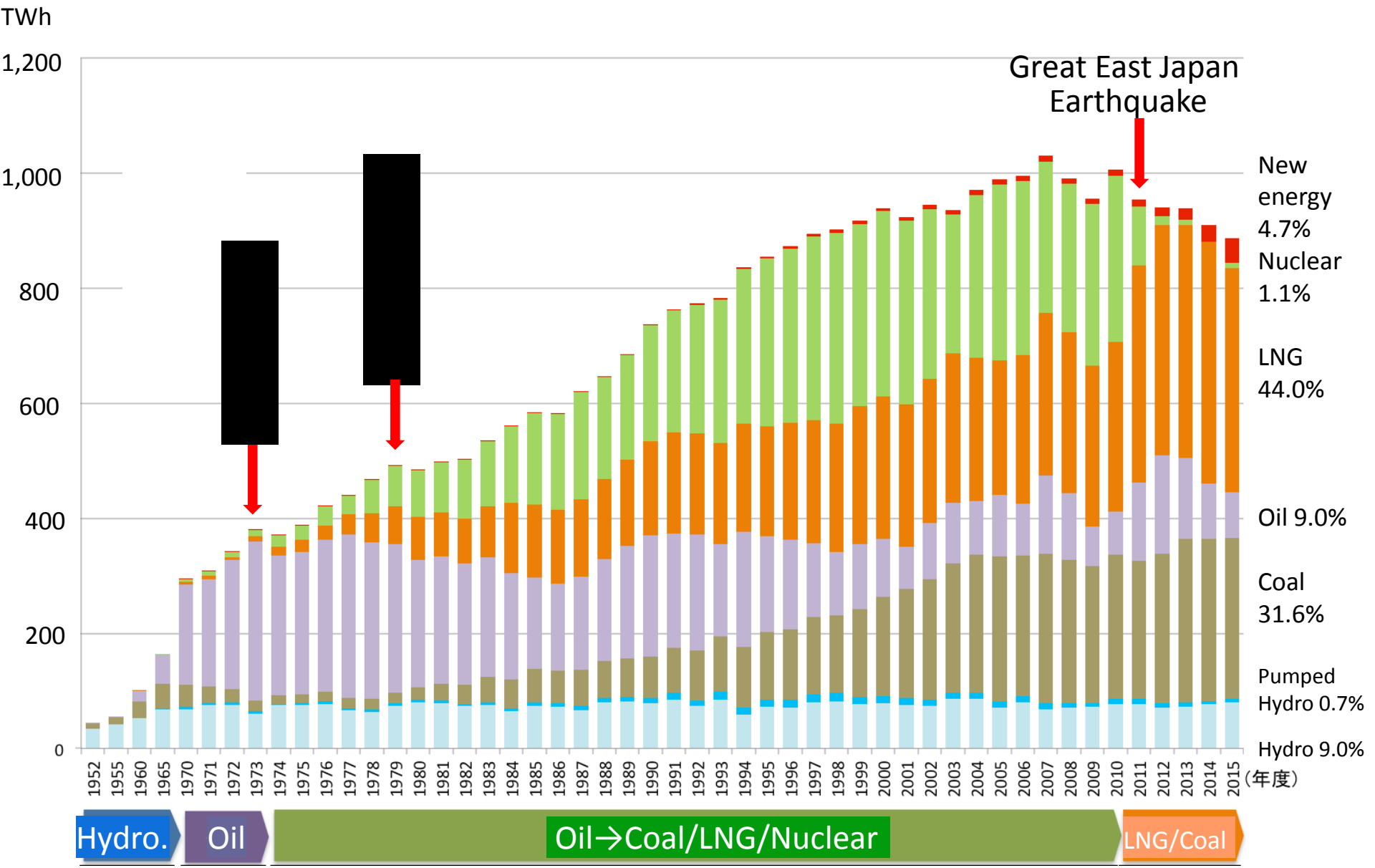
Panel Discussion on “The role of science, technology and innovation in substantially increasing the share of renewable energy by 2030”, Intersessional Panel of the UN CSTD, Palais des Nations, Geneva, Switzerland 6 Nov. 2017.

Key Policies and Recent Research and Development Activities on Renewable Energy in Japan

Kohei Uosaki
National Institute for Materials Science
Tsukuba, Japan

Power generation in Japan by various energy sources



METI 2017 Energy White Paper

Key Energy Policies of Japan

1st Oil crisis 1973
2nd Oil crisis 1979

Sunshine PJ 1974 – 1993
Moon light PJ 1978 – 1993
New Sunshine PJ 1993 – 2000

Agency of Industrial Oil Science and Technology, MITI

Kyoto protocol
(Dec. 1997 COP3)
Effective 2005
First period: 2008–12

1st Strategic Energy Plan Oct. 2003

2nd Strategic Energy Plan March 2007

Cool Earth - Energy innovation technology plan 2008 METI

3rd Strategic Energy Plan June 2010

Great East Japan Earthquake
(Accident of Fukushima Nuclear Power station)
March 2011

4th Strategic Energy Plan April 2014

Paris Agreement
(Dec. 2015 COP21)
Effective Nov. 2016

Energy Innovation Strategy April 2016 METI

National Energy and Environment Strategy for Technological Innovation towards 2050 (NESTI 2050) April 2016

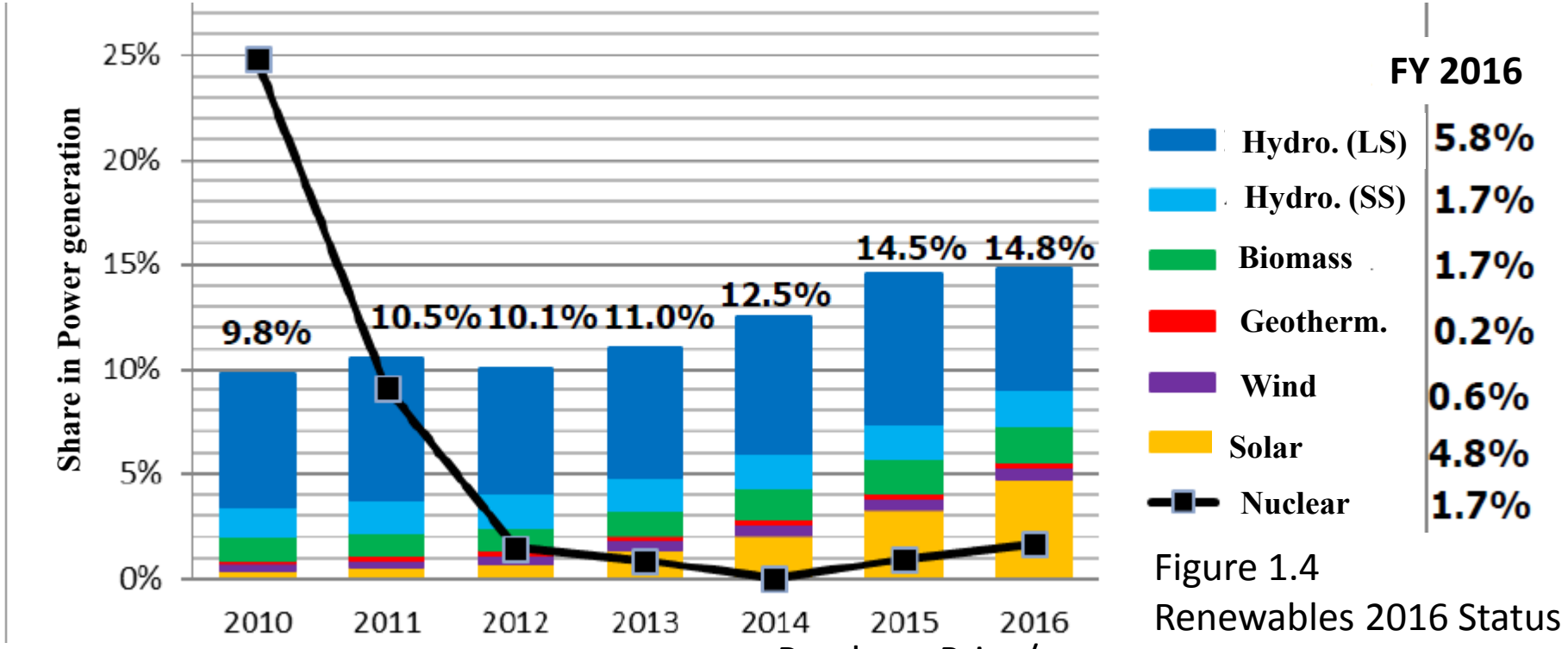
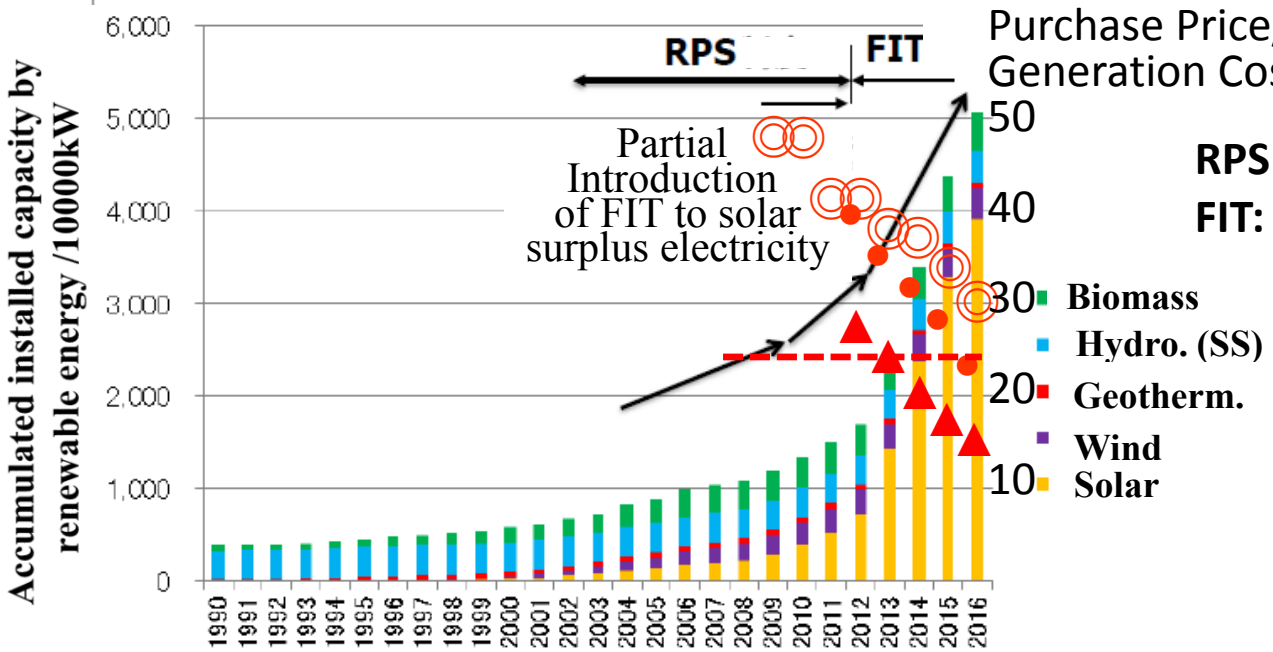


Figure 1.4
Renewables 2016 Status Report, Inst. Sustainable Energy Policies



RPS: Renewables Portfolio Standard
FIT: Feed-in Tariff

Figure 1.1
Renewables 2016 Status Report, Inst. Sustainable Energy Policies
with modification by KU

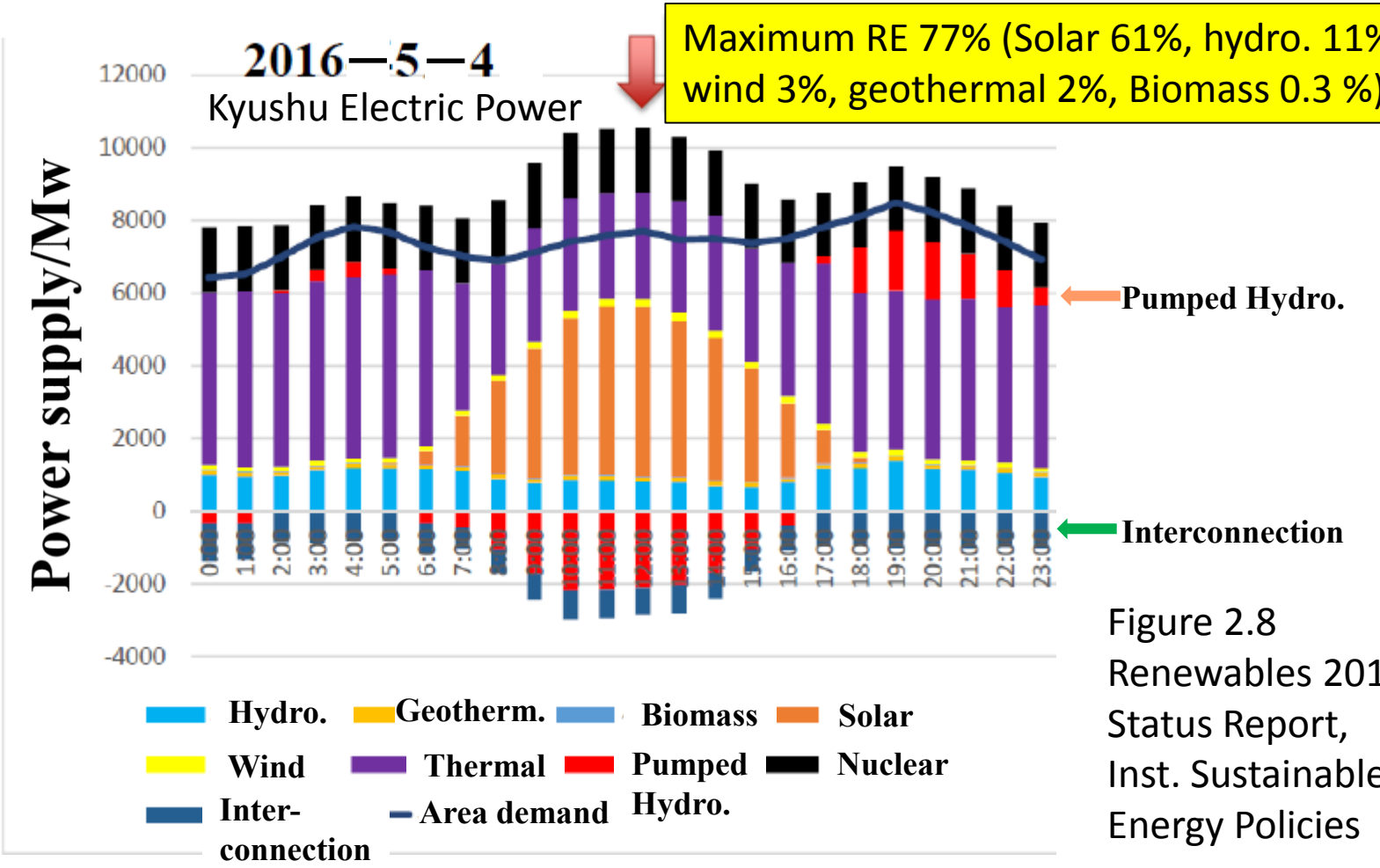
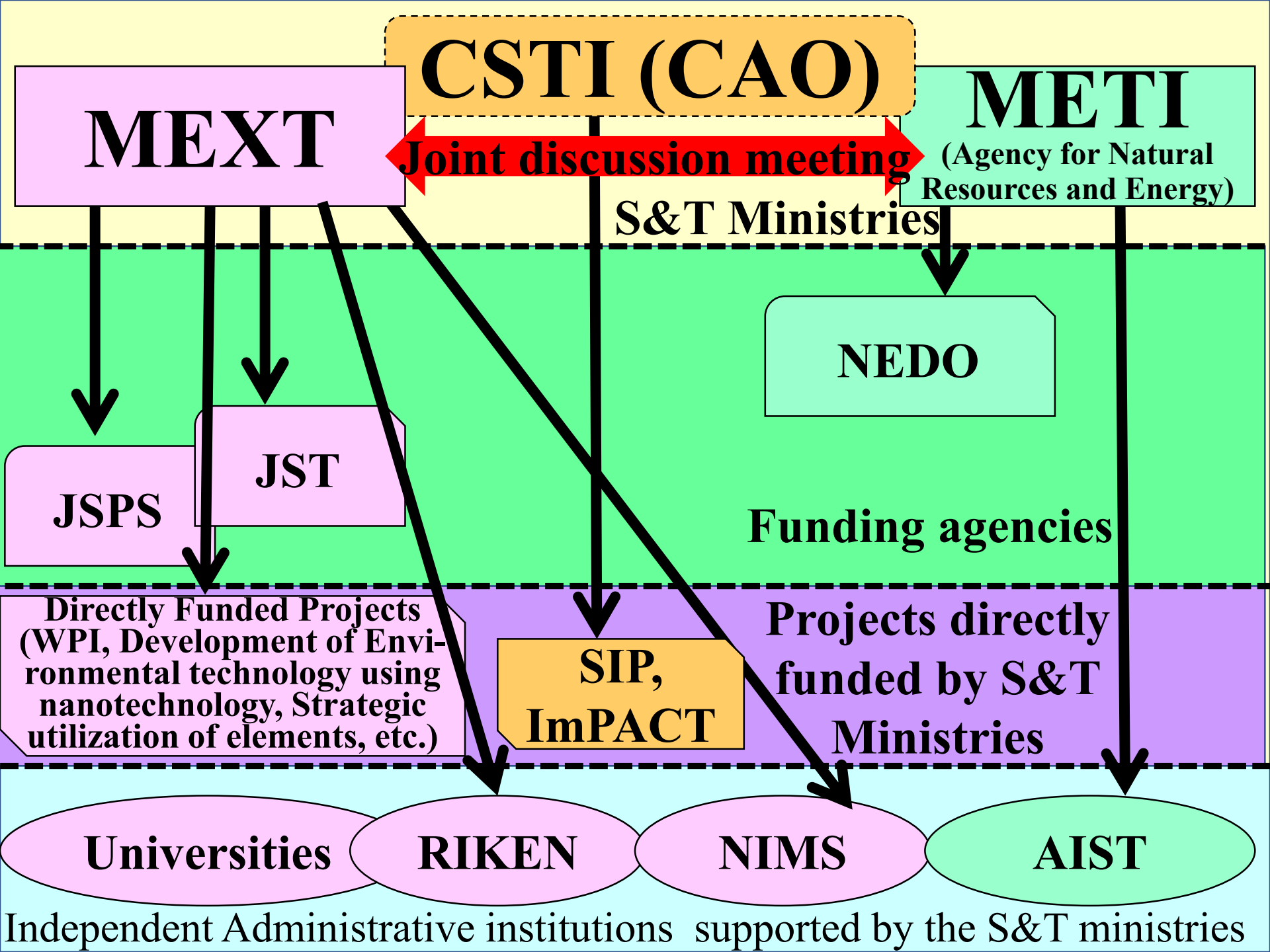


Figure 2.8 Renewables 2016 Status Report, Inst. Sustainable Energy Policies

FY 2012 ca. 2.3B$ 0.22 yen/kwh 62 yen/month/family
FY 2014 ca. 8B$ 0.75 yen/kwh 225 yen/month/family
FT 2016 ca. 23B$ 2.25 yen/kwh 675 yen/month/family
2017 New system is introduced.

Year 2019 problem: FIT for <10kW is only for 10 years.

→ Combination of renewable energy with storage is essential.


CSTI (CAO)
MEXT
METI
(Agency for Natural Resources and Energy)
Joint discussion meeting
S&T Ministries
NEDO
JST
JSPS
Funding agencies
Directly Funded Projects (WPI, Development of Environmental technology using nanotechnology, Strategic utilization of elements, etc.)
SIP, ImPACT
Projects directly funded by S&T Ministries
Universities
RIKEN
NIMS
AIST
Independent Administrative institutions supported by the S&T ministries

METI/New Energy and Industrial Technology Development Organization (NEDO)

Not only to support R&D but also provide subsidy

Solar
R&D: cost reduction of photovoltaics 50M$
Subsidy to FIT 270M$

Battery and EVs
R&D: Next generation battery 26M$
Subsidy to charging infrastructure 16 M$
Subsidy to introduce clean vehicles 110M$

Fuel cells and Hydrogen
R&D: low cost durable fuel cells 28M$
R&D: high pressure hydrogen tech. 37M$
R&D: production, storage, use 9M$
Subsidy to hydrogen station for fuel cell car 40 M$
Subsidy to purchase home use fuel cell 85M$
Demonstration of hydrogen supply chain 42M$

Wind
R&D: cost reduction, etc. 60M$
Demonstration of wind power station 20M$ and grid system for wind power station 27M$

Biomass
R&D for power generation 18M$

Geothermal
R&D: 27M$
Subsidy to geothermal search 80M$

Subsidy to **virtual power plant** demonstration 36M$

CAO (CSTI)

SIP (Strategic Innovation Promotion Program): energy carrier, power electronics ca.100 M$/5 yrs

MEXT/Japan Society for Promotion of Science (JSPS)

Grant-in-Aid
Curiosity driven basic research
Specially Promoted Research 5M$/5y

MEXT/Japan Science and Technology Agency (JST)

Strategic Basic Research Programs

CREST (Core Research for Evolutional Science and Technology):<6M$/5yx15
Solar energy, Energy conv. Interphase

PRESTO (Precursory Research for Embryonic Science and Technology): <0.5M$/3y x 30/PJ

ALCA (Advanced Low Carbon Technology Research and Development Program): 50M$/y, ~ 3M$/5y
Solar, Supercond., Elec. storage, Heat res. mat., Biotech, Chem. proc, Device
Specially promoted research on next generation battery and on biomass

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Energy Innovation Strategy April 2016 METI

National Energy and Environment Strategy for Technological Innovation towards 2050 (NESTI 2050) April 2016

Outlook on National Energy & Environment Strategy for Technological Innovation towards 2050 (NESTI 2050)

Ⅰ. Strategy

○ To meet the "2℃ target" referred in COP21, global GHG emissions need to be reduced to about 24 billion tons per year by 2050. Currently, global annual GHG emissions are approximated to 50 billion tons. Since the amount is projected to be about 57 billion tons based on submitted INDCs, approximately 30 billion tons of additional reduction is necessary. In so doing, it is essential to promote innovation for drastically reducing emissions on a worldwide scale.

○ Looking ahead to 2050, Japan has identified a number of innovative technologies with potential to make huge impacts on emission reductions, while assuming that the entire energy system will be optimized with the realization of "super smart society" (Society 5.0). R&D of the prioritized technologies will be promoted in the medium-to-long term, while identifying and addressing technological challenges.
⇒ Out of 30 billion tons of CO_2 reductions that are necessary to meet the 2 ℃ target, **several billion to 10 billion tons or more** of reductions are expected through this strategy.

* Based on the figures estimated by IEA. In the selected technological areas, the application of innovative technologies is added to the application of technologies whose development and demonstration have already been advanced.

Ⅱ. Identified target technology fields

Technologies :
(1) that are innovative and not the extension of the existing efforts but discontinuous and impactful
(2) with the potential for widespread adoption and significant emission reductions
(3) that require medium-to-long-term investment and combined forces among industry, academia and government
(4) in which Japan can take the lead or demonstrate our superiority

Energy Systems Integration Technologies
so that various components (i.e. energy production, transport, consumption) are networked by ICT and energy system is optimized by AI, big data and IoT

Core Technologies for Systems
namely, next generation power electronics, innovative sensors and superconductivity

Each innovative technologies

Energy Saving	1 Production process	○ Membrane Separation / Catalysts
	2 Structural material	○ Ultralight and super heat-resistant
Energy storage	3 Storage Battery	○ Metal-Air Batteries / All-Solid-State Batteries
	4 Hydrogen	○ CO_2 free hydrogen
Energy generation	5 Photovoltaic	○ Perovskite structure / Quantum dot
	6 Geo-Thermal	○ Hot dry rock geo-thermal / Supercritical geo-thermal
7 Capture and Effective Usage of Carbon Dioxide		

Ⅲ. Enhanced R&D systems

1. Forming R&D Structures as Unified Government Agencies
2. Creation of Innovation Technology Seeds and Flexible Positioning
3. Mechanisms to Encourage Industry Investment in R&D
4. Promotion of International Coordination and Joint R&D

Leading the world through innovation while keeping mitigation efforts and economic growth compatible with each other.

NESTI 2050

National Energy and Environment Strategy for Technological Innovation towards 2050 (NESTI 2050)

Target technology fields

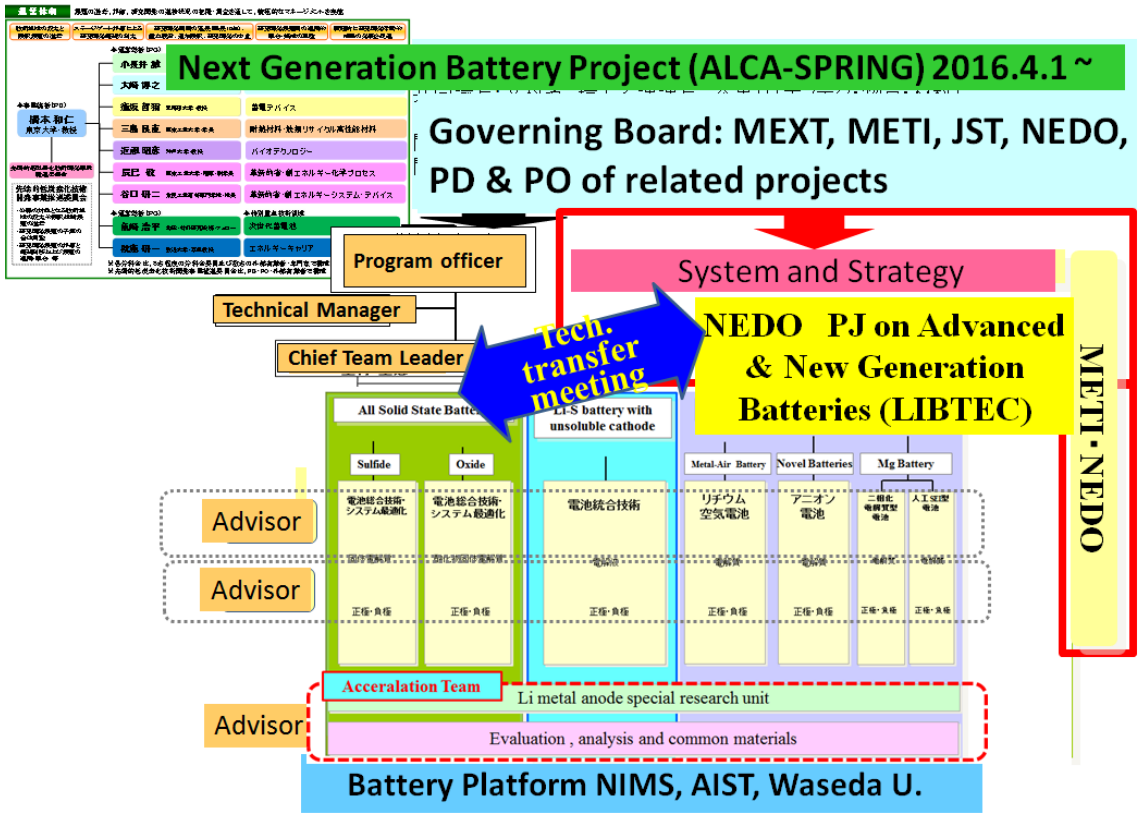
Energy Systems Integration Technologies
so that various components (i.e. energy production, transport, consumption) are networked by ICT and energy system is optimized by AI, big data and IoT

Core Technologies for Systems
namely, next generation power electronics, innovative sensors and superconductivity

Energy Saving	1. Production process	○ Membrane Separation/Catalysts
	2. Structural material	○ Ultra light and super heat-resistant
Energy storage	3. Storage Battery	○ Metal-Air Batteries/All-Solid-State Batteries
	4. Hydrogen	○ CO_2 free hydrogen
Energy generation	5. Photovoltaic	○ Perovskite structure/Quantum dot
	6. Geo-Thermal	○ Hot dry rock geo-thermal/ Super critical geo-thermal
7. Capture and Effective Usage of Carbon Dioxide		

MEXT/JST: Advanced Low Carbon Technology R&D Program (ALCA) - Specially Promoted Research for Innovative Next Generation Batteries (SPRING)

METI/NEDO: Evaluation Technology for Advanced & Next Generation Batteries



COMMIT2050: **CO**llaborative challenge of **M**EXT and **M**ETI for **I**nnovative future energy & environmental **T**echnologies toward **2050**

MEXT/JST

Innovation Program for Future Society (High risk, high impact R&D)/ Trans-dimensional energy technology

30M yen/y x 10 yrs
stage gate evaluation
FY 2017 ca. 27M$

Collaboration

METI/NEDO

Advanced Research Program for Energy and Environmental Technologies (Challenge for unexplored 2050)

10~20M yen/ x 5 yrs
stage gate evaluation
FY 2017 ca. 25M$

MEXT/JST and METI/NEDO jointly promote R&D on innovative low-carbon technologies, which have large potential for significant reduction of green house gas in 2050.