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Statistical and Methodological Issues on the APEC Energy Intensity and Renewable Energy Goals

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http://www.ieej.or.jp/egeda/

Presentation Outline

- APEC EI and RE Goals
- EGEDA's Role
- Methodological and Statistical Issues on the APEC EI and RE Goals
- Data Gaps in Current APEC Energy Statistics
- How could EGEDA Improve Data Completeness and Accuracy
- Summary

APEC EI and RE Targets

- APEC aspirational goal of reducing APEC-wide energy intensity (EI) by 45% by 2035 from 2005 level
  - Not yet clear if it is **Primary Energy Intensity** or **Final Energy Intensity**
  - Not clear also on what value of GDP should be used – GDP at purchasing power parities (PPP) or GDP based on exchange rates
- APEC goal of "doubling the share of renewables in the APEC energy mix, including in power generation, from 2010 levels by 2030."
  - Not clear if **Primary energy** or **final energy consumption mix**
  - Could mean share to total primary energy consumption
  - But if it means share to total final energy consumption, EGEDA could find ways on how to incorporate electricity and heat from renewable sources

EGEDA' Role

- EGEDA collects the following data from APEC member economies
  - Annual Energy Supply and Demand Data
    - Primary Supply to Final Consumption
    - Fossil Fuels, Nuclear, New and Renewable Energy
  - Socio-economic Statistics (World Bank and National Sources)
- Ensure completeness and accuracy as much as possible
- From these data, APEC's performance vis-à-vis targets can be monitored

Issues on Energy Intensity Goal

Methodological Issues (Primary vs Final Energy Intensity)

Final Energy Intensity

- Does not capture efficiency improvements in energy transformation as well as transmission and distribution
- Includes non-energy use
  - feedstock in the production of petrochemical products and fertilizers
  - bitumen for road construction,
  - lubricants used in machineries, etc.
- Should non-energy use be excluded?
  - Reduction in non-energy use would result only in reduced output such as: production of petrochemical products, less road paved, less lubrication in machineries but does not improve energy efficiency or reduce energy used per unit of output
- What about traditional use of biomass like firewood for cooking? Should these be included or excluded?

Methodological Issues

Primary Energy Intensity

- Conversion to primary energy equivalent of electricity production from geothermal, nuclear, hydro, and new energy sources such wind, solar, etc
- Currently, EGEDA uses the "***physical energy content method***" on which the following efficiency assumptions are used:
  - Geothermal (10%), nuclear (33%) hydro, solar & wind, etc (100%), biomass (depending on the power plant technology)
- The "***partial substitution method***" might be the better method
  - represents the amount of energy necessary in conventional thermal plants (how much would have been consumed if electricity is produced in conventional fossil fuel-fired power plant)
  - However, it is difficult to choose efficiency (conversion factor) in converting electricity output to primary energy equivalent
  - not relevant for countries with a high share of hydro

“Primary energy content” vs “Partial substitution” method

Example: Japan, 2011

	TPES[1]	Shares	TPER[2]	Shares
Coal	107,074	21.8%	107,074	21.6%
Oil	227,554	46.3%	227,554	46.0%
Gas	95,301	19.4%	95,301	19.3%
Nuclear	42,459	8.6%	**35,029**	7.1%
Hydro	7,666	1.6%	**19,201**	3.9%
Geothermal	2,535	0.5%	**742**	0.1%
Solar & Wind	385	0.1%	**1,354**	0.3%
Others	8,447	1.7%	8,447	1.7%
Total	491,421	100%	494,703	100%

[1] based on physical energy content

[2] calculated using the average efficiency thermal power plants of 40%

Nuclear, hydro and other NRE: very different values!

Why is the Use of "Primary Energy Content Method" an Issue?

- In the primary energy content method, an economy that would double geothermal energy in the future would increase the share of NRE immensely as the assumed efficiency is only 10% (**10 ktoe/1 ktoe of electricity**)
- The primary energy equivalent of the output would be 5 times higher than the natural gas needed to produce the same amount of electricity assuming that CCGT with 50% thermal efficiency is displaced by geothermal (**2 ktoe/1 ktoe of electricity**)
- The economy may meet its RE doubling goal, but
- Due to the "inefficiency" of geothermal electricity generation, the economy may fail in its energy intensity reduction goal
- Should we use "Partial Substitution Method"? Yes, at least when measuring performance versus the goals.

Issue on the Partial Substitution Method

- The efficiency used to convert electricity output to primary energy equivalent is the **average efficiency of all thermal power plants** in an economy
- This **average efficiency can vary every year** depending on the shares of the efficient and/or less efficient power plants
- Is not applicable to countries with large share of hydro
- **Possible Solution:** Just use a conversion factor that is agreed upon by all economies and apply the same to all economies
  - APEC Average or
  - Individual economy averages

Statistical Issues

Primary Energy Intensity

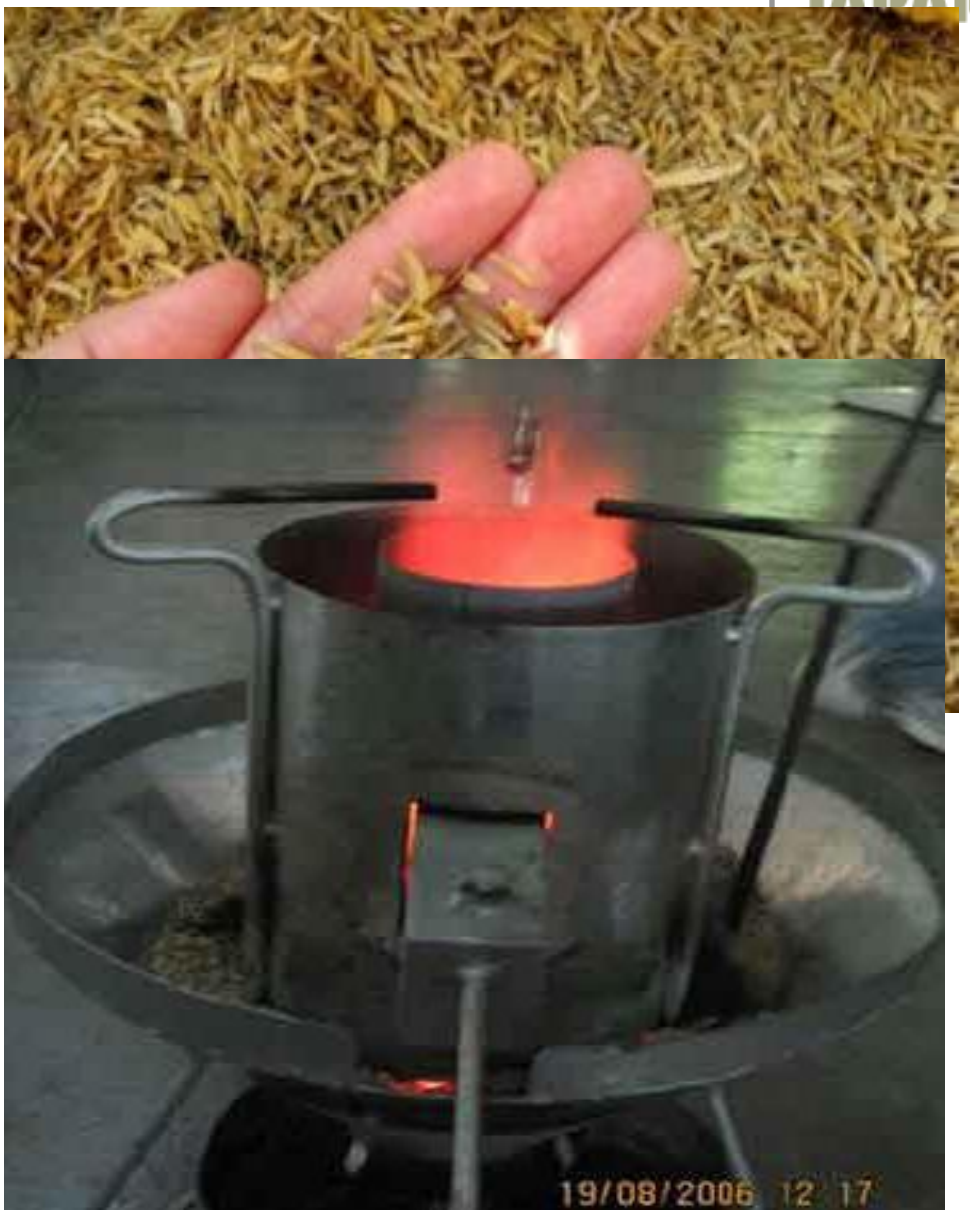
- International aviation bunkers and domestic aviation as well as International marine bunkers and domestic navigation are not disaggregated in several economies
  - Indonesia, Malaysia until 2011, Peru, Russia until 2009, and Vietnam
- Usually the totals are reported only as final consumption in domestic aviation and domestic navigation
- These are supposed to be subtracted from primary energy supply
- Result – Higher energy intensity than what it should be

Issues on Renewable Energy Target

Methodological Issues

What should be doubled?

- Certainly, not the consumption of firewood in the residential sector (danger of more rapid deforestation)
- But what if firewood is replaced by agricultural waste like rice husk or rice hull?
- What about impoundment hydro? Should this be included?
  - Should the area that are currently flooded by hydroelectric dams be doubled?
  - Should we include only non-impoundment types such as **run-of-river** hydro?



http://stoves.bioenergylists.org/taxonomy/term/1602

Methodological Issues

Share to Primary or Final Energy Consumption?

- If the RE target is based on share to primary energy consumption, use the **"partial substitution method"** when calculating the share
- If it is based on share to final energy consumption, electricity from renewables should be disaggregated from final electricity consumption
  - This would need more accurate power station use and transmission and distribution losses data
  - Many renewable energy installations are distributed generation which have very low or even zero losses

Statistical Issues

What should be covered apart from what are covered now?

- **Solar**
  - Covered: PV, thermal, water heating (if measured)
  - Not covered: crop drying, clothes drying
- **Wind**
  - Covered: Wind turbine for electricity generation
  - Not covered: Other uses
- **Geothermal**
  - Covered: electricity /space heating
  - Not covered: crop drying, hot water for bathing, etc
- **Hydro**
  - All are included and recently, output by different sizes of power plants will be collected (<1MW, 1MW-10MW, >10MW)
  - It might be better to disaggregate by each type of hydro (impoundment, diversion or run-of-river, multi-purpose and pump-storage)

Issues with Missing NRE Data

- How could we double RE share if we don't know how much we have at present?
- There is a need to determine the current levels of actual NRE supply/consumption
  - All economies must strive to measure the amount of renewable energy consumed and include the same in their energy statistics and balances
- Another issue is, what additional data should be collected?
  - EGNRET could help EGEDA on identifying these missing data

Data Gaps in APEC Energy Statistics

Data Gaps in APEC Energy Statistics

- Inconsistencies in historical data series of several economies
- Many data are just not available
  - Consumption of biomass in China, Malaysia and Papua New Guinea
  - Unmonitored/unreported electricity generation in very small energy installations such us: rooftop PVs, micro-hydro, etc
- There may be other uses of RE that are not covered by EGEDA definitions.

Data Gaps in APEC Energy Statistics

- Biomass:
  - China and Malaysia – only the amounts used for electricity generation; no data on household use
  - Papua New Guinea – no data
- International Aviation Bunkers:
  - Indonesia, Malaysia (until 2011), Papua New Guinea, Peru (no data in 2005, 2008 to 2012)
- International Marine Bunkers:
  - Brunei Darussalam, Indonesia, Papua New Guinea, Peru, Russia (until 2009), Thailand and Viet Nam
- EGEDA's coordinating agency, EDMC, is trying hard to address the gaps but will be successful only with the cooperation of the concerned economies

How Could EGEDA Improve Data Completeness and Accuracy?

- Capacity Building to enhance capacity of people collecting data in developing APEC member economies and to improve the quality and completeness of energy data
  - Annual Workshop on Energy Statistics
  - Capacity Building on Energy Statistics in Requesting Economies (1 week course)
  - Short-term Course on Energy Statistics (3-weeks course in Japan)
  - Middle-term Course (8-weeks internship at the Energy Data and Modeling Center in Japan)
  - Long-term Course (1 week temporary employment at the Energy Data and Modeling Center in Japan)
- EGNRET Assistance in identification of data that need to be collected
- A seminar on Renewable Energy focused on energy statistics for EGEDA members would be needed in collaboration with EGNRET, IRENA and IEA

Summary

- To able to monitor the achievements against the EI and RE goals, APEC needs to:
  - Improve energy data completeness and accuracy
  - Use the appropriate methodology when calculating EI and RE share using APEC Energy Statistics
  - Decide on the appropriate conversion factor for electricity generated from nuclear, geothermal, hydro and other renewable energy
  - Define what should and should not be included in the NRE doubling goal
  - Decide on what additional renewable energy data should be collected
- Cooperation among EGEDA, EGNRET and EGEEC would be very important on how to measure the baseline values of energy intensity and NRE share
- Continuous capacity building of energy statisticians will be necessary

THANK YOU FOR YOUR ATTENTION. YOUR COMMENTS AND SUGGESTIONS WILL BE HIGHLY APPRECIATED.

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