Deploying Renewables 2011

Best and Future Policy Practice

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International Energy Agency

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• Analyses market and policy trends for electricity, heat and transport
• Investigates the strategic drivers for RE deployment
• Benchmarks the impact and cost-effectiveness of economic support policies
• Provides best practice policy principles
• Covers 56 countries and all world regions
• Book and 3 supporting information papers
Strong Growth in RE Electricity ... and shift to Asia

<table>
<thead>
<tr>
<th>Generation 2010 [TWh]</th>
<th>Wind</th>
<th>Bioenergy</th>
<th>Solar PV</th>
<th>Hydro</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>338</td>
<td>296</td>
<td>31</td>
<td>3503</td>
<td>74</td>
<td></td>
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</table>

| CAGR 2005-2010 [%]    | 26.5% | 8.8%      | 50.8%    | 3.1%  | 4.6%  |
Costs are Reducing

- Hydro and some biomass and geothermal already cost-competitive
- Additional technologies getting competitive in a broader set of circumstances
- Opens up new deployment opportunities

PV decreasing costs by -19% for each doubling of cumulative installed capacity
Policies could radically alter the long-term energy outlook

World primary energy demand by scenario

In the New Policies Scenario, demand increases by 40% between 2009 & 2035
Low-carbon power technologies come of age

Global installed power generation capacity in the New Policies Scenario

Renewables & nuclear power account for more than half of all the new capacity added worldwide through to 2035

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Efficiency gains can contribute most to emissions reductions

World energy-related CO\textsubscript{2} emissions abatement in the 450 Scenario relative to the New Policies Scenario

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>450 Scenario</td>
<td>38</td>
<td>36</td>
<td>34</td>
<td>32</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>New Policies Scenario</td>
<td>38</td>
<td>36</td>
<td>34</td>
<td>32</td>
<td>30</td>
<td>28</td>
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<thead>
<tr>
<th>Energy Efficiency Measures</th>
<th>2020</th>
<th>2035</th>
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<tbody>
<tr>
<td>Efficiency</td>
<td>72%</td>
<td>44%</td>
</tr>
<tr>
<td>Renewables</td>
<td>17%</td>
<td>21%</td>
</tr>
<tr>
<td>Biofuels</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>5%</td>
<td>9%</td>
</tr>
<tr>
<td>CCS</td>
<td>3%</td>
<td>22%</td>
</tr>
<tr>
<td>Abatement</td>
<td>2.5</td>
<td>14.8</td>
</tr>
</tbody>
</table>

Energy efficiency measures – driven by strong policy action across all sectors – account for 50% of the cumulative CO\textsubscript{2} abatement over the Outlook period
Moving towards cleaner forms of electricity generation

Electricity generation by selected low carbon technology & share of electricity generation by scenario, 2009 and 2035

Low-carbon generation increases 2.5 times between 2009 & 2035 in the New Policies Scenario & almost quadruples in the 450 Scenario
Less nuclear means more of everything else

Power generation by fuel in the New Policies Scenario and Low Nuclear Case

The biggest chunk of the lost nuclear generation is replaced by power generation from coal, leading to a 6% increase in CO₂ emissions in the power sector.
The majority of energy subsidies still go to fossil fuels

World subsidies to fossil fuels consumption & renewable energy

Fossil-fuels subsidies amounted to $409 billion in 2010 – down from the peak of $550 billion in 2008 but still much larger than subsidies to renewables, which reached $66 billion in 2010
The overall value of subsidies to renewables is set to rise

Global subsidies to renewables-based electricity and biofuels in the New Policies Scenario

Renewable subsidies of $66 billion in 2010 (compared with $409 billion for fossil fuels), need to climb to $250 billion in 2035 as rising deployment outweighs improved competitiveness.
The door to 2°C is closing, but will we be “locked-in”?

World energy-related CO₂ emissions in the Current Policies and 450 Scenarios and from locked-in infrastructure in 2010 and with delay

Without further action, by 2017 all CO₂ emissions permitted in the 450 Scenario will be “locked-in” by existing power plants, factories, buildings, etc.
Measuring Policy Impact - Methodology

\[ PII = \frac{\text{Additional generation 2000 - 09}}{\text{Remaining to meet WEO 450 2030 generation}} \]
Are Policies Successfully Encouraging Deployment?  *Example: Onshore Wind*
Are payments for Generators in a Reasonable Range? *Ex: Onshore Wind 2009*
Impact vs Cost-Effectiveness

Example: Onshore Wind
Emerging Policy Challenges - PV

- Concentrated booming PV growth raises policy cost concerns in several EU countries
- Policies are not adapting quickly enough
- However, pressure will reduce as new markets emerge

Sources: IEA, EA PVPS, EPIA
Adjust Tariffs – On time & Often

Key point: Gap between incentives and costs and large, one-off tariff decreases can trigger “sales rush”
Importance of var-RE

WEO 450 Scenario electricity projections – EU

- 2008: 4% Wind, 17% Coal, 32% Oil, 25% Gas, 29% Nuclear
- 2020: 15% Wind, 32% Coal, 46% Oil, 46% Gas, 51% Nuclear
- 2030: 25% Wind, 46% Coal, 51% Oil, 51% Gas, 51% Nuclear
- 2035: 29% Wind, 51% Coal, 51% Oil, 51% Gas, 51% Nuclear
Emerging challenges: grid integration

Variability is not new, but it does get bigger

Flexibility is key

There are 4 flexible resources

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

A biomass-fired power plant
Industrial
A pumped hydro facility
Scandinavian interconnections
Grid integration of var-RE
Snapshot of present penetration potentials

<table>
<thead>
<tr>
<th>Country</th>
<th>VRE penetration potential</th>
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<tbody>
<tr>
<td>Denmark</td>
<td>63%</td>
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<tr>
<td>Nordic market</td>
<td>48%</td>
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<tr>
<td>United States West (2017)</td>
<td>45%</td>
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<td>NBSO area (of Canada)</td>
<td>37%</td>
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<tr>
<td>Great Britain and Ireland</td>
<td>31%</td>
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<tr>
<td>Mexico</td>
<td>29%</td>
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<tr>
<td>Spain and Portugal</td>
<td>27%</td>
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<tr>
<td>Japan</td>
<td>19%</td>
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- Height of bar shows deployment potential based on technical flexible resource.

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<th>Grid</th>
<th>Market</th>
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Best-Practice Policy Principles

- **Predictable** RE policy framework, integrated into overall energy strategy
- **Portfolio** of incentives based on technology and market maturity
- **Dynamic** policy approach based on monitoring of national and global market trends
- Tackle **non-economic** barriers
- Address **system integration** issues
Policy Priorities: Changing Over Time

**Inception**
- Clear RE strategy and targets
- Attractive support
- Set up regulatory framework

**Take-off**
- Predictable and rapidly adaptive incentives
- Focus on non-economic barriers
- Manage total support costs

**Consolidation**
- System integration and transformation
- Market design and expose RE to competition
- Public acceptance

Deployment

Time
Market Expansion Opportunities

- **Rising fossil fuel prices**
  - **Leading countries**
    - Fossil fuel importers
      - High GDP
    - Fossil fuel exporters
      - Low GDP
  - **New opportunities**
    - Fossil fuel importers
      - Low GDP
    - Fossil fuel exporters
      - High GDP

- **Energy dependence**
- **GDP/capita**
- **RE cost reductions**
Conclusions

• Policies have started delivering in terms of RE deployment and cost reduction

• RE getting competitive in a broader set of circumstances

• However major economic and non-economic barriers persist and sustained policy effort is still needed

• *Deploying Renewables* identifies best-practice policy principles
  
  • Cost-effective, dynamic, integrated approach
  • Aims to help sharing best practice internationally so that countries can learn from each other
Links

- [www.iea.org](http://www.iea.org)

- RE Publications
  - [Home](http://www.iea.org) > [Publications](http://www.iea.org) > Search per Topic: Renewables

- RE Policy Database
  - [http://renewables.iea.org](http://renewables.iea.org)

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