Innovation, Electricity, and Climate

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Technologies

- PV
- EV
- Shale-gas
- Self-driving cars
- AI (Deep-learning)

And more, accelerating… 2030? 2050?

Chance:

tech time span (2020, 2030) << climate time span (2050, 2100)

With new tech, many will be happy to cut emission deeply.

Innovation

Theorem: New Tech <= Combination (Old Techs)

Eg. Deep Learning (New AI)
<= Comb. (Old AIs, Big Data (Youtube), GPU* (Nintendo))

Corollary:

1. Tech development accelerates
2. Climate tech <= comb. (non-climate techs)
3. non-climate (general) tech dev. = economic growth = precondition for climate tech

You can not save energy by AI without developing AI first, and developing AI requires vigorous economy.

*.. Graphic Processor Unit

Gov. Of Japan visions/plans

Climate, economic growth, innovation, AI/ICT promoted as package

1. Environ/Energy Innovation Strategy (Cabinet Office)
   AI/ICT energy management, PV, batteries etc.
2. Society 5.0 plan (Cabinet Office)
   AI/ICT for public agenda (health, productivity, environment, etc.)
3. New Industrial Structure Vision (METI)
   AI/ICT for industries
4. AI Implementation Vision (NEDO*)
   vision on when and how AI may be used

* New Energy Development Organization

Electrification of Everything(EOE)

Electrification: historical & future trend

✓ Drivers

- income effect,
- tech development,
- demand for clean & convenient end-use energy

✓ And more drivers

- New techs: less costs, more variety of goods & service
- Internet of Everything (IOE) => EOE
- Climate (=> electrify & decarbonize elec)

By 2050: heavy electrification of building / transport sector. Increasing electrification of industrial sector.

AI, energy efficiency, and rebound effect

AI =>

- More efficiency (material, design, process, management,..)
- More abundance (cheep,more & new goods & service)

More elec likely:

✓Past: Machine replaced human => More GDP, More elec ("rebound effect")

✓(Direct burning of fuel at end use will decrease as substituted by elec)

Role of government

- ✓ De-carbonize elec without skyrocketing elec price: Gradually implement techs, as they become cheep over time.
- Keep macro-economy good <= bad economy is bad for general tech development
- Elec price must not be too high <= dis-electrification bad for climate (<=EV, heat pump competing with fossil fuel burning)
- Elec price must not be too low <= wasteful use bad for climate

✓Others

- Invest in R&D (not only climate tech, but general non-climate tech)
- Revise laws for new techs

Summary

- Tech develops rapidly. Opportunity to solve climate problem. At 2030 many will be happy to commit deep emission cut.
- Climate tech does not emerge alone. Progress of general tech, and economic growth prerequisite.
- GOJ plans/visions: climate, economy, innovation, AI/ICT promoted as package
- Electrification of Everything (EOE) and increasing elec demand likely in future
- Governments must decarbonize elec without skyrocketing elec price

Appendix: GOJ innovation visions/plans official presentation materials

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. Cu global annual GHG emissions are approximated to 50 billion tons. Since the amount is projected to be about 57 billion tons based o submitted INDCs, approximately 30 billion tons of additional reduction is necessary. In so doing, it is essential to promote innovatio 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 of the prioritized technologies will be promoted in the medium-to-long term, while identifying and addressing technological challeng
⇒ 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** 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 Un Government Age
2. Creation of Innc Technology Seed Flexible Position
3. Mechanisms to Encourage Indus Investment in R
4. Promotion of International Coordination an R&D

Technology (Common Platform Technology x Industry Core Technology) x Relevant data