Two years of cooperation in the GJETC - Joint Recommendations and Critical Dialogue on the Energy Transition in Germany and Japan

Presentation at the conference
“The Importance of International Cooperation under Disruptive Changes: Recommendations and Lessons Learnt from a fruitful German-Japanese Dialogue on the Energy Transition”

Friday, 20th April 2018
Press and Visitors’ Center of the Federal Government (PBZ)
Structure of the GJETC
German – Japanese Energy Transition Council

**Council Members**

**JAPAN**
- Chairman: Prof. Masakazu Toyoda
- Organization & Scientific Secretariat: IEEJ
- Jun Arima
- Toshiharu Ikaga
- Junichi Ogasawara
- Mami Ito
- Shinichi Sasayama
- Yasumasa Fujii
- Koji Nomura
- Tomihiro Taniguchi
- Hiroshi Okamoto

**GERMANY**
- Financing
- Management
- DBU + Mercator + AA
- Chairman: Prof. Peter Hennicke
- Organization/Consulting: ECOS Consult
- Scientific Secretariat: Wuppertal Institute
- Claudia Kemfert
- Felix C. Matthes
- Stefan Thomas
- Manfred Rauschen
- Patrick Graichen
- Miranda Schreurs
- Eicke Weber
- Franzjosef Schafhausen
- Uwe Leprich

20 April 2018
Output and results (http://www.gjetc.org)

- 4 comprehensive German-Japanese studies (total of 800 pages)
- 10 Input and topical papers, technology overview
- 3 Stakeholder Dialogues (industry, decentralized and efficiency sector)
- Recommendations “Report 2018”
Output and results
(http://www.gjetc.org)

GJETC Report 2018
Intensified German-Japanese Cooperation in Energy Research
Key Results and Policy Recommendations
Funding and supporting the GJETC

Planned 2nd phase (2018-2020):
Upscaling activities; financial support e.g. by foundations, ministries and renowned company partners
Two years of exciting knowledge exchange (Part 1)

• 1.1 Joint recommendations
• 1.2 Critical view on the Energy Transition in Germany

Prof. Dr. Jun Arima
Friday, 20th April 2018
1.1 Joint Recommendations

Study Topic 1 and 2
Study Topic 1
“Energy transition as a central building block of a future industrial policy – Comparison and analysis of long term energy transition scenario”
<table>
<thead>
<tr>
<th>Study Topic 1 Figure</th>
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<tbody>
<tr>
<td><strong>GERMANY</strong></td>
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<tr>
<td><strong>Final energy demand reductions through energy efficiency</strong></td>
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<tr>
<td>Strong reductions</td>
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<tr>
<td>Not considered</td>
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<td><strong>Changing the use of energy sources</strong></td>
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<td><strong>Increased use of domestic renewable energy sources</strong></td>
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<tr>
<td>Complete phase-out</td>
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<tr>
<td>No</td>
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<tr>
<td><strong>Substitution of fossil fuels through electricity</strong></td>
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<tr>
<td>No</td>
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<tr>
<td><strong>Importing low-carbon or carbon-free energy sources/carriers</strong></td>
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<tr>
<td><strong>Use of renewable energy based H2 or synthetic fuels as final energy carriers</strong></td>
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<tr>
<td>No use (until 2030)</td>
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<td><strong>Using CCS</strong></td>
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<tr>
<td><strong>Use of CCS technology to reduce industrial GHG emissions</strong></td>
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<td><strong>Use of CCS technology to reduce power sector GHG emissions</strong></td>
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Study Topic 1 Objectives of the Study

- Identify the official **national energy transition targets**
- Identify the range of existing research-based, long-term **scenarios**, including scenarios that go beyond official national targets
- Identify **reasons** behind the differentiation of scenarios
Study Topic 1  Key Findings

- Long-term energy policies in both countries are based on selected scenarios out of a range of projected energy futures.
- In Japan, there is an ongoing debate on the long-term (2050) CO$_2$ reduction goal and ways and means for achieving it. Germany has decided on a CO$_2$ reduction target range of 80-95% for 2050.

Key Differences

- Germany expects high shares in energy supply due to low costs and high potentials of wind and PV energy.
- Japan up to now expects higher costs and lower shares.
- In Japan, there is an ongoing debate on the future role of renewable energies. Up to now, Japan has decided on an electricity generation mix with a share of 20%-22% nuclear energy in 2030; Germany decided to phase out all nuclear up to 2022.
- Japan’s island nature restricts grid connection to neighbor countries as an available flexibility mechanism in the electricity system. The country therefore perceives different challenges from very high shares of variable wind and PV generation.
Joint Efforts in Decarbonizing the Energy Systems

• As Parties to the UN Paris Agreement where industrial nations need to take a lead by substantially reducing GHG emissions by 2050 and continuously pursuing carbon neutrality, both Japan and Germany will have to substantially **transform their energy systems** within the coming decades and beyond.

• Based on their long-standing friendship and their basis as technologically oriented industrial nations, Germany and Japan should work together on the ‘**man-to-the-moon-challenge**’ of a carbon neutral energy system.

• Up to now, the specification of the **mid-century-reduction targets** differs, however, between both countries. More in-depth exchange on these differences is needed.
Study Topic 1  Joint Recommendations

Through Analysis and Periodical Review

• Both Germany and Japan should conduct thorough analysis on **domestic resource availability** (potentials), **technological capabilities, economics**, including cost-benefit-comparisons, and implications for **energy security** in defining their long-term targets/goals and energy transformation strategies, taking into account climate science and international energy markets.

• Given that there are many uncertainties with regard to the above factors, policy makers should exercise **resilience and flexibility** through a periodical review of long-term pathways, reflecting the best available information and encouraging innovation. Although the choice of the energy mix and implementation strategies may differ by country, experiences in each country can mutually complement.

• While Germany has adopted **firm targets** for both 2030 and 2050, Japan differentiates between firm targets for 2030 and, to date, more aspirational goals for 2050.
Study Topic 1: Joint Recommendations

Robust and Accountable Targets/Goals, Strategies and Corresponding Policy Mix

• Both countries should respectively strengthen the efforts to create a set of targets/goals, strategies and implementation mechanisms to enable a robust policy mix that is effective, efficient, predictable and accountable for the general public as well as businesses and investors.

Disseminating Low Carbon Technologies to Other Countries

• Both Germany and Japan should seek to maximize their technological contribution to GHG emissions reduction by supporting and disseminating efficient, sustainable and low-carbon technologies to other countries, offering these technologies to global supply chains and developing innovative technologies enabling a long-term GHG emissions reduction.

Joint Scenario Modeling

• A continuous working group on joint German-Japanese scenario modeling should be established.
Study Topic 2  Figures

Social shifts underlying the "anti-nuclear-movement" narrative (Source: IZES/Arepo Consult/IGES/Nagoya University/NIES 2017)

Energy security (Source: IZES/Arepo Consult/IGES/Nagoya University/NIES 2017)
Study Topic 2  Objectives of the Study

• Identify the **targets, strategies and strategic framework conditions** in Germany and Japan for a successful energy transition.

• Analyze the respective **socio-cultural preconditions** in both countries and the approaches on changes of lifestyle and actors’ behavior in the fields of consumption, habitation, mobility, products, production and services.

• Examine the **perception of the energy transition** by the general public and geographical differences between Germany and Japan.
• In both countries, energy policy is based on the principles of economic efficiency, energy security and environmental sustainability (“Three E”).

• The citizens in both countries have a favorable view of the energy transition.

• An intensified bilateral policy research dialogue between the two countries has been identified as crucial, complemented by a national multi-stakeholder dialogue with businesses, civil society and the research community.
Continuous evaluation and involvement of all stakeholders

- The successful **implementation** of the energy transition and climate protection policy requires the continuous evaluation of conformity with the targets/goals, the widest possible involvement of all stakeholders, as well as transparent accountability and proactive communication with citizens.

- Both countries need to harness these driving forces for the energy transition better.
Part 1.2
A critical view of Japanese GJETC members on the energy transition in Germany
• While there is an argument that Japan should follow German experience (nuclear phase-out, aggressive promotion of RE), there are **stark differences** between Germany and Japan:

  • **Geographical condition**
    
    o Transmission connectivity of Germany $\leftrightarrow$ Isolated grid system of Japan without any interconnection
    
    o Japan’s vigilant approach keeping all energy options and maintaining enough margins for any unexpected event
    
    o Meaningful grid connection in the North East Asian region not envisaged

  • **Natural condition**
    
    o Share of inhabitable lands: 34% in Japan, 70% in Germany, Japan’s population 1.5 times of German one $\rightarrow$ More challenging to find suitable lands for PV or wind enabling competitive cost in Japan.
    
    o Wind potential concentrated in remote areas $\rightarrow$ long and costly transmission line connection.
    
    o Deep water $\rightarrow$ Costlier floating technologies for offshore wind
    
    o Japan’s typhoon and earthquake-prone condition $\rightarrow$ Higher construction cost of wind power and mega-solar in light of construction safety standard.

  • **Role of municipalities**
    
    o Federal state, Stadtwerke in Germany $\leftrightarrow$ Centralist government, historical development of utility industries in Japan
    
    o Japan could learn experience of Stadtwerke, it should be explored whether municipality-led RE introduction could result in optimum energy mix in aggregate
Observations (II)

- **Economic circumstances**
  - Optimism about economic implication of energy transition in Germany ➔ More cautious view in Japan with regard to international competitiveness, disposable income and employment due to higher energy price
  - Germany’s advantageous position in euro currency and higher share of export in GDP
  - Dominance of EU region in German trade ➔ dominance of APEC region in Japanese trade

- **Approach to energy transition process/scenario**
  - Germany: ambitious targets stemming from back-casting approach from 2050 target
  - Japan: 2050 goal as a direction or vision due to uncertainties (climate science, industrial, technological, societal and international), which is different in nature from 2030 target underpinned by bottom-up energy mix
  - Germany: focus on domestic production-based CO2 emissions
  - Japan: emphasis on CO2 emissions reduction through technology transfer and innovation beyond national border

- **Has German Energiewende been successful?**
  - Great success in expanding RE while N-S grid expansion lagging behind
  - Not succeeded in CO2 emissions, more priority nuclear phase-out than CO2 emissions reduction
  - Questionable cost effectiveness (e.g., DIHK, German Federal Court of Justice)

- **Cooperation between Germany and Japan should focus on the areas of common interests rather than seeking replication without due regard to specific national circumstances**
Two years of exciting knowledge exchange (Part 2)

2.1 Joint recommendations

2.2 Critical view on the Energy Transition in Japan

Prof. Dr. Peter Hennicke
20 April 2018
2.1 Joint Recommendations
Study Topic 3 and 4
Study Topic 3

“New allocation of the roles and business segments of established and new participants in the energy sector both currently and in a future electricity market design”
Ten electric utilities and their areas in Japan (Source: IZES/JEPIC 2017)

Transfer Capacity and Maximum Electricity Demand Forecast in Japan (Source: IZES/JEPIC 2017)
Cross-border transmission lines (as of end 2016) in Germany (Source: IZES/JEPIC 2017)

German cross-border flows with neighboring countries (Source: IZES/JEPIC 2017)
Study Topic 3 Objectives of the study

• Analyze the **national framework conditions**, especially for the electricity market design influencing the role of established and new participants in the energy sector.

• Analyze the **technical and economic challenges** for new electricity market arrangements and designs.

• Analyze the **conditions regarding a decentralized energy market**: a fair playing field for new actors to develop robust business models.
Study Topic 3 Key findings of the study

While Germany has gained more experience of restructuring the electricity market, both countries face similar challenges and opportunities concerning electricity market design of the near future.

**Challenges:**

- the **coordination** of a more decentralized system with significant shares of variable wind and PV generation and significant needs for flexibility options
- the **payback** of investments in a system that is characterized by very low short-term marginal costs
- the need for integration of the power, heat, and transport sectors (sector coupling)
- the need for an appropriate **regulatory framework** to trigger the necessary grid adjustments

**Opportunities**

- **New business and consumer concepts**, such as prosumers, municipal utilities, and energy cooperatives
Renewable Energies and System Integration

- **A robust market and regulatory framework** should be established, allowing for the large-scale expansion of RES-E and reflecting the specifics of variable and low-marginal cost renewables.

- These specifics will **create significant barriers** for different types of RES-E, even if they are highly competitive in terms of LCOE. **Renumeration mechanisms** should be designed in a way that supports
  - cost reduction in the generation and supply of variable RES-E, total system and integration costs, and
  - the roll-out of the non-technical infrastructure for the different types of RES-E

- A balanced **buildup of flexibility options** is needed to ensure security in supply
  - E.g. transmission network expansion to balance PV and wind feed-in, demand-side management, smart distribution grids, energy-efficient Power to Heat, cogeneration of electricity, heating and cooling, energy storage, potential technologies for the carbon-neutral production of hydrogen and synthetic fuels.
Restructuring the Electricity and Gas Sector

- The restructuring should be continued to achieve **structural changes** that provide major benefits for the energy transition as early as possible:
  - Enabling free customer choices
  - Opening up the market for more and more diverse participants
  - Making networks neutral parts of the system
  - Creating a robust economic framework for coordination and investments
  - Triggering more technical innovations
  - Achieving more transparency for all participants.

Centralized and Decentralized Energy Systems

- National energy policy should promote the **co-existence of centralized and decentralized energy systems**
  - In decentralized energy systems: innovative energy transition efforts in regions/municipalities, citizens’ finance models and civic participation should be encouraged.
Study Topic 4

“Energy end-use efficiency potentials and policies and the development of energy service markets”
Energy efficiency potentials per sector in Japan based on a comparison of policy scenarios: Potential = difference between Reference 2030 and Aggressive Conservation 2030 (Source: ecofys/IAE 2017)

Energy efficiency potentials per sector in Germany based on a comparison of policy scenarios: Potential = difference between Reference 2030 and Aggressive Conservation 2030 (Source: ecofys/IAE 2017)
Study Topic 4 Figures

Germany and Japan on top of an efficiency rating
(Source: ACEEE 2017)
Technical energy-saving potentials in Germany:

**Cutting energy demand by half? In Japan as well?**

TR: transport sector, IN: industry sector, TE: tertiary sector, HH: household sector, FED: final energy demand (Source: Fraunhofer ISI 2017)
Objectives of the study

- Identify **cost-effective energy end-use efficiency potentials** and main barriers preventing them
- Identify the **potential for demand response** in the different sectors, and the effects of ICT, Internet of Things, and Big Data
- Identify the respective **policy packages** to support energy end-use efficiency and demand response
- Identify the **current state of providers** of Energy Performance Contracting and Energy Supply Contracting; how to push energy service markets and remove barriers
- Identify energy efficiency-induced **rebound effects**, the Setsuden initiative, the role of energy sufficiency, and expected energy savings from behavioral approaches.
Study Topic 4 Key findings of the study

• Both countries are already world-leaders in energy productivity, also due to their existing policies.

• Both countries have ambitious energy efficiency targets for the future, based on the large potentials that still exist.
  o Both have to strengthen their packages of energy efficiency policies to overcome barriers, including those hindering demand response.

• While Germany could learn from Japan on energy efficiency in the transport sector, Japan could learn from Germany on energy-efficient buildings.
Energy Efficiency Governance

• The **governance of energy policy and the energy efficiency** policies themselves should be further developed in both countries
  
  o to close the implementation gap and to achieve ambitious absolute energy saving targets (the ‘Efficiency First’ principle)

• Adapt **adequate policy packages and programs** to overcome barriers and to harvest economic opportunities and the co-benefits of increasing energy efficiency and saving.
  
  o E.g. establish a strong National Energy Efficiency Agency and Energy Savings Fund that is integrated into the institutional setting and policy-making process.

Integrate energy and resource efficiency policies

• Harvest the enormous economic co-benefits by increasing material and energy efficiency and by implementing a circular economy, e.g. “Three R”: **Reduce, Reuse, Recycle**
Study Topic 4 Joint recommendations

Efficiency and Sufficiency

- Combine an ambitious **efficiency strategy** with an **energy sufficiency policy** to make energy consumption reduction targets easier to achieve.

- Develop a **combination of instruments** including mandatory energy efficiency or consumption standards, energy/CO$_2$ pricing, and revenue-neutral combined incentive/disincentive systems to provide a significant cushioning effect
  - in particular concerning vehicles, buildings, and appliances.

Energetic renovation of buildings

- Ensure **state funding** to incentivize investments, for consultancy education and training for “deep renovation” of the building stock and to increase the annual renovation rate.

- Develop renovation **roadmaps** and timetables for “low to plus energy houses”

- Provide public start-up funding to **shorten the payback periods** for building owners and to provide incentives for a “deep” renovation of residential and non-residential buildings.
Part 2.2
A critical view of German GJETC members on the energy transition in Japan
Questions and observations (I)

Energy-poor or energy-rich? Turn insularity into an economic opportunity?

- Island situation today is a huge challenge for energy security; but in a future decarbonized world as well?
- Can more ambitious deployment of efficiency and renewables minimize risks and foster economic co-benefits?
- “Alternative” Japanese scenarios show: nuclear phase out and 80% CO2 reduction is feasible. Scientific dialogue?
- Consensus building, citizens participation, scenario based social learning on long targets and policies. Needed?

Energy Mix 2030: Nuclear overestimated, efficiency/renewables underestimated?

- Share of nuclear today 3% → 2030: 22% including new reactors realistic? Public acceptance, external costs, waste?
- Efficiency potentials/costs are huge; what policy package to close the implementation gap?
- “Masterplan” for wind power deployments (potentials, grid extension, cost degression, flexibility options)?
- No long term back-casting? Might cause too high risks of lock-in-effects and stranded investments (coal, nuclear)?
- Continuous monitoring and steering flexibility needed. Supported by new polycentric governance structure?
Questions and observations (II)

Potentials, costs and prices: Correctly perceived?

- Broader analysis of potentials and cost degression perspectives of renewables/efficiency needed?
- Costs of renewable electricity too high due to missing incentive by priority feed-in? Nuclear first?
- Higher electricity prices are acceptable if bills are affordable due to efficient use (e.g. Germany; SME/Households)?
- Energy prices: low impact on average competitiveness; energy intensive: exemptions and maximized efficiency necessary?

“The future will be decentralized (Siemens)”? Everywhere? In Japan?

- Up to now: No comparable infrastructure of about 1000 Stadtwerke/850 cooperatives like Germany; the future in Japan?
- Regional resilience, revitalization of countryside, added economic and citizens value possible. Enough policy support?
- Encouragement for citizens participation and finance (cooperatives) crucial for acceptance. But is it acknowledged?
- About 800 new “power producers/suppliers” (2016) after liberalization. But about 75% external/big players. Citizen value?

Huge global “lead markets” for climate/resource protection technologies?

- Declining investment rate in Jap./Ger.: Investment program on ecological modernization supported by BDI. Keidanren?
- Energy efficiency and renewables are by far the largest global lead markets: Nuclear/coal as innovation barriers?
- Global markets on nuclear are small and on coal declining: Does “Mix 2030” locks into low competitiveness?
## Inspiration from other countries

<table>
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<tr>
<th>Country</th>
<th>Goal</th>
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<tr>
<td><strong>Denmark</strong></td>
<td>• Declared independence from oil, coal and gas.</td>
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<td>• In 2016 the <strong>share of renewables</strong> raised to more than 50%.</td>
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<td>• By 2035: 100% renewable electricity</td>
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<td>• By 2050: completely free of fossil fuels.</td>
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<td><strong>Taiwan</strong></td>
<td>• <strong>Phase out nuclear power</strong> by 2025</td>
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<td>• <strong>Solar PV sector</strong>: 1.3 GW (2016) to 20 GW (2025)</td>
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<td>• <strong>Wind power</strong>: 755 MB (2016) to 4200 MW (4.2 GW) (2025)</td>
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<td>**UK/ Canada</td>
<td>• <strong>UK</strong>: <strong>Phase out coal</strong> by 2025</td>
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<td>• Canada: closing down of coal power stations by 2030</td>
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<td></td>
<td>• Both countries have not yet planned to phase out nuclear power.</td>
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<td><strong>China</strong></td>
<td>• <strong>Solar PV</strong> target 2020: 105 GW (surpassed target with an installation of 112 GW)</td>
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<td>• <strong>Wind cumulative</strong> installed capacity expected by 2020 to about 264 GW.</td>
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<td>• Announced to cancel about 100 <strong>coal</strong> plants/120GW under development</td>
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<td>• World market leader in <strong>hydropower</strong>, <strong>bioenergy</strong> for electricity and heat, <strong>electric vehicles</strong>.</td>
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<td>• Responsible for 40% of the <strong>global renewable capacity growth</strong> (2016)</td>
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Part 3
Further Research Needs
Further Research Needs

How to set and meet energy transition targets/goals and strategies?

- Scenario development and modeling
- Long-term energy system transformation
- Macroeconomic implications of a long-term energy system transformation: The benefits of cooperation and “beyond the border“ GHG emissions reduction
- Long-term innovation
- Implications for long-term strategies and foundations of a robust policy mix

Improving participation and dialogue for the energy transition

- Overall visions of Germany and Japan for the future energy system
- Identification of and dealing with socio-economic, sectoral and regional implications of difficult choices in the course of energy transition
- Intensified societal dialogues on the energy transition including all relevant stakeholder groups
- Socio-cultural preconditions
- Comparative study of governance structures and approaches
Further Research Needs

Energy (end use) efficiency and savings transition targets/goals and strategies?

• The “efficiency first” principle
• Energy efficiency potentials
• Energy efficiency policy packages
• Mobility and transport
• Energy saving and sufficiency
• Energy service markets
• Energy policy and energy prices

Energy supply and electricity market design

• Integration of variable renewable electricity (wind, PV)
• Instrument design for financing renewable energies
• Combined heat/cold and power producers (Co-/Trigeneration)
• Incentives for the various flexible options
• Business models and perspectives
• Developing markets for energy services
• Working on a target model for a future market design and the interim transitional steps toward such market design
• Economic barriers to sector coupling/distribution of taxes and levies
• Understanding the challenges and probable costs of the nuclear fuel cycle
Joint recommendation
to establish an educational exchange program

• Conclusion of a bilateral agreement, budget, and marketing concept for a
  German-Japanese support program for the exchange of students, joint
  master's and doctoral theses, and generally for vocational training and
  school education is strongly advised.

• A model could be the Erasmus Program of the European Union.

• With regard to an ambitious Japanese and German exchange program,
  attractive financial support for acquiring language skills and for
  accommodation abroad is necessary.
Joint recommendation to continue the dialogue

The Council recommends a continuous and intensified German-Japanese dialogue, including that of the GJETC, on technologies, social innovations, and policies to speed up sustainable energy transformation in both countries.

- Current implementation processes could be significantly supported through cooperation and the exchange of knowledge.

- The GJETC has created a format and a role model that allows science-based policy advice to be provided close to politics, but independent of political interference.

- After two years a good foundation has been created in order to take the joint work of the GJETC to a new, advanced level in a second phase (2018-2020).
Thank you very much for your attention!

http://www.gjetc.org/