CAETS Energy Committee (CEC)
Meeting Minutes

Meeting: Thursday, 10 AM, March 7th, 2019 at Four Seasons Hotel, Seoul

Attendees

- Donggun Park, *NAEK,* Korea
- (Chair) Chinho Park, *NAEK,* Korea
- Seungil Moon, *NAEK,* Korea
- Robert Evans, *CAE,* Canada
- Liu Jizhen, *CAE,* China
- Wang Qinghua, *CAE,* China
- Bernard Tardieu*, NATF,* France
- Masakazu Sugiyama, *EAJ,* Japan
- Frank Behrendt, *acatech,* Germany
- Patrick Hartmann, *acatech, Germany*
- Steve Lennon, *SAAE,* South Africa
- Jihye Gwak*, Korea Institute of Energy Research,* Korea
- Sanghak Lee, *Korea Electronics Technology Institute,* Korea
- Suhwan Choi, *NAEK,* Korea
- Yeong Park, *NAEK,* Korea
- Narai Kim, *NAEK,* Korea
- Hyerinne Hahn, *NAEK,* Korea
- Yujin Chong, *NAEK,* Korea

Latest Developments

- France, Japan, and other members to submit final additional items to the German delegation re: 2018 Report
- Working title for 2020 Report: “Solutions for High-level Penetration of Intermittent Renewable Energy”
- Questionnaire to be sent out TBD, members given 2 months to complete and submit respective parts
- Audience set as material for political advisory to other academies

Summary of Energy Status by Country

Germany, acatech

- Intro to **acatech**: Accepts companies as well as personal fellows (carried by federal and the state)
- Key goals of acatech: Climate change, ensuring mobility (transition to electrical systems and renewable fuels), inspiring youth as the next technical innovators of tomorrow
- Energy projects: Energy Systems of the Future (ESYS)
    - Electricity market design, (de)central energy supply, reliability of digitized energy system

Korea, NAEK

- Korea's energy situation:
    - Behind in PV/Wind generation ratio compared to world averages, High GHG emissions
    - National plan to 2030: Expand renewable electricity by 20%, too low of a goal?
        - Expanding renewable, LNG
        - Reducing coal, but not enough
- Main policy plans:
    - 1. Realizing high efficiency energy society
    - 2. Establishing smart energy infrastructure
    - 3. Developing future energy industry
    - 4. Implementing "people" governance
- Panmunjom Declaration
- North Korea's situation:
    - Low power factor, frequent equipment failure and blackouts
    - Damaged transmission & distribution facilities
    - Serious unbalance between demand and supply
    - 47-51 Hz frequency in Pyongyang
    - 10 years ago. Pyongyang's frequency was about 47 Hz, now is brighter, demand increase?
- Energy Solutions for Unification:
    - 1. Smart city solution: Wonsan
        - Suitable for inter-Korean exchange and cooperation
    - 2. HVDC - Connecting with North Korea's power system
    - 3. East Asian Super Grid: Solution to the isolated power system
        - A world-grid solution to energy challenges

Canada, CAE

- Intro to CAE
- Canada a major fossil fuel consuming nation (fossil fuels 77%, renewables 16%)
- Huge hydroelectric storage, able to sell storage to CA when price is high
- Major producer of oil, mined uniquely via oil sands
- Energy conversion chain:
    - Sources (fossil Fuels, nuclear, renewable) → Processing → Energy Carries (petroleum products, natural gas, electricity, hydrogen) → Storage
- The H_2 "Battery": Where does the hydrogen come from?
    - Not efficient compared to lithium ion or

    - Hydrogen CANNOT compete with electricity, will require nearly 3 times a conventional battery
- Canada home to the world's biggest "batteries"

South Africa, SAAE

- Intro to SAAE, South Africa: high unemployment, poverty issues, and opportunity inequalities. Current focus on economic growth, social equity, and environmental sustainability
- Overview of the South African energy sector:
    - Eskom, vertically integrated monopolistic system
- Recent developments: 30-year plan to balance supply and demand
- Constant risk of not meeting energy demand, enormously disruptive to the economy
- 2028 Network Plan
- Unbundling of Eskom: Will restructure the SA power sector, create of a new electricity market and increase in private sector, cause an increase in micro trading and mini grids, more energy storage (pump), and has potential for huge emission reductions

China, CAE

- CAE hosted the last CAETS Beijing conference in 2015, with Xi Jinping delivering keynote address
- Generation capacity portfolio
    - Similar to South Africa
- Huge shift to Electric Vehicles
- Renewable power generation in China, ranked #1 in the world
- Still increasing energy demand

Japan, EAJ

- Japan's energy situation: Renewable hydrogen for the disruptive installation of renewable energy
- Following 2011 Fukushima disaster, still considering nuclear
- PV installations and PV capacity in Japan in a steep increase since 2012
- Difficulties in grid management
    - Japan with 2 different frequencies, 10 independent systems within Japan
    - Kyushu: rush in PV installation, suppression of PV output to grid
- Need for imported renewable energy, in keeping with the Paris agreement
- 80% reduction in GHG emission by 2050
- Hydrogen storage: Short-term storage satisfied by battery, but long-term storage requires some H_2 battery
    - Demonstration site: Installation in Huis Ten Bosch Hotel
- H_2 and Regional Energy Management
    - Intercontinental hydrogen transport

- Necessary Partnerships with Australia, for development of CPV modules
    - ~20% energy conversion efficiency increase ahead

France, NATF

- Euro-CASE: European effort to work on issues relating to cybersecurity, health, and tech education
- Unlike Paris, European agreements are binding
- National Low Carbon Strategy: French roadmap for reducing GHG emissions
- Building efficiencies: Not a strong economic incentive for people to make changes to changes to low-emission
- Public aversion to wind farms
- Capturing public opinion on nuclear energy
    - France's goal to maintain 50% energy from nuclear
    - Not yet expanding to new reactors

Review of the 2018 CAETS Report

Tips from Patrick (acatech):

(For NAEK) thinking about the questionnaire, need to have clear structure so that non-committee members can be directed to relevant sources of info

- Questionnaire needing well-organized compilation tasks

Best Practices Set from the Committee on Sept 10, 2018

- Digital version only
- New target group: Other CAETS academies, not for the general public, as material for political advisory
- Time frames for political strategies have to be considered
- Table comparing 8-10 key differences
- The report should be submitted to an energy related journal
- Comparison Tables:
    - Country strategies
    - Energy mixes
    - Generation, distribution, and storage approaches for energy
    - Overview on electric vehicle strategies
    - **Comparable data difficult to extract from questionnaire

2018 Report To-Dos

- Prof. Sugiyama to submit a report to add as a Japan delegation
- Prof. Tardieu to submit a report to add as France delegation
- Please direct to Patrick Hartmann by **March, 2019**

Discussion on the 2020 Report

- Continuation from 2018 theme
    - Integration of increasing amounts of “fluctuating renewable sources” of electricity into the (smart) distribution grid -- how resilient are smart grids against attacks? (Montevideo)
    - 2018 report’s theme: All-Electric Systems
- Smart Grid: Just about electricity or about energy as a whole?
    - What are the technology standards that constitute as “smart”?
    - Or just about to shifting to **more renewables?**
    - Rolling out smart meters?
    - How to deal with the modified use of the transmission grid?
    - How to deal with accidents?
        - Install smart systems ahead of time to shut down some consumers minus necessities like freezers, heating, etc.
    - Resilience against unauthorized attacks?
- Proposal to pivot to a new question: **<u>What does the next grid system look like?</u>**
    - Find common parts in the **ideal network**, despite differences on the exact technology
    - How to advise to policymakers: Decentralized supply or transmission super grids?
    - Reliability: If main system is not reliable, people are inclined to set up backup generators.
        - Then, smart grids must include a good, available storage system. What does such a storage system look like? Is a “battery” the panacea to all energy problems?
- Report: A table-oriented comparison by country, juxtaposing the represented countries’ electric systems, and grid technology → compile into report → be a resources to countries that are looking to align themselves to a similar model

Focus of the Committee:

Objectives:

- Material for scientific advisory to provide guidance to a nonpublic audience of **academia**
- Publish findings in a **scientific or academic journal**
- Address the primary question**: What are technological and policy-oriented solutions to current problem of intermittency?**
- Juxtaposition of country-by-country analysis on the subject, so that leaders can quickly find and match their respective country to the most similar case study
    - Purpose of juxtaposing (as compared to cross-comparison analysis): Despite the specifics of technology varying by country, where are some common points of interest that can be incorporated into new electrification grids?

Proposed topics to address (to be expanded upon in questionnaire):

1. Traffic/Mobility
2. Heating & Cooling (industrial, carbon-based vs. residential, electric)
3. P2P, Self-Consumption
4. Storage: H_2, Pumped-Hydro, Compressed Air
5. Demand and Supply Management

Contents in Detail

1. Introduction

    - Problems generated from introducing intermittent renewable energies in large scale: What are the current drawbacks of an intermittent electrical system?

2. Solution Part 1: **Technological Solutions** (i.e. hydro, ESS, hydrogen, etc.)

    1. Stability of grid operation / Resilience / Security
    2. Smart meter & predictive/preventive control
    3. Interaction with mobility and heating / cooling
    4. Electricity storage: H_2 /Hydrocarbon, Pumped-hydro, Compressed air
    5. Demand and supply management

3. Solution Part 2: **Business Market Regulation**

    1. New BMs arising (P2P, self-consumption, Block Chains, etc.)
    2. New electricity pricing mechanisms (taxes, tariffs, etc.)
    3. Big Data
    4. Carbon Emissions Trading

4. Solution Part 3: **Implementing Policies** (i.e. tariff prices, taxes, etc.)

    1. New distribution infrastructure investment
    2. Ownership of energy infrastructure (government vs. private) & how to best integrate with transmission side companies
    3. Public acceptance (increasing exposure and positive perception on renewables)

5. Conclusions

    1. Expecting economic growth from this new market
    2. Some cross comparison between all case studies