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

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Advanced Renewable Tariffs for an Energy Revolution by Paul Gipe
Renewable Energy Has Come of Age

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

Paul Gipe, wind-works.org
Jutland, Denmark

Paul Gipe, wind-works.org

Biogas Combined Heat & Power, Jutland, Denmark
Freiburg -- Germany’s Solar City
2009 World Wind Capacity

Megawatts (Thousands)

Europe
North America
Asia

More than 1/2 From Feed-in Tariffs

Paul Gipe, wind-works.org
2009 World Wind Capacity

38,000 MW

77,000 MW

42,000 MW
2009 Solar PV Capacity

- 20,000 MW Worldwide
- 7,000+ MW/yr
- $20+ Billion
- Major Markets
  - Germany--3,800 MW*
  - Italy--700 MW/yr*
  - Japan--500 MW
  - USA--450 MW/yr
  - California--200 MW/yr

*Feed-in Tariff Market

Paul Gipe, wind-works.org

Rancho Seco, California
World Solar PV Capacity 2009
~20,000 MW

More than 3/4 from Feed-in Tariffs

Paul Gipe, wind-works.org
Setting the Stage

... The Scale of the Problem

Paul Gipe, wind-works.org
North Americans Have Been Dabbling Around the Edges of Renewable Energy Policy

Little Recognition of the Crisis Facing the Continent

Paul Gipe, wind-works.org
Profound Issues Confront North America’s Energy Future

• Climate Change Only One Issue
• Transportation (Liquid) Fuels
  Very Little Public Transit
• Domestic Supplies Declining
Profound Issues Confront North America’s Energy Future

• Our Total Dependence on Oil as a Transportation Fuel Leads to Tragic Consequences--Only Some of Which Make the News.

Paul Gipe, wind-works.org
US Electricity Generation
~4,000 TWh/yr

- Nuclear: 801 TWh/yr
- Hydro: 289 TWh/yr
- Other: 81 TWh/yr
- Fossil-Fired: 2850 TWh/yr
Canadian Electricity Generation
~530 TWh/yr

- Fossil-Fired: 325 TWh/yr
- Nuclear: 75 TWh/yr
- New RE: 10 TWh/yr
- Hydro: 155 TWh/yr

Paul Gipe, wind-works.org
# Scale Needed: North America

<table>
<thead>
<tr>
<th>Thermal Generation</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>75,000</td>
</tr>
<tr>
<td>USA</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Total</td>
<td>1,600,000</td>
</tr>
</tbody>
</table>
Electric Vehicle Charging

Paul Gipe, wind-works.org
## Scale Needed: North America

<table>
<thead>
<tr>
<th>Passenger Vehicle Miles</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>50,000</td>
</tr>
<tr>
<td>USA</td>
<td>750,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>800,000</strong></td>
</tr>
</tbody>
</table>
Scale Needed: North America

- ~2,500,000 MW Wind
- ~120x Today!

Paul Gipe, wind-works.org
Ponnequin, Colorado
Can It Be Done in North America?

- 2,500,000 MW / 200,000 MW/yr
- ~12.5 yrs
- <20 years Heavy Truck Production
  Thermal Generation
  Passenger Vehicle Miles
- Yes, It Can Be Done
- But Not At Current Pace

Paul Gipe, wind-works.org
North American RE Market Growth

• Exciting, Yes
• Significant, Yes
• Not Nearly Enough by Any Standard
USA & Canada
100% Clean Energy?
Yes! It Can Be Done!
But Not With Current Policies

Paul Gipe, wind-works.org
Cowley Ridge, Alberta
Canadian Electricity Consumption with 325 TWh Hydro

100% Renewable

Export or Transport

50

50% Cut in Consumption

Consumption

275

Paul Gipe, wind-works.org
North America is Capable of Huge National Undertakings

- TVA, BPA, WPA
- Ontario Hydro, Hydro Quebec
- Universal Health Care (Canada)
- Civil Rights, Anti-Smoking

Paul Gipe, wind-works.org
Alberta Has the Best Wind & the Best Solar Resource in Canada

Cowley Ridge, Alberta

Paul Gipe, wind-works.org
Solar PV Yields

Germany
Nova Scotia
Ontario
France
Spain
Italy
Alberta
Colorado

Source: RetScreen
Paul Gipe, wind-works.org
North America
Better Than Germany?

- More Land
- More Wind
- More Hydro (Notably Canada)
  For Backup & For Storage
- Fewer People

Paul Gipe, wind-works.org
North America Better Than Germany?

• Biomass: Forests and Wood Wastes?
• Solar PV: Much Better than in Germany
• Geothermal: More Than We Thought
• North America Has it All
North America Needs Massive Reconstruction of its Infrastructure

Renewable Energy Development Can Reindustrialize the North American Economy

Paul Gipe, wind-works.org

Noordoostpolder, the Netherlands
And Create a Rural Revolution Through “Electricity Rebels”*

*Who own their own generation.

Paul Gipe, wind-works.org

Friedrich-Whilhelm-Lübke-Koog, Germany
A Challenge Worthy of Great Nations

Paul Gipe, wind-works.org

Vestas V110, Denmark
Renewable Tariffs

The Philosophical Context

Geothermal: Colline Metallifere, Italy

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

Paul Gipe, wind-works.org
Wieringemeerpolder, the Netherlands
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, Vermont
  Meeting Aggressive Targets

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

- >50% of Wind Worldwide
- >75% of Solar PV Worldwide
- >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
## Renewables Can Be Added Quickly

<table>
<thead>
<tr>
<th></th>
<th>Wind 5 yrs</th>
<th>Wind 10 yrs</th>
<th>Solar 5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>15 TWh/yr</td>
<td>35 TWh/yr</td>
<td>5 TWh/yr</td>
</tr>
<tr>
<td>Spain</td>
<td>15 TWh/yr</td>
<td>28 TWh/yr</td>
<td>5 TWh/yr</td>
</tr>
</tbody>
</table>

Germany Renewables: 10 Years--5% to 15%
Spain: 10 Years--0% to 10%
Alberta: ~67 TWh/yr

Paul Gipe, wind-works.org
High Penetration Quickly is Possible

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>1.2%</td>
</tr>
<tr>
<td>California</td>
<td>1.5-2.3</td>
</tr>
<tr>
<td>Germany</td>
<td>6.5%</td>
</tr>
<tr>
<td>Spain</td>
<td>14.3%</td>
</tr>
<tr>
<td>Portugal</td>
<td>15.3%</td>
</tr>
<tr>
<td>Denmark</td>
<td>21%</td>
</tr>
</tbody>
</table>

2009: Multiple Sources
Paul Gipe, wind-works.org

Cowley Ridge, Alberta
### Political Price-Political Quantity

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

Both are Market Mechanisms

Paul Gipe, wind-works.org
Ernst & Young
Germany and Britain
Cost of Renewables (2006)

• Germany: 4x more energy generated
• Germany: @ 1/5 less relative cost of GB Renewable Obligation Certificates
Over Cost of French Renewable Tariffs

Year

2003 2004 2005 2006 2007 2008 2009

TWh

Million Euros

Source: www.cre.fr
Paul Gipe, wind-works.org
Aggressive Targets Require Aggressive Measures

German Renewable Energy Targets

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>12.5%</td>
<td>39%</td>
<td>50%</td>
<td>80%</td>
</tr>
</tbody>
</table>

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

• #1 Community Involvement
  Germany & Denmark

• #2 Advanced Renewable Tariffs
  Many EU Countries use Electricity Feed Laws

Paul Gipe, wind-works.org
Stauning, Denmark
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, Spain . . .
  . . . 18 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 (France, Oregon)

Paul Gipe, wind-works.org
Renewable Tariffs & Solar Photovoltaics in Germany

Advanced Renewable Tariffs Launched

1,000-Rooftops (2,500 x 3kW)

100,000 Rooftops

Year

MW Total (Thousands)

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

- ~3,800 MW in 2009!
- Total 9,000 MW
  ~9 TWh/yr of Generation
- New Target: 3,000 MW/yr!
- ~2%Supply in Bavaria
- ~1+%Supply in Germany

USA: Total of 1,250 MW in 2009.
Paul Gipe, wind-works.org
German Farms--Solar PV Crop

- ~1,000 MW on Barn Rooftops in 2009
- ~3,000 MW Total in 2009 (€15 Billion)
- ~3 TWh/yr (€1.5/yr Billion)
German Granny Flat
What’s Wrong with This Picture?

Paul Gipe, wind-works.org
Near Freiburg, Germany
German Churches . . .
. . . Protecting Creation
Germany’s Renewable Tariffs
The Results (2009)

• 16% of Electricity
• 10% of Primary Energy
• Jobs
  Wind: 90,000
  Solar PV: 50,000
  Biogas: 8,000
  Total: 300,000

Paul Gipe, wind-works.org
Höhe Westerwald, Germany
Cost of German EEG (2008) ~$50/yr/household

BMU: EEG Costs <5%, ~€0.01/kWh, 2008.

Paul Gipe, wind-works.org
Building Acceptance

• Must Share Opportunity
• Public Must Participate by Creating Equal Opportunity for All
• For Renewables To Reach Their Potential

Paul Gipe, wind-works.org
Husum, Germany
Increasing Acceptance #1

“Your Own Pigs Don’t Stink”

Paul Gipe, wind-works.org

Jutland, Denmark
What is Community Power?

- Local
  Responsible to the Community
- Locally Owned
  Cooperatives, First Nations, Farmers, Homeowners
- Commercial-Scale Generation
Community Power

- Greater Acceptance
- More Power More Quickly
- More People Involved Locally
- More Money Locally
- More Jobs Locally

Paul Gipe, wind-works.org
Danish Co-ops (Vindmøllelaug or Fællesmølle)

- 1/4 Capacity Nationwide
- ~ $1.7 Billion
- 100,000 Households Own Shares
- 5% of Population

Thyborøn-Harboøre Vindmøllelaug

Anton Bro
German Co-ops (*Bürgerbeteiligung*)

- 1/3 Capacity Nationwide
- $6 Billion
- 200,000 Own Shares
- 2/3 Schleswig-Holstein
- 4/5 Nordfriesland Amt

Paul Gipe, wind-works.org

Schauinsland, Germany
WindShare
Toronto, Canada

- First Urban Turbine in N.A.
- Co-Owned
  WindShare Co-op
  450 Members
  Toronto Hydro
- Prominent Location
- Highly Visible
- Highly Popular

Paul Gipe, wind-works.org
## Co-Op & Farmer-Owned Wind

<table>
<thead>
<tr>
<th>Country</th>
<th>Farmer (%)</th>
<th>Co-op (%)</th>
<th>Corporate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Netherlands</td>
<td>60%</td>
<td>5%</td>
<td>35%</td>
</tr>
<tr>
<td>Germany</td>
<td>10%</td>
<td>40%</td>
<td>50%</td>
</tr>
<tr>
<td>Denmark</td>
<td>64%</td>
<td>24%</td>
<td>12%</td>
</tr>
<tr>
<td>Great Britain</td>
<td>1%</td>
<td>1%</td>
<td>98%</td>
</tr>
<tr>
<td>Spain</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Dave Toke, University of Birmingham, 2005, 2008

Paul Gipe, wind-works.org
Stromrebellen (Electricity Rebels)

- Democratizing Generation
- Creating Local Investment
- Creating Local Jobs
- Creating Opportunity--and Hope
- Denmark, Germany, and France, Minnesota, Ontario and ... ?
Josef Pesch, Fesa

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

Paul Gipe, wind-works.org
Ursula Sladek, EWS
(Elektrizitätswerke 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
Local Entrepreneurs Building Local Projects

- 2.6 MW Locally Owned Solar Plant
- Locally Developed, Locally Built, Locally Owned

Nico Petersen, Solar Park Rodenäs

Paul Gipe, wind-works.org
Never Underestimate the Ingenuity of Farmers

• When the Barn Doesn’t Face South
• Build a Rack That Will!

Paul Gipe, wind-works.org
Friedrich-Wilhelm-Lübke-Koog, Germany
The Farmers of Nordfriesland

- 0.3% the Size of Alberta
  2,000 km²
- 560 MW of Wind
  Community-Owned, <1% of Land Area
- 1.3 TWh/yr
  2% of Alberta’s Total Generation
  As Much as All the Wind in Alberta
  €100 million ($130 million)/yr
Community Power is also about Faith in Yourself and in Your Community Yes, You Can Do This You Don’t Have to be Danish, German, or French

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

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

• Low Program Caps
  California: 20%?
  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?

Paul Gipe, wind-works.org

Friedrich-Whilhelm-Lübke-Koog, Germany
Renewable Tariffs . . .
Developing Momentum
Renewable Tariffs in North America . . Unthinkable?

• Yes--Just 4 years ago
  “You’re Absolutely Nuts!”
  Andy Karsner, DOE, 2006

• Today? No

• Now Possible

• Growing Trend
  in North America
  & Developing World
  China, India, Mongolia

Paul Gipe, wind-works.org
Grassroots Movement

• Explosion of Interest
• Groups Active
  Across US & Canada
• Public Out in Front
  Demands Aggressive Action
• Tipping Point Reached?

San Gorgonio Pass, California
Paul Gipe, wind-works.org
Renewable Tariffs Are In Play

- Nova Scotia to British Columbia
- Washington State to Florida
- Vermont to California
- US House
Ontario Moved First

First Modern System of Advanced Renewable Tariffs in North America

Paul Gipe, wind-works.org

Montfort, Wisconsin
Ontario “Gets It”

• Closing Coal Plants
• Delaying Nuclear Build
• Putting Renewables First

Groundbreaking in North America
Ontario’s Green Energy Act
The Most Progressive Renewable Energy Policy in North America in Two Three Decades
Ontario’s Green Energy Act

• Changes Public Policy on Electricity
  Includes Industrial & Environmental Policy

• Gives Renewables Priority
  In Utility Procurement & System Design

• Targets Industrial Development & Job Creation
  50,000 Jobs in Three Years

Paul Gipe, wind-works.org
Ontario’s Feed-in Tariffs

- First Offshore Wind Tariffs in NA
- First Aboriginal Bonus in NA
  First NA Policy for First Nations
- First Differentiated Solar PV Tariffs
  6 Tranches or Classes
- Most Differentiated Biogas Tariffs
  5 Tranches or Classes
- Best Wind, Solar, & Biogas Tariffs in NA
  Competitive Internationally

Paul Gipe, wind-works.org
Ontario’s Feed-in Tariffs

- No Subsidies or Grants
- Costs Borne by Ratepayers
  Not Taxpayers--More Egalitarian
- Community Wind Bonus
  Individual Farmers Qualify
  $0.01 CAD/kWh Bonus
  $0.145 CAD/kWh (€0.10/kWh)

Paul Gipe, wind-works.org
Ontario Program Status

• 19,000 MicroFIT Applications
  ~190 MW Potential
  6,000 Contracts Offered (~60 MW)
  800 Systems on Line in 1 year

• 8,000 MW of FIT Applications
  Requires Substantial Deposit

• $9 Billion in Likely Private Investment

Paul Gipe, wind-works.org
Ontario Program Status

• 2,500 MW Awarded Contracts
  1,500 MW to Come with Line Completion
• 460 MW Community & Aboriginal
  ~20% of Total
Ontario Program Status

- 650 MW Solar PV
  with 500 MW of SOC PV ~1,000 MW Contracted
- 1,200 MW Onshore Wind
- 300 MW Offshore Wind
“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 for North Americans to Take the Road to the Future

Freiburg, Germany

Paul Gipe, wind-works.org
Feed-in Tariffs

“Turn farms, homes, and businesses into entrepreneurs”

--Terry Tamminen, Former Chief Policy Advisor to Governor Arnold Schwarzenegger
Move From
A Culture of Consumption
to
A Culture of Conservation

--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 . . .
... A Lot More Solar

Hinesburg, Vermont

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
Renewables . . .
When You Look Closely . . .
. . . Worth Every Cent

Paul Gipe, wind-works.org
Renewable Energy
The Revolution Has Begun!

www.wind-works.org

Manawatu Gorge, New Zealand