Challenges for the Growth of Renewable Energy Markets

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Today’s Contents

- Overview of global energy markets
- Projection of renewables market in Asia
- Japan’s challenges for deploying renewables
- Grid integration of variable renewables
- Conclusions
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  - WEO 2012
  - 1st Medium-term RE Market Report 2012
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 Foundations of global energy system shifting

- Resurgence in oil & gas production in some countries
- Retreat from nuclear in some others
- Signs of increasing policy focus on energy efficiency

 All-time high oil prices acting as brake on global economy

- Divergence in natural gas prices affecting Europe (with prices 5-times US levels) and Asia (8-times)

 Symptoms of an unsustainable energy system persist

- Fossil fuel subsidies up almost 30% to $523 billion in 2011, led by MENA
- CO₂ emissions at record high, while renewables industry under strain
- Despite new international efforts, 1.3 billion people still lack electricity
A power shift to emerging economies

Change in power generation, 2010-2035

China

India

United States

European Union

Japan

The need for electricity in emerging economies drives a 70% increase in worldwide demand, with renewables accounting for half of new global capacity
Shares of renewables in different scenarios

Note: CPS = Current Policies Scenario; NPS = New Policies Scenario; 450 = 450 Scenario.

IEA, WEO 2012
The multiple benefits of renewables come at a cost

Global renewable energy subsidies

Renewable subsidies were $88 billion in 2011; over half the $4.8 trillion required to 2035 has been committed to existing projects or is needed to meet 2020 targets
RE Market Report Analytical Framework

Japan example

- Generation and capacity forecast based on -
  - Power demand
  - Power sector structure
  - Grid and system integration
  - Economic attractiveness
  - Financing
  - Policy framework robustness

- Identify drivers and challenges for renewable deployment
Growth in renewable power is forecast to accelerate

- Hydropower remains the main renewable power source (+3.1% p.a.)
- Non-hydro renewable sources grow at double-digit annual percentage rates (+14.3% p.a.)
Growth is led by non-OECD countries

- Non-OECD accounts for two-thirds of the overall growth
  - China, Brazil, India lead; others grow significantly as well
- OECD growth still largely driven by Europe but Americas and Asia-Oceania make significant contributions
Non-hydro technology deployment spreads out

- Number of countries with cumulative capacity larger than 100MW (can cover consumption of 100k households) increases significantly
- Growth areas include Asia, Africa, Latin America and the Middle East
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OECD Asia-Oceania growth mostly in solar PV

- Japan grows (mostly solar PV) under generous FiTs and uncertain nuclear situation
- Australia’s growth is centered around wind and solar PV
- New Zealand continues its steady growth
- Korea and Israel grow from a low base
ASEAN a significant source of other Asia growth

- Geothermal expands in Indonesia and the Philippines
- Significant hydropower additions expected in Vietnam
- Thailand continues to grow a portfolio of renewable power sources – biomass, biogas, waste-to-power, solar PV, wind

Global geothermal capacity forecast
China accounts for 40% of global growth

**Drivers:**
- Growing energy needs
- Diversification
- Government targets
- Ample low-cost finance
- Robust manufacturing

**Challenges:**
- Pricing framework
- Priority dispatch
- Grid upgrades
- Prohibitive licensing for small-scale systems

![Graph showing China forecast renewable generation and power demand vs GDP growth](Image)
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  - A specific focus on solar PV
- Grid integration of variable renewables
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A decline in nuclear is compensated by a 3-fold increase in electricity from renewables, a continued high reliance on LNG imports & improvements in efficiency.
Japan grows strongly under uncertain nuclear situation and new feed-in tariff policy

Drivers:
- Uncertainties about nuclear restart
- New feed-in tariffs
- Good match of solar PV for shaving peak load

Challenges:
- Power system fragmentation
- Relatively high capital costs of renewable energy
- Location of wind and geothermal resources far from demand centres
Solar PV - from volatility to smoother growth

- Short term volatility and slowing growth in Europe
  - In some markets, cost reductions outpaced incentive reductions

- Japan’s high incentives could cause deployment to surge to unsustainable levels if incentives are not adjusted over time
Ongoing Issues for PV

- Impact on electricity bills in some countries
  - German EEG-surcharge will increase 45% in 2013
  - But likely to stabilise from 2014 on

- Emerging trade disputes
  - Imbalance is smaller if whole value chain is taken into account

Supply in 2011 (Manuf. Capacity 55 GW)

Demand in 2011 (New Installations 30GW)
Technology improvements and economies of scale drive sharp cost reduction

Overcapacity leads to price setting below costs
2012 PV Market stronger than expected

- Another >7 GW year in Germany
- Italy slows down but less than expected, other markets accelerate
- Cumulative world capacity around 100 GW
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A power system perspective is important

- Variability and uncertainty are not new
  - But at high shares (of VRE) the challenge will be considerable

- Residual demand shape is irregular (particularly wind, wave)
Grid Integration of Variable Renewables (GIVAR)

- 2011: IEA published technical assessment of integration

- Key points:
  - Feasible share of variable RE depends on system flexibility; no principle ceiling
  - Technical assessment of power system flexibility based on case studies

- New phase:
  - Refined definition of flexibility
  - Assess Economics of Flexibility
Flexibility is key

There are 4 flexible resources

Dispatchable power plants
Demand side Response (via smart grid)
Energy storage facilities
Interconnection with adjacent markets

Source: IEA Harnessing Variable Renewables 2011
### Snapshot of present penetration potentials

The height of the bar shows deployment potential based on technical flexible resource.

<table>
<thead>
<tr>
<th>Country</th>
<th>VRE penetration potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>63%</td>
</tr>
<tr>
<td>Nordic market</td>
<td>48%</td>
</tr>
<tr>
<td>United States West (2017)</td>
<td>45%</td>
</tr>
<tr>
<td>NBSO area (of Canada)</td>
<td>37%</td>
</tr>
<tr>
<td>Great Britain and Ireland</td>
<td>31%</td>
</tr>
<tr>
<td>Mexico</td>
<td>29%</td>
</tr>
<tr>
<td>Spain and Portugal</td>
<td>27%</td>
</tr>
<tr>
<td>Japan</td>
<td>19%</td>
</tr>
</tbody>
</table>

#### Grid

- Denmark: High
- Nordic market: Medium
- United States West (2017): Medium
- NBSO area (of Canada): High
- Great Britain and Ireland: Low
- Mexico: Low
- Spain and Portugal: Medium
- Japan: Low

#### Market

- Denmark: Medium
- Nordic market: Medium
- United States West (2017): Medium
- NBSO area (of Canada): High
- Great Britain and Ireland: Low
- Mexico: Low
- Spain and Portugal: Medium
- Japan: Low

**Score:**
- ☑ High
- ▼ Medium
- ❌ Low
GIVAR III Scope & Objectives

GIVAR III Publication

Market design and policy recommendations

Variable RE Impact Analysis

Flexible Resources Analysis

Case Studies
- Market review
- Quantitative methods
Case Study Regions

- China
  - Inner Mongolia

- ES&PT
  - Tamil Nadu for wind, Rajasthan for solar

- India

- Japan

- NW Europe
  - NOR, DNK, SWE, FIN, DEU, GBR, IRL, FRA

- US

- PJM, ERCOT
Revised FAST Tool

**Input**

- Flexible Resources
  - Flexible Generation
  - Storage
  - Inter-connection
  - DSM

- Variable Resources
  - Wind
  - Solar
  - Load

**Output**

- Wind and solar statistics
- Net load statistics
- Penetration / curtailment curves
- Start-up of conventional units

**FAST 2.0**
Relevance for Japan

- Grid integration of renewables will be key issue with growing shares of v-RE
- IEA analysis brings together expertise from leading institutions world wide
- Co-operation could be very fruitful:
  - Benefit from international best practice
  - Help the IEA to better understand the situation in the Japanese system, which is an important and special case
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Is renewable energy under pressure?

■ In the short term, there are pressure indicators, particularly in the most dynamic segments: solar PV and wind
  - Challenging macroeconomic and financing conditions
  - Policy uncertainty, (e.g. stop-and-go decision making) in some key markets
  - Economic incentives cut in some markets
  - Market competition from other energy sources, particularly gas in the US
  - Industry upheaval and integration challenges

■ In the long term, larger integration issues to emerge
  - Renewables becoming more competitive over time
  - Market design reforms needed for high penetrations of low marginal cost, variable renewables into power systems

■ Yet, the overall renewable outlook is quite positive
  - Robust fundamentals and drivers remain; huge long-term potential of RE
  - Outlook will depend on policy robustness
Policy messages

- **Clarity, predictability** and a **long-term orientation** of RE policy frameworks are keys to maintaining investment
  - Policymakers should avoid stop-and-go decision making, which can cause investment to stall

- These frameworks should focus on the whole **portfolio** of renewables (incl. hydropower, bioenergy, RE heat, etc.)

- Meanwhile, there needs to be increased focus on **market designs** that integrate higher levels of renewables in power systems (both variable and dispatchable)

- A radical turn away from renewables now **would be more costly** in the long run in terms of climate costs and energy import bills
For further insights and analysis...

- The Medium-Term Renewable Energy Market Report 2012 online at:
  
  www.iea.org

- Thank you for your attention!
  
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