Disclaimer: The views expressed are those of Paul Gipe and are not necessarily those of the sponsor.

Disclosure: Paul Gipe has worked with Aerovironment, ANZSES, An Environmental Trust, APROMA, ASES, AusWEA, AWEA, David Blittersdorf, Jan & David Blittersdorf Foundation, BWEA, BWE, CanWEA, Canadian Co-operative Assoc., CAW, CEERT, Deutsche Bank, DGW, DSF, EECA, ES&T, GEO, GPI Atlantic, IREQ, KWEA, MADE, Microsoft, ManSEA, MSU, NRCan, NRG Systems, NASA, NREL, NZWEA, ORWWG, OSEA, Pembina, PG&E, SeaWest, SEI, TREC, USDOE, WAWWG, WE Energies, the Folkecenter, the Izaak Walton League, the Minnesota Project, the Sierra Club, World Future Council, and Zond Systems, and written for magazines in the USA, Canada, France, Denmark, and Germany.
Feed-in Tariffs & Massachusetts Offshore Feed-in Tariff (MORFIT)

By Paul Gipe
World Wind Generating Capacity

More than 1/2 From Feed-in Tariffs

Paul Gipe, wind-works.org
2012 World Wind Capacity

63,000 MW  110,000 MW  101,000 MW
World Wind Capacity 2012
~275,000 MW

Europe 39%
North America 23%
Asia 36%
Africa 0%
South America 2%
Renewable Tariffs
The Philosophical Context

Paul Gipe, wind-works.org
Geothermal: Colline Metallifere, Italy
What are Our Goals?

- **Primary**
  High Penetration of Renewables Quickly

- **Secondary**
  Equitably Distributed Ownership
  Rural Development
  Distributed Generation
  New Industry & Jobs
Do We Really Want Renewables?
If Yes, Then What Works Best?

San Gorgonio Pass, California

Paul Gipe, wind-works.org
Market Mechanism Status

• Quotas (RPS & Tendering)
  Timid Targets Seldom Met

• Renewable Tariffs
  Meeting Aggressive Targets

Paul Gipe, wind-works.org
Haverigg, Cumbria, Britain
Feed-in Tariffs Deliver Results

- >50% of Wind Worldwide
- >72% of Solar PV Worldwide (IEA 2012)
- >90% of Farm Biogas Worldwide

Ydby, Denmark
Paul Gipe, wind-works.org
Myths to Dispel

- Renewables Are Free or Cheap
  But They Are Affordable & They Are Worth It
- Renewables Can’t Be Added Quickly
  or Can’t Make a Difference
- Feed-in Tariffs Not Market-Based
- Feed-in Tariffs Are Costly

Paul Gipe, wind-works.org

Husum, Germany
Renewable Tariff Design
Price Regulation

• Most Efficient
• Least Costly
• Simpler
• Is Compatible with Market Economies

From Bernard Chabot, ADEME

Paul Gipe, wind-works.org
### Political Price-Political Quantity

<table>
<thead>
<tr>
<th>Feed Law</th>
<th>Price</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quota/RPS/Tendering</td>
<td>Political</td>
<td>Market</td>
</tr>
</tbody>
</table>

Both Are Market Mechanisms

Paul Gipe, wind-works.org
### IEA: Quota & Feed-in Tariff Cost of European Wind (2005)

<table>
<thead>
<tr>
<th></th>
<th>USD/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quotas &amp; TGC</td>
<td>0.13-0.17</td>
</tr>
<tr>
<td>Feed-in Tariffs</td>
<td>0.09-0.011</td>
</tr>
</tbody>
</table>

FITs: $0.04-$0.06/kWh less costly.

Paul Gipe, wind-works.org
FIT Markets Least Costly Policy

Current level of support and costs per Member State

Wind in EU: RPS More Costly Than Needed
Paul Gipe, wind-works.org
Elements of Success in Germany

- Right of Interconnection
- Right to Sell Electricity
- Right Price for Fixed Period

Advanced Renewable Tariffs (FITs) Launched
Advanced Renewable Tariffs

• What Are They?
  Payment for Generation (Feed-in Tariffs)
  Political Price, Not Political Quota

• How Do They Work?
  Price Differentiation
  Paying for Solar, Paying for Wind

• Where?
  Germany, France,
  ... 70+ countries

Paul Gipe, wind-works.org
Renewable Tariff Design

• Simple, Comprehensible, & Transparent
• Priority Access & Purchase
• Lengths Sufficient for Profitability
• Prices Sufficient to Pay for Generation

Fair But Not Undue Profit
Through Price Differentiation

Paul Gipe, wind-works.org

Altamont Pass, California
FIT Fixed Price Model

Fig. 1. Fixed price model for FIT policy design.

Paul Gipe, wind-works.org

Toby Couture, Energy Policy
FIT Fixed Price with Inflation Adjustment

Fig. 2. Fixed price model with full or partial inflation adjustment.

Paul Gipe, wind-works.org
Toby Couture, Energy Policy
FIT Fixed Price
Different Time Periods

Fig. 3. Front-end loaded tariff model.

Paul Gipe, wind-works.org
Toby Couture, Energy Policy
FIT Fixed Price

Variable Premium Model

If the spot market price is high enough, the FIT premium goes to zero. In this case, the producer typically receives the spot market price.

Figure 14. Spot market gap model
French Wind Tariffs
Resource Productivity Method

- Fair Profits at Medium Wind Sites
- Not “Undue” Profits at Windy Sites
- Profitability Index Method (Chabot)

Not Discounted Cash Flow Model

Paul Gipe, wind-works.org
Igny, Lorraine, France
## Renewable Tariffs Contract Length

<table>
<thead>
<tr>
<th>Country</th>
<th>Wind</th>
<th>Solar</th>
<th>Hydro</th>
<th>Biomass</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>15</td>
<td>20</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Germany</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Ontario</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Portugal</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Spain (2007)*</td>
<td>&gt;15</td>
<td>&gt;25</td>
<td>&gt;25</td>
<td>&gt;20</td>
</tr>
</tbody>
</table>

**Longer Contracts Reduce Initial Price.**

Paul Gipe, wind-works.org
## Renewable Tariffs Inflation Adjustment

<table>
<thead>
<tr>
<th>Country</th>
<th>Inflation Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>0%</td>
</tr>
<tr>
<td>Ontario RFP</td>
<td>15%</td>
</tr>
<tr>
<td>Ontario SOC</td>
<td>20%</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>26%</td>
</tr>
<tr>
<td>France</td>
<td>60%</td>
</tr>
<tr>
<td>Spain</td>
<td>50-75</td>
</tr>
<tr>
<td>Greece</td>
<td>100%</td>
</tr>
<tr>
<td>Ireland</td>
<td>100%</td>
</tr>
</tbody>
</table>

Higher Inflation Adjustment Reduces Initial Price.

Paul Gipe, wind-works.org
German Wind Tariffs
Reference Yield Method

Paul Gipe, wind-works.org
French Wind Tariffs Post 2006

Paul Gipe, wind-works.org
Tiered Tariffs: V80 Example

- V80 Sweeps ~5,000 m²
- 7 m/s site (~1,000 kWh/m²/y)
- Generation: ~5 x10⁶ kWh/y
- 5 Years
- Delete High & Low Years
- Average 3 Remaining Years
- 15 x10⁶ kWh/3 = 5 x10⁶ kWh
- 5 x10⁶ kWh/ 5,000 m² = 1,000 kWh/m²
- Use Yield to Find Tariff T2
FIT Prices Paid for Offshore Wind Energy

Paul Gipe, wind-works.org

Middelgrunden, Denmark

Germany
France
Ontario
Ireland

$USD/kWh

0 0.05 0.1 0.15 0.2 0.25
French Wind Tariffs by Specific Yield

Paul Gipe, wind-works.org

Chateau de Lastours, France
French Offshore Wind Tariffs by Capacity Factor

Paul Gipe, wind-works.org
Zeebrugge, Belgium
German Ownership of Wind in 2010: 27,000 MW

- Individuals: 52%
- Farmers: 21%
- Developers: 7%
- Utilities: 16%
- Investment Funds: 2%
- Industrial: 2%

14,500 MW ~$30 Billion!

www.unendlich-viel-energie.de
Paul Gipe, wind-works.org
Near Shore-Onshore
Hvide Sande Vindmølleaug

- 3 X 3 MW Vestas V112 on Shoreline
- 80% Holmsland Klit Tourist Board
- 20% Owned by 400 Area Residents
- Land Lease: € 644,000 to the Harbour
- Payback: 7-10 years
- Return on Investment: 9%-11%/year

Paul Gipe, wind-works.org
Hvide Sande, Denmark
Thyborøn-Harboøre Vindmøllelaug

- Near Offshore
- Share Cooperative
- 4 x 2 MW
- 35 Million kWh/yr
- All Information Public
Lynetten Co-op København

- 7 x 600 kW
- 4 Owned by Co-op
- 3 Owned by Municipal Utility
. . . Lynetten Wind Co-op

Paul Gipe, wind-works.org
Lynetten Co-op København

Map © Google.com

Paul Gipe, wind-works.org
Middelgrunden Co-op København

- 20 x 2 MW Off-shore
- 1/2 Owned by Co-op, 1/2 Owned by Municipal Utility
- Visible from Christiansborg Palace
- 8,500 Investors
- €570 per Share

Paul Gipe, wind-works.org  Wikipedia Commons
Middelgrunden Co-op København

Map © Google.com
Renewable Policy--Best Practice

• Bold Targets
  That Can Excite the Imagination

• Advanced Renewable Tariffs
  . . . A System of Feed-in Tariffs

Landau, Rheinland-Pfalz, Germany
Feed-in Tariff Best Practice

- Policies Must be Comprehensive and Inclusive . . . Open to All for All
Feed-in Tariff Best Practice

• Open to All for All
  Homeowners, Farmers, Business & Industry, Communities, Indigenous
  Regardless of Income
  Tariffs with & without Tax Credits

Paul Gipe, wind-works.org
Solar Park Rodenäs
MORFIT Next Steps

• Test Political Appetite
  Limit Program Size?
  Pilot Projects?
  Limit Program to Local Ownership?

• FIT Design Study & Workshop
  Funding?

• Legislation or Executive Order
Offshore Wind FIT Consultants

• Jérôme Guillet, PhD (Economics), Green Giraffe Energy Bankers, Paris: Offshore Wind Finance
• Toby Couture, MSc (Financial & Commercial Regulation), E3 Analytics, Berlin: FIT Design
• Bernard Chabot, PE, BCConsult, France: Differentiated Wind FIT Design
• Wilson Rickerson, MSc (Energy and Environmental Policy), Boston: FIT Design

Paul Gipe, wind-works.org
Offshore Coop Wind Project Contact

• Middelgrundens Vindmøllelaug: http://www.middelgrunden.dk/middelgrunden/?q=en
• Jens H. Mollgaard Larsen, jenshmlarsen@gmail.dk
“Nothing is as powerful as an idea whose time has come.”
-- Victor Hugo*

*“Il n'est rien au monde d'aussi puissant qu'une idée dont l'heure est venue.” Victor Hugo*