Feed-in Tariffs: Accelerating the Deployment of Renewable Energy

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Preview of presentation

• A brief overview of Feed-in Tariffs (FITs)
• Exploring the impact of FITs in Germany, Spain, and Canada
• Assessing the “cost effectiveness” of FITs
• Possible Benefits to New Zealand
• The components of a well designed FIT
• The importance of comprehensive government policy
But first, three caveats
• What is a “renewable” electricity generator?
Brief overview of FITs

FITs = guaranteed, fixed price for renewable energy, often for 20 or 30 years, with any increased costs spread across all consumers as a whole; justification premised on five arguments:

1: Subsidies – fossil fuels and nuclear tend to dominate international government subsidies
2: Market failures – a host of market failures and barriers impede renewable electricity
3: Climate change – renewable power technologies have immense environmental benefits
4: Flexibility – FITs are less onerous than command-and-control regulatory approaches
5: Cost – FITs cost governments virtually nothing
Why should New Zealand adopt one? Consider Germany

• If you want to:
  • Create jobs (250,000 jobs)
  • Reduce emissions (115m tonnes CO2 saved p.a.)
  • Save energy imports (€4.3bn)
  • Build an industry (€25 bn turnover in plant construction and operation)

Source: Miguel Mendonca, World Future Council
Brief overview of FITs

FITs can differ greatly:

1. differentiate by technology
2. differentiate by size or application
3. differentiate by resource or site
4. differ by length of payments
5. provide for periodic review
6. provide for balancing accounts to spread program cost
7. differ by target size or quota
8. differ by level of degression
Brief overview of FITs

- Differentiation by application

<table>
<thead>
<tr>
<th>German Solar Tariffs, 2007</th>
<th>Years</th>
<th>/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Photovoltaic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freestanding</td>
<td>20</td>
<td>0.380</td>
</tr>
<tr>
<td>&lt;30 kW rooftop</td>
<td>20</td>
<td>0.492</td>
</tr>
<tr>
<td>&lt;100 kW rooftop</td>
<td>20</td>
<td>0.468</td>
</tr>
<tr>
<td>&gt;100 kW rooftop</td>
<td>20</td>
<td>0.463</td>
</tr>
<tr>
<td>Facade cladding &lt;30 kW</td>
<td>20</td>
<td>0.535</td>
</tr>
<tr>
<td>Facade cladding &lt;100 kW</td>
<td>20</td>
<td>0.511</td>
</tr>
<tr>
<td>Facade cladding &gt;100 kW</td>
<td>20</td>
<td>0.506</td>
</tr>
</tbody>
</table>
Brief overview of FITs

- Differentiation by size

### German Biogas Tariffs, 2007

<table>
<thead>
<tr>
<th>Biogas</th>
<th>Years</th>
<th>/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;150 kW</td>
<td>20</td>
<td>0.110</td>
</tr>
<tr>
<td>&lt;500 kW</td>
<td>20</td>
<td>0.095</td>
</tr>
<tr>
<td>&lt;5 MW</td>
<td>20</td>
<td>0.085</td>
</tr>
<tr>
<td>&lt;20 MW</td>
<td>20</td>
<td>0.080</td>
</tr>
</tbody>
</table>
**Brief overview of FITs**

- Differentiation by location

<table>
<thead>
<tr>
<th>Solar Thermal</th>
<th>Years</th>
<th>/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5 MW Mainland</td>
<td>20</td>
<td>0.25</td>
</tr>
<tr>
<td>&lt;5 MW Islands</td>
<td>20</td>
<td>0.27</td>
</tr>
<tr>
<td>&gt;5 MW Mainland</td>
<td>20</td>
<td>0.23</td>
</tr>
<tr>
<td>&gt;5 MW Islands</td>
<td>20</td>
<td>0.25</td>
</tr>
</tbody>
</table>
Brief overview of FITs

- Differentiation by target or quota

- **Hydro**: 5 MW on small rivers
- **Wind**: 135 MW (currently installed 27 MW)
- **Biomass for electricity**: 72 MW biomass & biogas CHP
Brief overview of FITs

- Differentiation by resource:

<table>
<thead>
<tr>
<th>Wind Energy</th>
<th>Years</th>
<th>Hours</th>
<th>Factor</th>
<th>Tariff /kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore</td>
<td>1-10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small-scale</td>
<td>11-15</td>
<td>2,400</td>
<td>0.27</td>
<td>0.082</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,500</td>
<td>0.29</td>
<td>0.079</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,600</td>
<td>0.30</td>
<td>0.075</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,700</td>
<td>0.31</td>
<td>0.072</td>
</tr>
<tr>
<td>Medium</td>
<td>11-15</td>
<td>2,800</td>
<td>0.32</td>
<td>0.068</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,900</td>
<td>0.33</td>
<td>0.063</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,000</td>
<td>0.34</td>
<td>0.058</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,100</td>
<td>0.35</td>
<td>0.053</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,200</td>
<td>0.37</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,300</td>
<td>0.38</td>
<td>0.043</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,400</td>
<td>0.39</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,500</td>
<td>0.40</td>
<td>0.033</td>
</tr>
<tr>
<td>High</td>
<td>11-15</td>
<td>3,600</td>
<td>0.41</td>
<td>0.028</td>
</tr>
</tbody>
</table>
Brief overview of FITs

- Differentiation by degression (Germany, again):

<table>
<thead>
<tr>
<th>Technology</th>
<th>Level of degression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydroelectric power</td>
<td>---</td>
</tr>
<tr>
<td>Wind energy</td>
<td>1.5 %</td>
</tr>
<tr>
<td>Photovoltaics</td>
<td>5 %</td>
</tr>
<tr>
<td>Geothermal power</td>
<td>---</td>
</tr>
<tr>
<td>Landfill/sewage plant/mine gases</td>
<td>---</td>
</tr>
<tr>
<td>Biomass</td>
<td>1 %</td>
</tr>
</tbody>
</table>
Exploring the impacts of FITs in Germany

<table>
<thead>
<tr>
<th>Renewable energy proportion of total electricity consumption</th>
<th>Primary energy consumption in Germany (share of renewable energies)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990: 3.4%</td>
<td>2000: 14.401 Pj (renewable energy 2.6%)</td>
</tr>
<tr>
<td>2000: 6.3%</td>
<td>2005: 14.286 Pj (renewable energy 4.7%)</td>
</tr>
<tr>
<td>2004: 9.3%</td>
<td>2006: 14.465 Pj (renewable energy 5.8%)</td>
</tr>
<tr>
<td>2006: 12.0%</td>
<td>2010: (estimate) 13.492 Pj (renewable energy 8.4%)</td>
</tr>
</tbody>
</table>

*Source: AGEE-Stat/BMU*

<table>
<thead>
<tr>
<th>Composition of renewable electricity production for 2006</th>
<th>Wind power: 41.3%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hydroelectric power: 29.3%</td>
</tr>
<tr>
<td></td>
<td>Biomass: 19.2%</td>
</tr>
<tr>
<td></td>
<td>Photovoltaics: 2.7%</td>
</tr>
<tr>
<td></td>
<td>Landfill gas, sewage plant gas, biogenic waste: 7.5%</td>
</tr>
</tbody>
</table>
Exploring the impacts of FITs in Germany

Development of the German PV market

**Market data grid-connected systems 2007**
- Newly installed capacity: 1,100 MWp
- Total installed capacity: 3,834 MWp
- No. of newly installed systems: 130,000
- Total no. of systems installed: 430,000
- Turnover 2007: €5 B / $7.25 B
- Employees: 40,000

**Milestones**
- 1991: First Feed-in Law
- 2000: Renewable Energy Sources Act (EEG)
- 2004: Amendment of EEG
Wind energy in Germany: Installed capacity

Source: Rainer Hinrichs—Rahlwes/German Renewable Energy Federation
Exploring the impacts of FITs in Germany

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>2007: Jobs</th>
<th>2006: Jobs</th>
<th>2004: Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind power</td>
<td>84,300</td>
<td>82,100</td>
<td>63,900</td>
</tr>
<tr>
<td>Biomass</td>
<td>96,100</td>
<td>95,400</td>
<td>56,800</td>
</tr>
<tr>
<td>Solar energy</td>
<td>50,700</td>
<td>40,200</td>
<td>25,100</td>
</tr>
<tr>
<td>Hydropower</td>
<td>9,400</td>
<td>9,400</td>
<td>9,500</td>
</tr>
<tr>
<td>Geothermal energy</td>
<td>4,500</td>
<td>4,200</td>
<td>1,800</td>
</tr>
<tr>
<td>Public/Non-profit</td>
<td>4,300</td>
<td>4,300</td>
<td>3,400</td>
</tr>
</tbody>
</table>

*estimations

- 2007: around 249,300 jobs*
- 2006: around 235,600 jobs*
- 2004: around 160,500 jobs
Exploring the impacts of FITs in Germany

Lifecycle Greenhouse Gas Emissions for Conventional and Renewable Power Plants (equivalent grams of CO$_2$/kWh)

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Emissions (grams of CO$_2$/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>1,005</td>
</tr>
<tr>
<td>Heavy Oil</td>
<td>778</td>
</tr>
<tr>
<td>Diesel</td>
<td>778</td>
</tr>
<tr>
<td>Hydrogen Fuel Cell</td>
<td>664</td>
</tr>
<tr>
<td>LNG</td>
<td>611</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>443</td>
</tr>
<tr>
<td>Nuclear</td>
<td>66</td>
</tr>
<tr>
<td>Geothermal</td>
<td>38</td>
</tr>
<tr>
<td>Solar PV</td>
<td>32</td>
</tr>
<tr>
<td>Biomass</td>
<td>27.5</td>
</tr>
<tr>
<td>Solar Thermal</td>
<td>13</td>
</tr>
<tr>
<td>Biogas</td>
<td>11</td>
</tr>
<tr>
<td>Hydroelectric</td>
<td>10.5</td>
</tr>
<tr>
<td>Wind</td>
<td>9.5</td>
</tr>
</tbody>
</table>
Exploring the impacts of FITs in Germany

Total CO₂ avoidance through the use of renewable energy sources

<table>
<thead>
<tr>
<th>Year</th>
<th>CO₂ avoidance million t</th>
<th>Source: BMU according to Working Group on Renewable Energies / Statistics (AGEE-Stat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>114</td>
<td></td>
</tr>
</tbody>
</table>

Energy-related CO₂ emissions in million t/a

CO₂ emissions avoided on account of renewable energies in million t/a

Version: March 2008; all figures provisional
Exploring the impacts of FITs in Spain

Three Spanish companies in the top 10

Iberdrola is the 1st company worldwide in wind capacity

Source for all slides from Iberdola: Carlos Gasco
Employment Creation in the Renewable Energy Sector

1,027 companies working in the renewable energy sector suppose an important employment growth driver

Renewable energy’s contribution to employment in Spain:

- Direct employment: 89,001 jobs
- Indirect Employment: 99,681 jobs
- Total Employment: 188,682 jobs

The employment quality in the renewable energy sector is significantly better than in Spain as a whole

Employment In the Renewable Energy Sector

- Indefinite Contracts: 18%
- Temporary Contracts: 81%

Employment In Spain

- Indefinite Contracts: 31%
- Temporary Contracts: 69%
Employment Creation in the Renewable Energy Sector

Concerning renewables, wind energy creates 37% of the jobs

<table>
<thead>
<tr>
<th>Renewable Technology</th>
<th>Number of workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>32,906</td>
</tr>
<tr>
<td>Mini Hydro</td>
<td>6,661</td>
</tr>
<tr>
<td>Thermal Solar</td>
<td>8,174</td>
</tr>
<tr>
<td>Solar Thermoelectric</td>
<td>968</td>
</tr>
<tr>
<td>Solar Photovoltaic</td>
<td>26,449</td>
</tr>
<tr>
<td>Biomass</td>
<td>4,948</td>
</tr>
<tr>
<td>Others</td>
<td>8,895</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>89,001</strong></td>
</tr>
</tbody>
</table>

50% of the workers in the renewable energy sector have university degrees

Source: CCOO review on renewable energy
Iberdrola Renewable

Worldwide leader in wind energy ...

7,704 MW of installed capacity + 42,053 MW of pipeline*

... with a huge pipeline that provides for future growth

* Includes mini-hydro & other renewable energy technologies
Exploring the impacts of FITs in Canada
FIT provides 11 cents per kWh for mini-hyro, biomass, and wind; 42 cents per kWh for solar, all 20-year contracts (had ~17 MW of solar in 2005)

- Wind = ~655 MW
- PV = ~316 MW
- Hydro = ~66 MW
- Bio-energy = ~67 MW
(as of February 2008)
Assessing the cost-effectiveness of FITs

- A note on electricity prices: they are incredibly skewed in favor of conventional sources, excluding subsidies

<table>
<thead>
<tr>
<th></th>
<th>Coal</th>
<th>Oil</th>
<th>Gas</th>
<th>Nuclear</th>
<th>Hydro</th>
<th>Wind</th>
<th>Solar</th>
<th>Biomass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>0.06</td>
<td>0.03</td>
<td>0.003</td>
<td>0.0003</td>
<td>0.02</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max</td>
<td>72.42</td>
<td>39.93</td>
<td>13.22</td>
<td>64.45</td>
<td>26.26</td>
<td>0.80</td>
<td>1.69</td>
<td>22.09</td>
</tr>
<tr>
<td>Mean</td>
<td>14.87</td>
<td>13.57</td>
<td>5.02</td>
<td>8.63</td>
<td>3.84</td>
<td>0.29</td>
<td>0.69</td>
<td>5.20</td>
</tr>
<tr>
<td>SD</td>
<td>16.89</td>
<td>12.51</td>
<td>4.73</td>
<td>18.62</td>
<td>8.40</td>
<td>0.20</td>
<td>0.57</td>
<td>6.11</td>
</tr>
<tr>
<td>N</td>
<td>29</td>
<td>15</td>
<td>24</td>
<td>16</td>
<td>11</td>
<td>14</td>
<td>7</td>
<td>16</td>
</tr>
</tbody>
</table>
## True $ of Power (Marginal LCOE + Social Cost)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Marginal Cost (U.S. ¢/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Efficiency and DSM</td>
<td>2.5</td>
</tr>
<tr>
<td>Offshore Wind</td>
<td>3.0</td>
</tr>
<tr>
<td>Onshore Wind</td>
<td>6.0</td>
</tr>
<tr>
<td>Geothermal</td>
<td>7.1</td>
</tr>
<tr>
<td>Hydroelectric</td>
<td>7.8</td>
</tr>
<tr>
<td>Biomass (Landfill Gas)</td>
<td>10.8</td>
</tr>
<tr>
<td>Parabolic Troughs (Solar Thermal)</td>
<td>11.4</td>
</tr>
<tr>
<td>Biomass (Combustion)</td>
<td>13.6</td>
</tr>
<tr>
<td>Advanced Nuclear</td>
<td>16.0</td>
</tr>
<tr>
<td>Solar Ponds (Solar Thermal)</td>
<td>19.7</td>
</tr>
<tr>
<td>Advanced Gas and Oil Combined Cycle</td>
<td>20.2</td>
</tr>
<tr>
<td>Gas Oil Combined Cycle</td>
<td>20.5</td>
</tr>
<tr>
<td>Advanced Gas and Oil CC w/ CCS</td>
<td>24.8</td>
</tr>
<tr>
<td>Integrated Gasification Combined Cycle</td>
<td>25.9</td>
</tr>
<tr>
<td>Scrubbed Coal</td>
<td>26.3</td>
</tr>
<tr>
<td>IGCC with Carbon Capture</td>
<td>27.9</td>
</tr>
<tr>
<td>Advanced Combustion Turbine</td>
<td>39.0</td>
</tr>
<tr>
<td>Solar Photovoltaic (panel)</td>
<td>39.9</td>
</tr>
<tr>
<td>Combustion Turbine</td>
<td>42.1</td>
</tr>
</tbody>
</table>
### Costs in Germany:

#### Cost effects of EEG-promoted electricity generation (estimated / 2006)

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Cost (billion euros)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEG differential costs</td>
<td>3.2</td>
</tr>
<tr>
<td>Additional costs, regulation energy</td>
<td>0.1</td>
</tr>
<tr>
<td>Transaction costs</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3.3 billion euros</strong></td>
</tr>
</tbody>
</table>

#### Benefit effects of EEG-promoted electricity generation (estimated / 2006)

<table>
<thead>
<tr>
<th>Benefit Category</th>
<th>Benefit (billion euros)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in the wholesale price</td>
<td>5.0</td>
</tr>
<tr>
<td>Price reduction through merit-order effect, i.e. EEG electricity crowding out electricity produced from fossil fuels</td>
<td>3.4</td>
</tr>
<tr>
<td>Avoided external costs for electricity generation</td>
<td></td>
</tr>
<tr>
<td>External costs from climate change and air pollutants</td>
<td></td>
</tr>
<tr>
<td>Avoided energy imports</td>
<td></td>
</tr>
<tr>
<td>Savings in hard coal and gas imports for electricity generation, including large-scale hydroelectric power plants.</td>
<td><strong>= 9.4 billion euros</strong></td>
</tr>
</tbody>
</table>
Costs in Spain:

Wind energy costs:
- 1MWh of wind costs = premium + incentive = 38 €/MWh
- Wind production in 2007 = 26.7 TWh
- Total cost of wind energy to the system = 26.7 TWh x 38 € MWh = 1,014 M€

Avoided costs provided by wind energy in the market option:
- Without wind, market price would have increased an average of 6 €/MWh
- Costs avoided by wind energy = total demand x 6€/MWh = 276 TWh x 6 €/MWh = 1,656 M€

Wind costs 1,014 M€  Avoided costs 1,656 M€  SAVINGS 641 M€
Wind production’s impact on the pool’s price

Example March 17th-22nd 2008: A wind generation increase, causes a reduction of the pool’s price of some 15€/MWh.
20,000 MW of wind by 2010 will avoid the deterioration of some 2.300 MM € per year of the Spanish Current Account Balance

Substitution of 45 TWh installed of wind energy

Associated Variable Costs

- Emissions purchase: 482 MM €
- Fuel transport to the Asset: 132 MM €
- Fuel variable cost: 1.670 MM €

...replacing the wind production with the imported fossil fuels...
Assessing the cost-effectiveness of FITs

- Technological learning

Reduction in Cost of Renewable Energy Technologies (Levelized cents/kWh at $2000)
Assessing the cost-effectiveness of FITs

Capacity Factor and Nuclear Generation, 1973 to 2001
Assessing the cost-effectiveness of FITs

Capacity Factors and Installed Capacity for Wind Generators in the United States
Assessing the cost-effectiveness of FITs

Capacity Factors and Installed Capacity for Solar Generators in the United States
Components of a well-designed FIT

Support mechanisms must be:

1. predictable and consistent
   1. provide certainty in the market
   2. draw investors
   3. provide lead-time to prepare for change

2. appropriate
   1. policies must match objectives
   2. should not be too high or too low

3. flexible
   1. small adjustments can be made on a regular, predetermined time schedule
   2. built in flexibility towards meeting mandates

4. Credible/enforceable

5. Clear, simple, and transparent

Components of a well-designed FIT

All effective FITs must have 2 components:
- Access to the grid and interconnection;
- Price for electricity must contribute to profitability or prospect of profitability

Prerequisites for RE policy must include
- Political desire and commitment
- Willingness to pay for renewable energy
- Stable public policy to guarantee returns on investment

Possible benefits of a FIT for New Zealand electricity consumers

- Lower capital cost as economies of scale and learning is established
- Additional revenue from investments and becoming a quasi-utility
  - Normal 7% return on investment at average rates
  - Clearing prices determined every half hour at each NZ T&D node (remember the prison!)
    - Possible export of unbundled renewable energy credits
- Improved energy security and efficiency
- More stable electricity rates and cheaper rates when grid parity is reached (electricity rates have increased 70% from 1990 to 2002)
- Cleaner air, climate, and water
Possible benefits of a FIT for New Zealand electric utilities (in addition to lower capital costs, more stable rates, and happier customers)

- Direct revenue stream (geothermal, hydroelectric upgrades and small-scale hydro, large-scale wind and solar, distributed solar PV)
- Indirect revenue stream from renewable energy credits
- Displaced fuel costs
  - More than one-third of New Zealand electricity in 2008 came from natural gas (26%), coal (7%) and diesel (2%)
  - Decreased global volatility
  - Decreased import dependence (diesel/oil)
- T&D displacement / less grid congestion
  - Electricity demand increased 2.4% annually from 1974 to 2007, imbalance between North Island and South Island
  - Ancillary services from distributed solar PV
  - Better lead times / debt to equity ratios
- Insulation from possible carbon tax / post-Kyoto agreement
Possible benefits of a FIT for New Zealand regulators (in addition to happier customers and cleaner utilities)

- Jobs, infrastructure investments, and economies of scale (all major FIT countries now export renewable technologies)
- Less greenhouse gas emissions
- Improved energy security and diversification
  - By fuel type (hydroelectric!)
  - By location (spatial distribution and intermittency)
  - Terrorism and accidents
- Enhanced competitiveness / improved trade balance
- Improved visibility and leadership (meet and surpass the 90% by 2025 target)
The importance of comprehensive policy

- Rigorous government policy is needed to overcome the market barriers to renewable power technologies

<table>
<thead>
<tr>
<th>Country</th>
<th>Feed-in tariff</th>
<th>Renewable portfolio standard</th>
<th>Capital subsidies, grants, or rebates</th>
<th>Investment or other tax credits</th>
<th>Sales tax, energy tax, or VAT</th>
<th>Tradable renewable energy certificates</th>
<th>Energy production payments or tax credits</th>
<th>Net metering</th>
<th>Public investment, loans, or financing</th>
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Public policy mechanisms
- **Policy architecture must respond to impediments as a whole**

<table>
<thead>
<tr>
<th>Impediment</th>
<th>Policy</th>
<th>Details</th>
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<tbody>
<tr>
<td>Utilities and businesses will not invest in clean power</td>
<td>Make clean power mandatory</td>
<td>Create a national feed-in tariff (FIT) and guarantee clean power access to the grid</td>
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<td>Political support for clean power has been inconsistent and unfair</td>
<td>Eliminate subsidies</td>
<td>Immediately repeal federal government subsidies for nuclear and fossil fuel technologies</td>
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<td>Consumers do not receive accurate price signals for electricity</td>
<td>Get the price right</td>
<td>Abolish electricity rate caps, eliminate declining block rate pricing, reflect time of use in electricity rates, and internalize external costs</td>
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<td>Property owners and environmentalists are uninformed about clean power technologies</td>
<td>Inform the public and protect the poor</td>
<td>Establish a national systems benefit charge (SBC) to generate revenue to distribute information and educate the public, provide low-income assistance and weatherization, and promote energy efficiency and DSM programs</td>
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</table>
Consider California:

- Accurate price signals
  - Time of use rates
  - Unbundled electricity bills
  - Transparency
- Uniform rules
- Stable and committed government support
- Consistent definitions of eligible resources
- Tax credits
- Renewable Portfolio Standard
- Considering FIT

California Renewable Energy Capacity by Source, 2003
Thank you!

For great holiday gifts:

- The Dirty Energy Dilemma
- Energy and American Society – Thirteen Myths
- The Dirty Energy Dilemma