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

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Paul Gipe, wind-works.org
Fundamentals of Wind Energy & Community Ownership
by
Paul Gipe
Electricity Rebellion--the Rallying Cry

Renewable Energy “is a local resource. It is our resource. And we want to make money from it.”--Wolfgang Paulsen (Stromrebelle)
Rebel Agenda

• We Want Renewable Energy
• We Can Do It Ourselves
• We Bring Our Own Risk Capital and Invest in Our Own Region
• We Accept the Change in the Landscape that Results

Hans-Detlef Feddersen on the Bürgerwind Movement.
Renewable Energy Has Come of Age

Noordoostpolder, The Netherlands
Paul Gipe, wind-works.org
Montefalcone, Italy
Galicia, Spain

Paul Gipe, wind-works.org
Freiburg -- Germany’s Solar City

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

More than 1/2 From Feed-in Tariffs

Paul Gipe, wind-works.org
World Wind Capacity 2012
~275,000 MW

North America 23%
Africa 0%
Asia 36%
South America 2%
Europe 39%
Worldwide Wind Energy
US$125+ Billion in 2012

- Project Development: 54%
- Electricity Sales: 42%
- O&M: 4%

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

63,000 MW

110,000 MW

101,000 MW

Paul Gipe, wind-works.org
World Solar PV Capacity 2012
~100,000 MW

2/3 in Europe
3/4 from Feed-in Tariffs

Paul Gipe, wind-works.org
Worldwide Solar PV Market
US$100+ Billion in 2012

Electricity Sales 11%

Development 89%

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Why Wind?

• Reduces Use of Fossil & Nuclear Fuels
• Most Cost-Effective of New Renewables
• Relatively Benign

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Why Now?

• Wind Works
   Greater Reliability
• Productivity Improved
   More Efficient
   Taller Towers
• Costs Declined
   Economies-of-Scale

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Northern Ireland

40 m, 500 kW

80 m, 1.8 MW

Kincardine, Ontario

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We Know What Works . . . and What Doesn’t
Wind is Modular

- Quickly Installed
- When Needed
- As Needed
- Where Needed
- By Anyone

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Wind is Flexible

- Scale
  Large or Small Projects
- Location
  Near or Far
- Time
  Short Lead Times
- Ownership
  Local or Absentee

Paul Gipe, wind-works.org
Wind Energy’s Benefits

• Clean & Green (Mostly)
  No SO$_x$, NO$_x$, or CO$_2$

• Renewable
  Net Positive Energy Balance (4-6 months)

• Domestic: Not Subject to Embargo

• Does Not Consume Water

• Modular = Flexible

• . . . and Can Be Removed

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Wind Energy’s Impacts

• Aesthetics or Intrusiveness
• Erosion & Scarring from Roads
  Length, Width, Number and Slope
• Shadow Flicker & Disco Effect
• Climate?
• Noise--They are Audible
• Wildlife
  Habitat Disruption
  Bird & Bat Kills: Collisions, Electrocutions

Paul Gipe, wind-works.org
Renewables Can Scale Quickly

Paul Gipe, wind-works.org

Whitelee, Glasgow, Scotland
High Penetration Quickly is Possible

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent Wind</th>
<th>TWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>2.7%</td>
<td>8.0</td>
</tr>
<tr>
<td>Italy</td>
<td>4%</td>
<td>13.0</td>
</tr>
<tr>
<td>Germany</td>
<td>7.8%</td>
<td>45.0</td>
</tr>
<tr>
<td>Spain</td>
<td>18%</td>
<td>49.0</td>
</tr>
<tr>
<td>Portugal</td>
<td>19%</td>
<td>10.0</td>
</tr>
<tr>
<td>Denmark</td>
<td>30%</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Multiple Sources; 2012
Paul Gipe, wind-works.org
Cowley Ridge, Alberta
**High Penetration Quickly is Possible**

<table>
<thead>
<tr>
<th></th>
<th>Percent Solar</th>
<th>2012 TWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>4.4%</td>
<td>12.0</td>
</tr>
<tr>
<td>Germany</td>
<td>5%</td>
<td>29.0</td>
</tr>
<tr>
<td>Italy</td>
<td>5.6%</td>
<td>18.0</td>
</tr>
</tbody>
</table>
Renewables: Making a Difference Today

Paul Gipe, wind-works.org

Dardesheim, Germany
Germany Total & Non-Hydro Renewable Generation 1980-2011

Year

% of Supply

Total Renewables
Non-Hydro Renewables

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Denmark Total & Non-Hydro Renewable Generation 1980-2012

Paul Gipe, wind-works.org
Italy Total & Non-Hydro Renewable Generation 1980-2012

% of Supply

Year

Paul Gipe, wind-works.org
Revolutionary: 100% Renewable

- Dardesheim Today--Electricity
- Schleswig-Holstein 2020--Electricity
- Rheinland-Pfalz 2030--Electricity
- Scotland 2020--Electricity
- Denmark 2035--Electricity & Heat

50% Wind by 2020

Paul Gipe, wind-works.org

Druiberg, Sachsen-Anhalt, Germany
Why the European Success?

• #1 Community Involvement
  Germany & Denmark

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Building Acceptance

- Opportunity Must Be Shared
- Public Must Participate by Creating Equal Opportunity for All

Paul Gipe, wind-works.org

Husum, Germany
Increasing Acceptance: Rule #1

Your Own Pigs... Don’t Stink

Paul Gipe, wind-works.org

Biogas, Malstedt, Niedersacshsen, Germany
Community Ownership

- Greater Acceptance
- More Power More Quickly
- More Money Locally
- More Jobs Locally
- More Democratic

Jutland, Denmark
Paul Gipe, wind-works.org