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

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Electricity Rebellion--Democratizing Generation with Renewable Energy
by Paul Gipe
Renewable Energy Has Come of Age

Noordoostpolder, The Netherlands

Paul Gipe, wind-works.org
Montefalcone, Italy
Galicia, Spain
Jutland, Denmark

Paul Gipe, wind-works.org

Biogas Combined Heat & Power, Jutland, Denmark
Freiburg -- Germany’s Solar City
Where are We Now?
Where are We Going?

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

Megawatts (Thousands)

Europe
North America
Asia

Year

More than 1/2 From Feed-in Tariffs

Paul Gipe, wind-works.org
World Wind Industry

• Growth Rate: 20%-30%/yr

Paul Gipe, wind-works.org

Hvide Sande, Denmark
World Wind Capacity 2013
~300,000 MW

- Europe: 38%
- Asia: 38%
- North America: 22%
- Africa: 0%
- South America: 2%
2013 North American Wind Capacity

Paul Gipe, wind-works.org
2013 Asian Wind Capacity

Paul Gipe, wind-works.orgw
European Wind Capacity 2013

Paul Gipe, wind-works.org
Worldwide Wind Energy
US$125+ Billion in 2013

- Project Development: 45%
- Electricity Sales: 53%
- O&M: 2%

Paul Gipe, wind-works.org
Why Wind?

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

Paul Gipe, wind-works.org
Why Now?

• Wind Works  
  Greater Reliability

• Productivity Improved  
  More Efficient  
  Taller Towers

• Costs Declined  
  Economies-of-Scale

Paul Gipe, wind-works.org
We Know What Works
...and What Doesn't

Eole, Cap Chat

© Vortec

Paul Gipe, wind-works.org
Size Today

- 3 MW
- ~10,000 m²
- 10,000,000 kWh/yr
Wind is Modular

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

Paul Gipe, wind-works.org

Tehachapi, California
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\textsubscript{x}, NO\textsubscript{x}, or CO\textsubscript{2}
- Renewable
  Net Positive Energy Balance (4-6 months)
- Domestic: Not Subject to Embargo
- Does Not Consume Water
- Modular = Flexible
- ... and Can Be Removed

Paul Gipe, wind-works.org
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
Solar PV Growing Rapidly

• 2013: 140,000 MW Worldwide
• 40,000+ MW/yr
• Major Markets
  China—12,000 MW/yr
  Japan—4,000 MW/yr
  USA—4,000 MW/yr
  Germany—3,500+ MW/yr
  Italy—900 MW/yr
World Solar PV Capacity 2013
~140,000 MW

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

Paul Gipe, wind-works.org
Leading World Solar PV Markets
Total Installed 2013

Germany: 35 thousand MW
China: 23 thousand MW
Italy: 18 thousand MW
Japan: 11 thousand MW
USA: 11 thousand MW
Spain: 5 thousand MW

Paul Gipe, wind-works.org
Solar PV in Germany

• Total 35,000 MW
• ~30 TWh/yr of Generation
• ~5% Supply in 2013
• 2020: 50-70,000 MW
  10%-12% of Supply

USA: Total of 11,000 MW in 2013.
Paul Gipe, wind-works.org
Worldwide Solar PV Market
US$200+ Billion in 2013

Electricity Sales 7%

Development 93%

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>Country</th>
<th>Percent Solar</th>
<th>2013 TWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>5%</td>
<td>13.0</td>
</tr>
<tr>
<td>Italy</td>
<td>7%</td>
<td>22.0</td>
</tr>
<tr>
<td>Germany</td>
<td>5%</td>
<td>30.0</td>
</tr>
</tbody>
</table>
## World Biomass Penetration

<table>
<thead>
<tr>
<th></th>
<th>% Consumption</th>
<th>TWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>8.6%</td>
<td>12.6</td>
</tr>
<tr>
<td>Germany</td>
<td>6.1%</td>
<td>37.0</td>
</tr>
<tr>
<td>Italy</td>
<td>3.3%</td>
<td>11.3</td>
</tr>
<tr>
<td>California</td>
<td>2.0%</td>
<td>5.7</td>
</tr>
</tbody>
</table>

Paul Gipe, wind-works.org  
Jutland, Denmark
## Geothermal Penetration Worldwide

<table>
<thead>
<tr>
<th>Country</th>
<th>% Consumption</th>
<th>TWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iceland</td>
<td>30.0%</td>
<td>4.6</td>
</tr>
<tr>
<td>Philippines</td>
<td>27.0%</td>
<td>10.3</td>
</tr>
<tr>
<td>El Salvador</td>
<td>14.0%</td>
<td>1.4</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>13.1%</td>
<td>1.3</td>
</tr>
<tr>
<td>New Zealand</td>
<td>10.0%</td>
<td>4.1</td>
</tr>
<tr>
<td>California</td>
<td>4.4%</td>
<td>12.7</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3.7%</td>
<td>9.6</td>
</tr>
<tr>
<td>Mexico</td>
<td>3.0%</td>
<td>7.0</td>
</tr>
<tr>
<td>Italy</td>
<td>1.6%</td>
<td>5.7</td>
</tr>
<tr>
<td>USA</td>
<td>0.3%</td>
<td>14.4</td>
</tr>
<tr>
<td>Japan</td>
<td>0.1%</td>
<td>3.1</td>
</tr>
</tbody>
</table>
Portugal Total & Non-Hydro Renewable Generation 1980-2012

- % of Supply
- Total Renewables
- Non-Hydro Renewables

Year

80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12

Paul Gipe, wind-works.org
Spain Total & Non-Hydro Renewable Generation 1980-2013

% of Supply

Year

Paul Gipe, wind-works.org
Why the European Success?

• #1 Community Involvement
  Germany & Denmark

Paul Gipe, wind-works.org
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
German Ownership of Renewables in 2010: 53,000 MW

~$100 Billion!

- Individuals: 40%
- Farmers: 11%
- Developers: 14%
- Utilities: 13%
- Investment Funds: 11%
- Others: 9%
- Industrial: 1%

www.unendlich-viel-energie.de
Paul Gipe, wind-works.org
German Homeowners . . .
. . . New Revenue

• Anyone with a Roof Can Do Solar in Germany
• And Make Money Doing It!

Paul Gipe, wind-works.org
German Farmers . . .

. . . New Cash Crops

- Wind
- Solar PV
- Biogas

Friedrich-Wilhelm-Lübke-Koog, Germany
The Farmers of Nordfriesland

- 0.5% of California
  2,000 km²; 165,000 Population
- 850 MW of Wind
  90% Community-Owned
  6,000 Investors (4% of Population)
  <1% of Land Area
- 1.3 TWh/yr
  More than Altamont, More than San Gorgonio
  ~Tehachapi Pass
  €100 million ($150 million)/yr

Paul Gipe, wind-works.org
Friedrich-Wilhelm-Lübke-Koog, Germany
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.

Paul Gipe, wind-works.org  Friedrich-Wilhelm-Lübke-Koog, Germany
Elements of Successful Electricity Rebels

• Transparency
• Cooperation & Compromise
• Creative Problem Solving
• “Together, We’re Strong”

Hans-Detlef Feddersen on the Bürgerwind Movement.

Paul Gipe, wind-works.org
Rockenhausen, Rheinland-Pfalz, Germany
Meet Germany’s Jeffersonian Rebels
Powering an Energy Revolution

- The Power of Community Ownership
  Local, Distributed, Democratic

Nico Petersen, Solar Park Rodenäs

Paul Gipe, wind-works.org
Meet Hans-Detlef Feddersen
Pioneer in the BürgerWind Movement

Paul Gipe, wind-works.org
Friedrich-Wilhelm-Lübke-Koog, Germany
Bürger Windpark Lübke-Koog

- 176 inhabitants
- 1,350 ha
- 49.5 MW Wind
- 95% of Households

Paul Gipe, wind-works.org
Friedrich-Wilhelm-Lübke-Koog, Germany
Bürger Windpark Lübke-Koog

- Wind
- Solar
- Biogas

Paul Gipe, wind-works.org
Friedrich-Wilhelm-Lübke-Koog, Germany
Meet the Rebel Mayor of Dardesheim
Bürgermeister Rolf-Dieter Künne

- Proud of Männerchor
- Proud of Brass Band
- Proud of Wind & Solar
  100% Renewable Energy

Paul Gipe, wind-works.org
Meet Adam Twine--Westmill Coop

- 6.5 MW Wind: 5 x 1.3 MW
- 3.6 MW Solar PV

Paul Gipe, wind-works.org

Vale of White Horse, Oxfordshire, England
Josef Pesch, Fesa

- 45 MW
- 60 million kWh/yr
- Just One of Many

Paul Gipe, wind-works.org
Ursula Sladek, EWS
(Elektritzitätswerke Schönau)

- 31,000 Customers
- Hydro, Solar, & Wind
Local People Helping Local People
Hans-Heinrich Andresen

- Manages 16 Wind Farms
- in 16 Villages
- All Locally Owned
  15 Owners in Smallest
  400 Owners in Largest
- Now Planning Their Own Transmission Line

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
Renewable Tariffs
The Philosophical Context

Paul Gipe, wind-works.org
Geothermal: Colline Metallifere, Italy
Do We Really Want Renewables?

San Gorgonio Pass, California

Paul Gipe, wind-works.org
If Yes, Then What Works Best?

• Who Gets Contracts
  Elite Few or All Who Want Them?

• How To Pay For Them
  RECs/ROCs/Green Tags
  Subsidies (PTC, ITC)
  Advanced Renewable Tariffs
  --Differentiated Feed-in Tariffs
Market Mechanism Status

- **Quotas (RPS & Tendering)**
  Timid Targets Seldom Met

- **Renewable Tariffs**
  Once Only Non-Anglophone Countries
  Now Ontario, Great Britain
  Meeting Aggressive Targets
What Has Made the Revolution Possible? What Has Empowered the Rebels?

- Grid Access
- Priority to Renewables
- Advanced Renewable Tariffs
- Desire to Make it Work!

Paul Gipe, wind-works.org

Jutland, Denmark
Renewable Policy--Best Practice

• **Bold Targets**
  That Can Excite the Imagination

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

Landau, Rheinland-Pfalz, Germany

Paul Gipe, wind-works.org
Feed-in Tariff Best Practice

- Policies Must be Comprehensive and Inclusive... Open to All for All
Comprehensive & Inclusive

• Wind & Solar
• Biomass & Geothermal
• Renewable Heat
Feed-in Tariffs Deliver Results

- >50% of Wind Worldwide
- >75% of Solar PV Worldwide
- >90% of Farm Biogas Worldwide
European Renewable Policy

- 23/27 States Use FITs
- Since 1997

  85% of all Wind from FITs
  ~100% of all Solar PV from FITs
  ~70% of all Biogas from FITs

- FITs Most Cost-Effective Policy
- FITs Principal Way to Meet Targets

Fraunhofer Institute: www.reshaping-res-policy.eu
Paul Gipe, wind-works.org  Wörstadt, Germany
Cumulative Feed-in Tariff Programs Worldwide

REN 21: Renewables 2102 Global Status Report
Paul Gipe, wind-works.org
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,
  ... 23 EU 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
Renewable Tariff Design
Price Differentiation

• For Different Technologies
• For Different Applications
• For Different Sizes
• For Different Resource Intensities

For Wind (Germany, France, & China!)
For Solar (Pakistan, Oregon)

Paul Gipe, wind-works.org
Challenges in North America

• Piecemeal Policy Approach
  Too Slow
  RPS for Wind, Subsidies for Solar

• “Cheap Energy Contract”
  Cheap Today--Expensive Tomorrow
  Burdens the Poor and All Americans

Paul Gipe, wind-works.org
Challenges in North America

• Low Program Caps
  California: 33%?
  LABC-Los Angeles: 3%
  Oregon: 25 MW! (Why Bother?)

• Solar Only or Wind Only

• Timidity & Lack of Vision
  Do We Want Renewables or Don’t We?
A Challenge Worthy of Great Nations

Paul Gipe, wind-works.org

Vestas V110, Denmark
North America is Capable of Huge National Undertakings

- TVA, BPA, WPA
- Ontario Hydro, Hydro Quebec
- Universal Health Care (Canada)
- Civil Rights, Anti-Smoking
Renewable Tariffs in North America . . . Unthinkable?

• Yes--At One Time
  “You’re Absolutely Nuts!”
  Andy Karsner, DOE, 2006

• Today? No
• Now Possible
• Proof They Work!

Paul Gipe, wind-works.org
“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
Time to Take the Road to the Future
Move From
A Culture of Consumption
to
A Culture of Conservation

--Former Ontario Premier Dalton McGuinty

Paul Gipe, wind-works.org

Montfort, Wisconsin
Move From
A Nation of Consumers
to
A Nation of Producers

Paul Gipe, wind-works.org
Lackawanna, New York
No Time for Half-Measures

No Time to Lose

Paul Gipe, wind-works.org
We Need A Lot More Wind . . .

Matane, Quebec

Paul Gipe, wind-works.org
. . . A Lot More Geothermal

Paul Gipe, wind-works.org

Geothermal: Colline Metallifere, Italy
A Lot More Solar

Paul Gipe, wind-works.org
A Lot More Renewable Energy Technology for Life*

*from N.F.S. Grundtvig, Danish Theologian

Paul Gipe, wind-works.org
Renewable Energy

The Revolution Has Begun!

www.wind-works.org

Manawatu Gorge, New Zealand