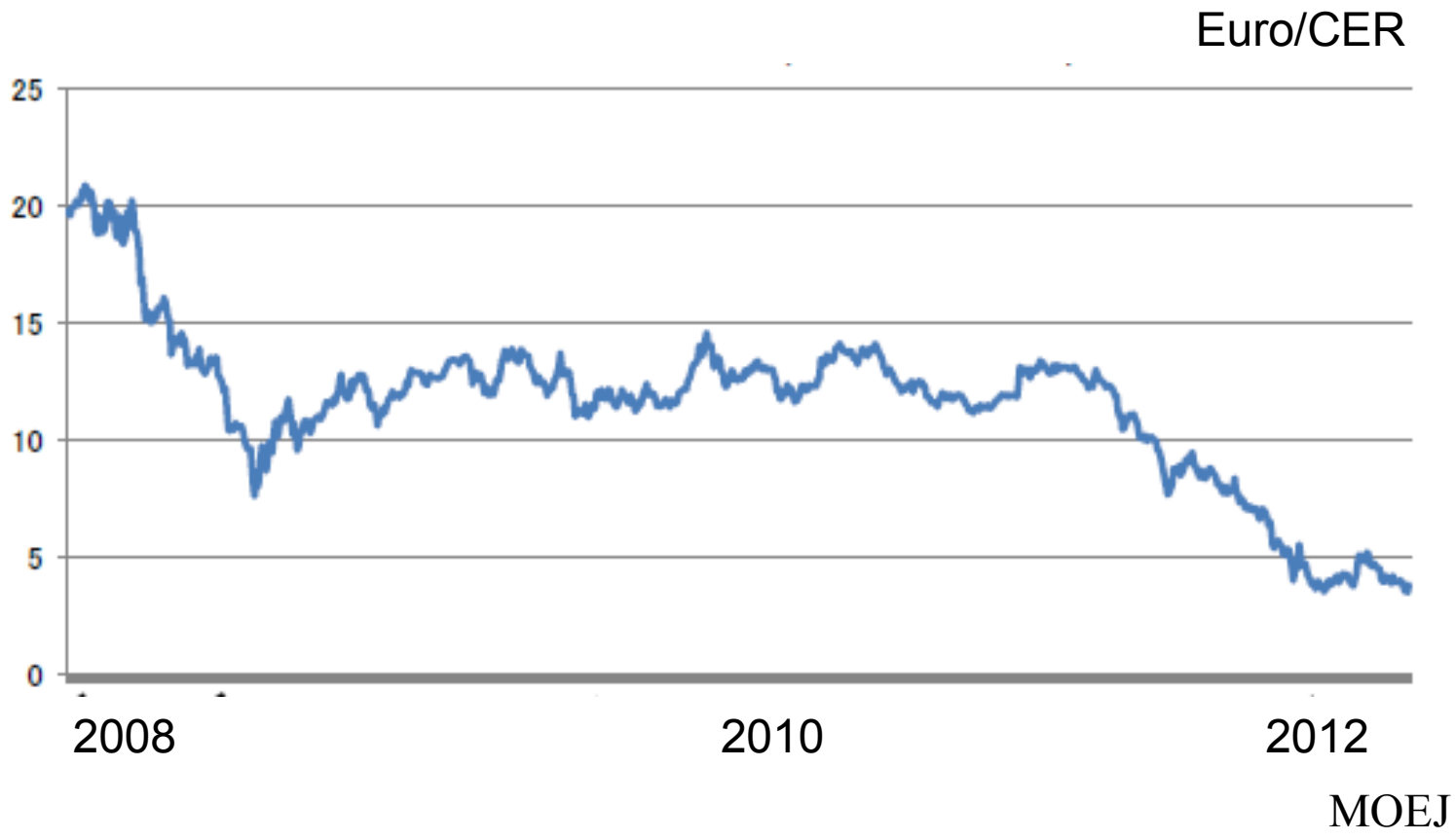
| Type of renewable energy generation | Capacity | Connected to electricity grid | Independent power generation |
|---|---|---|---|
| Wind power source | - | 0.08-0.095 | 0.1-0.15 |
| Hydropower station | Up to 5,000 kW | 0.045-0.060 | - |
| | Up to 500 kW | - | 0.08—0.10 |
| | 501-2,000 kW | - | 0.05-0.06 |
| | 2,001-5,000 kW | - | 0.045-0.05 |
| Solar power source | - | 0.15-0.18 | 0.20-0.30 |

SNC 2010

## Renewable Energy low

- Article 13 Renewable Energy Fund

Renewable Energy Low (Article 21)
50% of proceeds assigned to state and local property entities and institutions from selling the certified greenhouse gas reduction to other countries in compliance with the Kyoto Protocol to the United Nations Framework Convention on Climate Change




MOEJ

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# Additional technology proposal

Promotion of Renewable Energy (Wind and Solar)

Capacity in 2013

| Power Plant | Capacity | Share |
|---|---|---|
| Thermal PPs | 877.3 MW | 87 % |
| Renewable power | 81.7 MW | 8 % |

Ministry of Energy

Capacity of the energy system in Mongolia ≒ 1000MW

The national dispatching center recommends that share of wind parks in the energy system should be no more than 10% of total installed capacity of the system due to the electricity fluctuation (TNA 2013).

Limitation ≒ 100MW

# However:

Clean Energy Co., Ltd

Already installed

- 50MW Salkhit Wind farm

Annual net electricity production of the wind farm is estimated ate around 140-170 million kWh equivalent to 4-5% of the CES

5 companies have already gotten the construction license (Article 7 of RE low )

| Company name | WP Capacity, MW | WP Location (aimag and soum) | Permission from energy ministry (Date and number) | License from Energy Regulatory Committee (Date and term) | Remark |
|---|---|---|---|---|---|
| "Glean Energy" | 50 | Tuv, Sergelen | 2007-03-02, a/304 | 2007-03-27, 5 years 2012, 1 year | To be connect to central grid |
| "Glean tech" | 250 | Umnugovi, khanbogd | 2008-10-13, a/82 | 2008-12-18, 5 years | 102 MW to be connected to central grid, 148 Mw to export to China |
| "Sainshand wind park" | 52 | Dornogovi, Sainshand | 2010-11-01, a/3418 | 2011-03-19, 5 years | To be connect to central grid |
| "AB solar and wind" | 100 | Dornogovi, Dalanjargalan | 2008-10-13, a/81 | 2011-11-22, 5 years | To be connect to central grid |
| "Idiner global" | 50.4 | Govisumber, Sumber | 2011-11-18 a/4059 | 2011-12-13, 5 years | To be connect to central grid |

500MW (by 2020)

TNA 2013

Grid Limitation ≒ 100MW < 550MW (Salkhit + planed Wind)

Even though the installed capacity of energy systems is expected to increase in the future, it will still limit the number of wind parks that can be connected to the grid (TNA 2013).

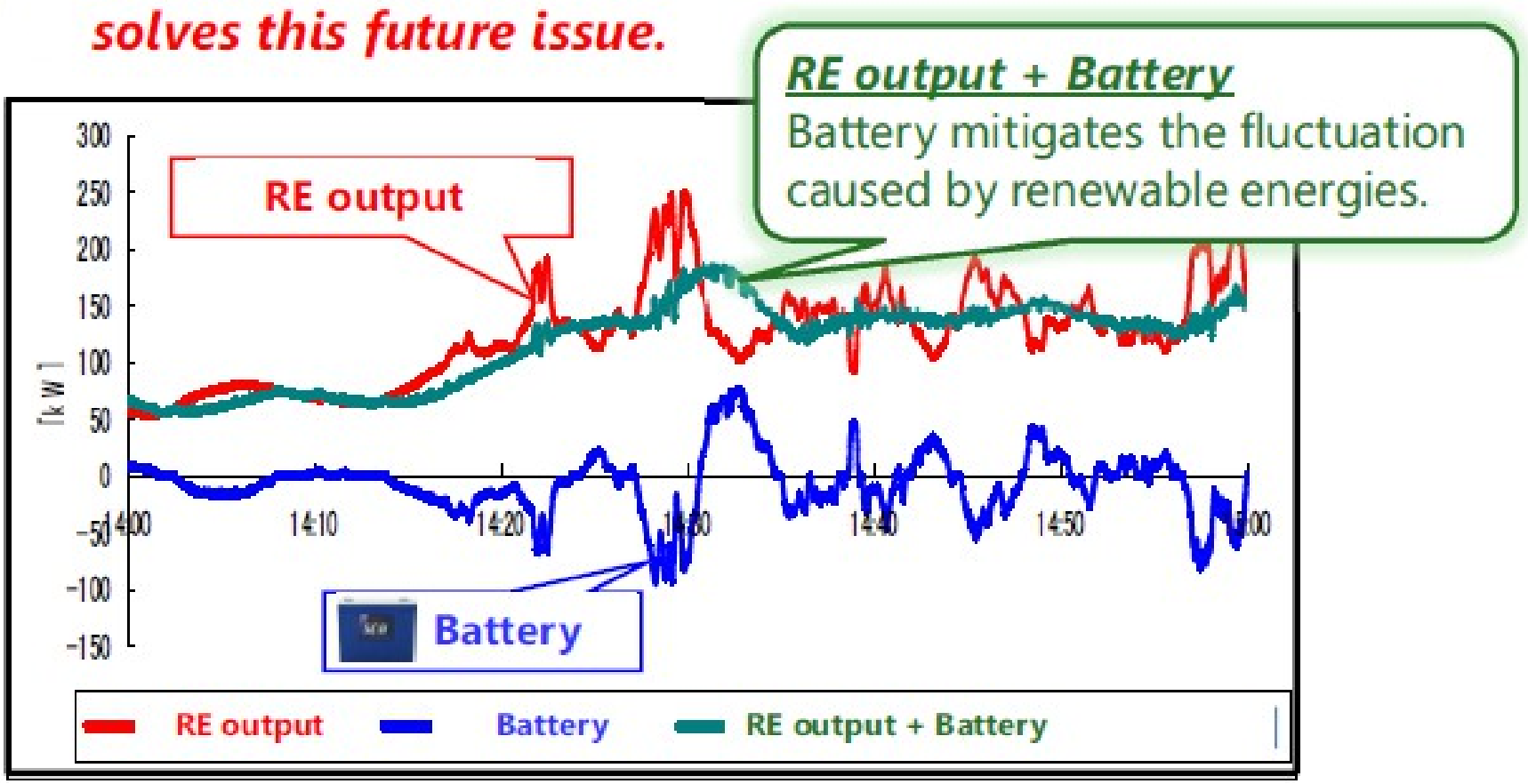
Expected solution

In order to reduce or overcome these technical difficulties, it is necessary to improve the energy generation mix increasing the share of manageable or flexible sources for generation in the energy system. Especially if CES connect large hydro power plants into the current energy system, system stability will increase which create suitable condition for more wind parks to be connected to the system (TNA 2013).

It is necessary to wait until EgiinHPP and Shuren HPP construction

Taking several years more

# Additional technology proposal

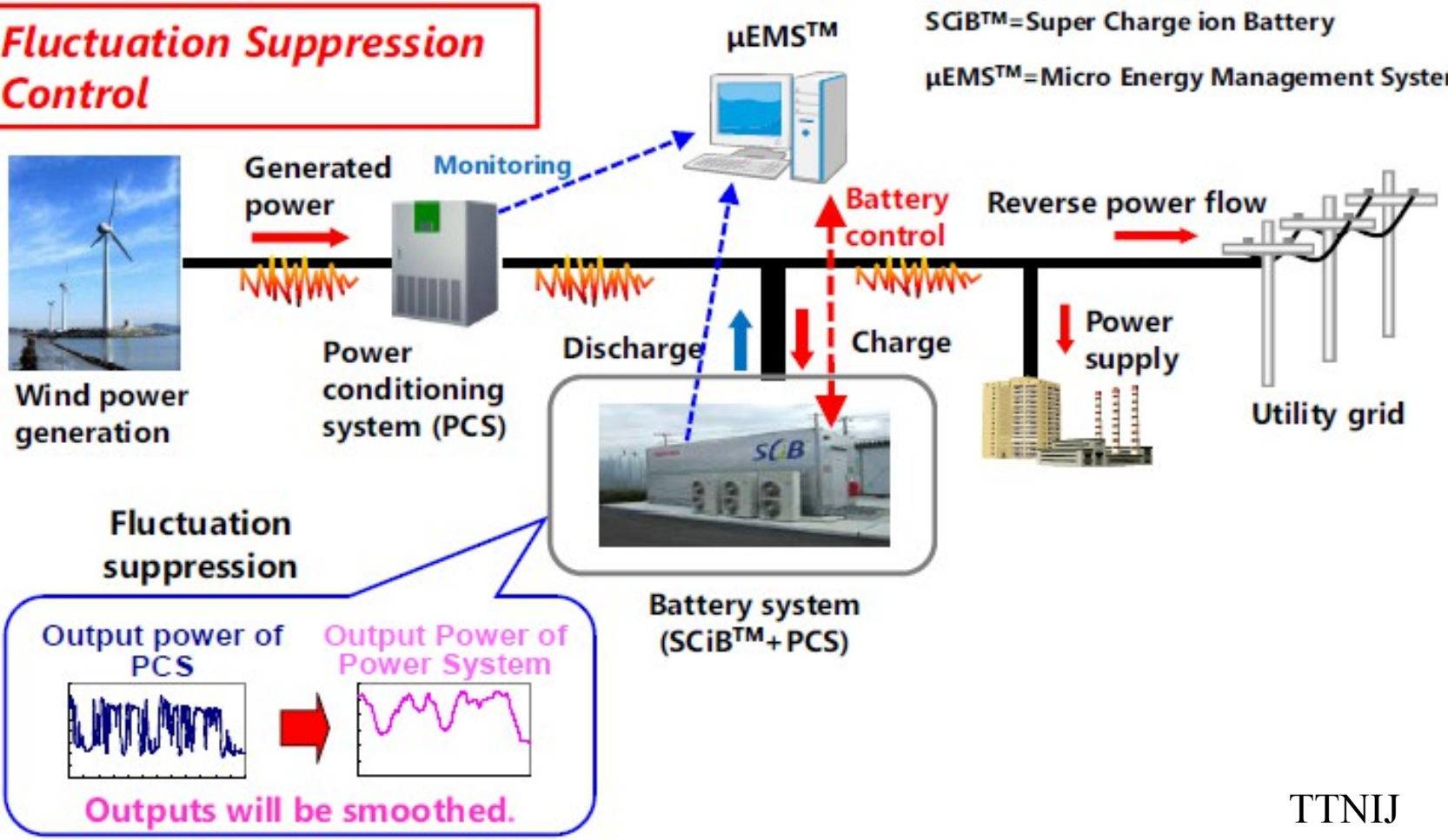



TTNIJ

## Fluctuation Suppression Control

SCiB™=Super Charge ion Battery

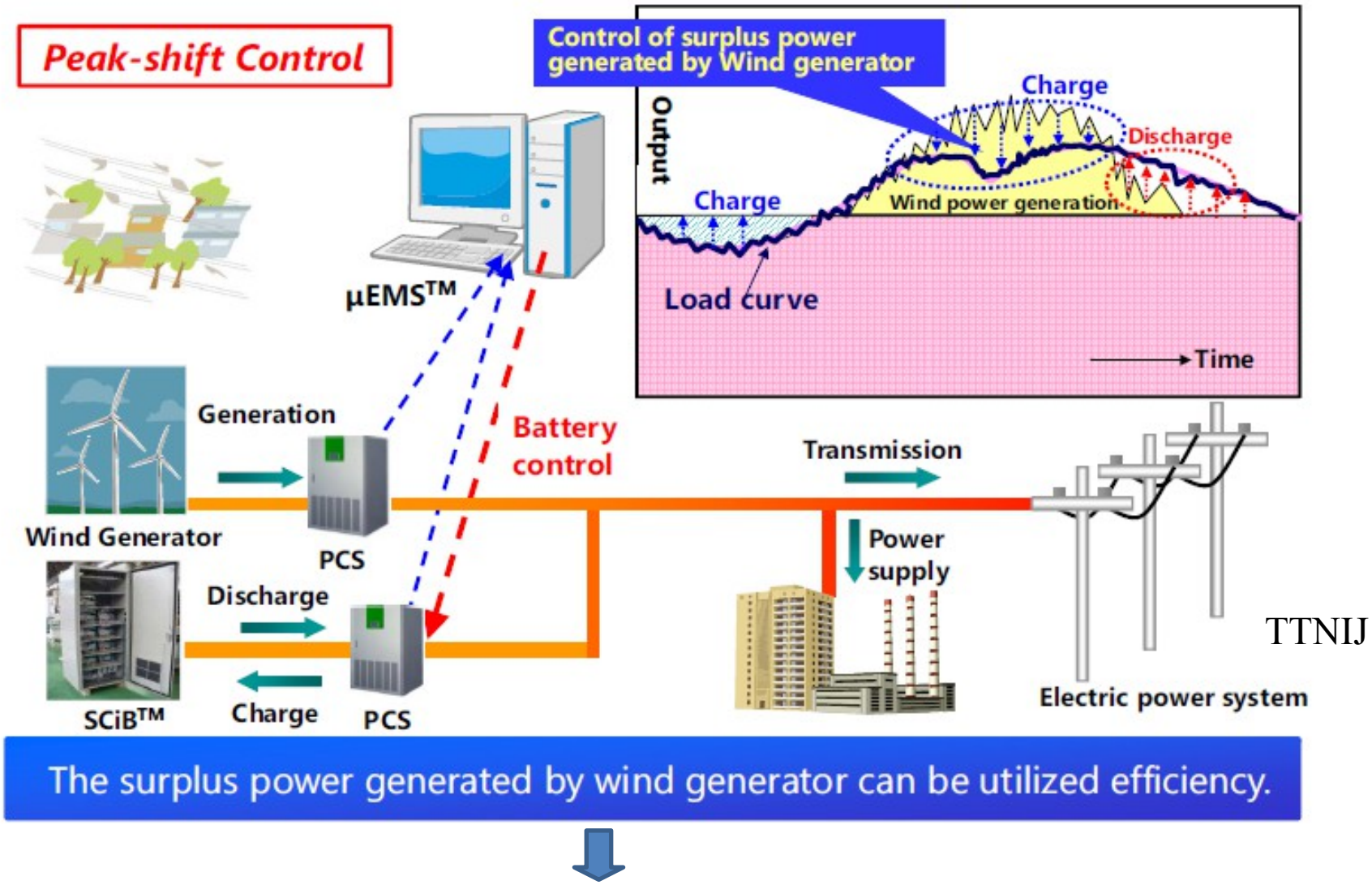
μEMS™=Micro Energy Management System




TTNIJ

The output of WF is smoothed by controlling a battery system.

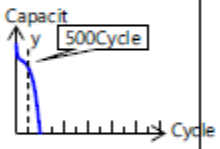
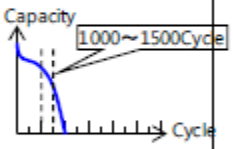
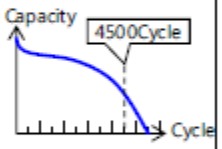
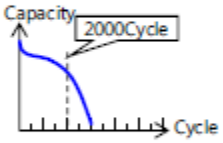
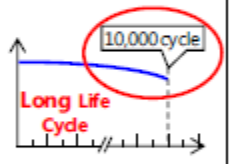
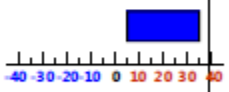
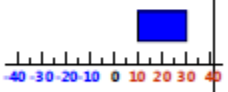
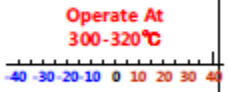
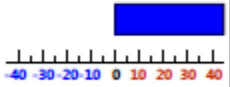
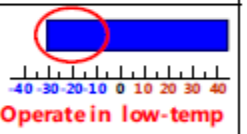
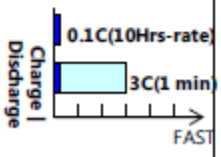
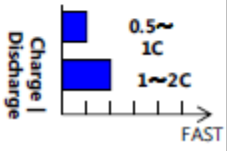
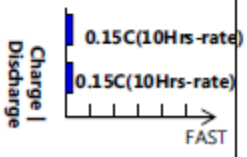
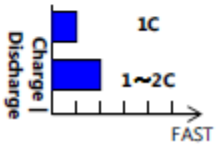
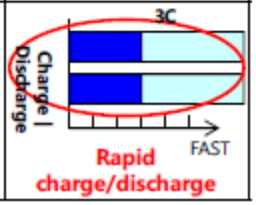
The battery supports introduction of Wind and Solar facility to connect with CES




It is possible to use night time generated electricity by RE supplying charged electricity during peak time to reduce the rate of electricity import from Russia or to reduce coal consumption

Fin

TOSHIBA

| | Lead-Acid | Ni-MH | NaS | Conventional Lithium-ion | SCiB™ |
|---|---|---|---|---|---|
| Capacity/Weight (Energy Density) |  | **1/2** of Lead-Acid  | **1/3** of Lead-Acid  | **1/4** of Lead-Acid  | **1/4** of Lead-Acid  |
| Life-Cycle |  |  |  |  |  |
| Working Temperature |  |  |  |  |  |
| Charge/Discharge Performance |  |  |  |  |  |