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

Disclosure: Paul Gipe has worked with ANZSES, APROMA, ASES, AusWEA, AWEA, BWEA, BWE, CanWEA, DGW, EECA, ES&T, GEO, IREQ, KWEA, MADE, NASA, NREL, NZWEA, OSEA, USDOE, Aerovironment, the Folkecenter, the Izaak Walton League, Microsoft, ORWWG, OSEA, PG&E, the Minnesota Project, NRG Systems, SeaWest, SEI/REIO, the Sierra Club, WAWWG, and Zond Systems, and written for magazines in the USA, Canada, France, Denmark, and Germany.

Paul Gipe & Assoc.
Developing Distributed Generation with Advanced Renewable Tariffs

Chateau de Lastours, France
The Troika of Meeting Demand

- Conservation
  #1 Use Less
- Improved Efficiency
  #2 Do More with Less
- Renewable Energy
  #3 Invest in the Future

Fuchskaute
Höhe Westerwald, Germany
<table>
<thead>
<tr>
<th>Region</th>
<th>kWh/yr/home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas</td>
<td>14,000</td>
</tr>
<tr>
<td>Ontario</td>
<td>10,000</td>
</tr>
<tr>
<td>California</td>
<td>6,500</td>
</tr>
<tr>
<td>Netherlands</td>
<td>3,000</td>
</tr>
</tbody>
</table>
Swept Area per Household

Wind Turbine Area (m²)/Household

Texas
Ontario
California
Germany
The Result in the Nies-Gipe Household

Month

kWh/month

2001
2002
5 yr Avg

Jan Feb March April May June July Aug Sept Oct Nov Dec
Renewable Sources of Energy

Not Quick,
Not Cheap,
Not Easy
But Worth Every Cent
Wind Energy Has Come of Age

Colorado

California

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Montefalcone, Italy
Why Wind?

- Reduces Use of Nuclear & Fossil Fuels
- Most Cost-Effective of New Renewables
- Relatively Benign
Wind Energy’s Benefits

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

• **Renewable**
  Net Positive Energy Balance (4-6 months)
  Net Positive Emissions Balance (6-9 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 Kills: Collisions, Electrocutions

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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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We Know What Works . . .and What Doesn’t
Kincardine, Ontario

40 m, 500 kW

80 m, 1.8 MW

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Northern Ireland
Wind is Flexible

- **Scale**
  - Big or Small Projects

- **Location**
  - Near or Far

- **Time**
  - Short Lead Times

- **Ownership**
  - Local or Absentee
Wind is Modular

• Quickly Installed
• When Needed
• As Needed
• Where Needed
• By Anyone
World Wind Generating Capacity

Year

Megawatts (Thousands)

Asia
North America
Europe
2005 World Wind Capacity

9,150 MW

41,000 MW

7,800 MW
Wind Energy is a Real Business
US$22 Billion in 2005

- Project Development: 53%
- Electricity Sales: 42%
- O&M: 5%
Wind Growing Rapidly
2003-2005

- Germany: ~2,100 MW/yr
  20,000 MW by 2006
  30,000 MW by 2012
- Spain: ~1,800 MW/yr
- USA: ~1,500 MW/yr
- Growth: 20%-40%/yr
## High Penetration is Possible

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Netherlands</td>
<td>2%</td>
</tr>
<tr>
<td>Spain</td>
<td>6.5%</td>
</tr>
<tr>
<td>Germany</td>
<td>5.3%</td>
</tr>
<tr>
<td>Germany 2012</td>
<td>12.5%</td>
</tr>
<tr>
<td>Denmark</td>
<td>20%</td>
</tr>
<tr>
<td>Germany 2025</td>
<td>25%</td>
</tr>
</tbody>
</table>

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Solar PV Growing Rapidly

• 2005: 3,500 MW Worldwide
• 1,200 MW/yr
• $20+ Billion
• Major Markets
  - Germany--600+ MW/yr
  - Japan--350 MW/yr
  - Spain--100MW/yr?
  - California--40 MW/yr

Rancho Seco, California
Renewable Tariffs & Solar Photovoltaics in Germany

MW Installed per Year

Year

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

100,000 Rooftops

Renewable Tariffs Launched

0 100 200 300 400 500 600 700

90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05
Era of Distributed Generation

• Here Now
• Resilient, Not Brittle
• Short Lead Times
• Near Load, Less Losses
• Opportunity for Many
• Fosters Energy Awareness
Distributed Wind Energy

Thy, Denmark

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Distributed Wind Energy

Ostfriesland, Germany

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Distributed Wind Energy

Wisconsin, USA

Michigan, USA

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Distributed Wind Energy

Jutland, Denmark

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Distributed Wind Energy

- 5 x 600 kW
- Co-owned
  1/2 by Two Farmers
  1/4 by NEG-Micon
  1/4 by Utility
Why the European Success?

- #1 Community Involvement
  Germany & Denmark
- #2 Advanced Renewable Tariffs
  16 EU Countries use Electricity Feed Laws

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Why Community Involvement?

• More Acceptance
• More Power More Quickly
• More People Involved Locally
• More Money Locally
• More Jobs Locally
Community Wind--The Third Way

1. Large Wind Power Plants
2. Small Wind Turbines
3. Locally-Owned Commercial Turbines

WindShare Meeting,
Toronto, Canada
What is Community Power?

• Local
  Rooted in and Responsible to the Community
• Locally Owned
  Cooperative, First Nation, Farmer-Owned
• Commercial-Scale Generation
• Small Projects Making a Big Difference
Increasing Acceptance #1

“Your Own Pigs Don’t Stink”

Jutland, Denmark

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Danish Co-ops
(Vindmøllelaug or Fællesmølle)

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

Thyborøn-Harboøre Vindmøllelaug

Anton Bro
Paul Gipe & Assoc.
Middelgrunden Co-op København

- 20 x 2 MW Off-shore
- 1/2 Owned by Co-op
- 1/2 Owned by Utility
- 8,500 Investors
- ~$1,000CAD per Share
- Visible from Folketing
Paderborn Co-op

- 4 Wind Plants
- 17 Companies
- 80 x V66 & E66
- 110 MW
- €140 Million
- 780 ha (2,000 ac)
- All Companies Local
- Paying Local Taxes

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WindShare
Toronto, Canada

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

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## 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>40%</td>
<td>10%</td>
<td>50%</td>
</tr>
<tr>
<td>Denmark</td>
<td>65%</td>
<td>25%</td>
<td>10%</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.
Elements of Success in Europe

- Right Price for Fixed Period
- Right of Interconnection
- By-Right Permitted Rural Use

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Market Mechanism Status

• Premium Prices (Renewable Tariffs)
  Typically Non-Anglophone Countries

• Quotas (RPS with RECs & ROCs)
  Typically Anglophone Countries

• Tendering
  Ireland, France & Britain (Failed)
  RPS in Most USA States
  Most Canadian Provinces

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Haverigg, Cumbria, Britain
Advanced Renewable Tariffs

• What Are They?
  Feed Laws or Minimum Price Systems
  Political Price, Not Political Quota
  Simple Contracts

• How Do They Work?
  Simple, Comprehensible, Transparent
  Little Administration

• Where?

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<table>
<thead>
<tr>
<th>Existing Standard</th>
<th>Existing Non-Standard</th>
<th>Regulations Pending</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Minnesota C-BED</td>
<td>Czech Republic</td>
<td>Japan</td>
</tr>
<tr>
<td>Brazil</td>
<td>PEI, Canada</td>
<td>Hungary</td>
<td>Italy?</td>
</tr>
<tr>
<td>California (PV)</td>
<td>The Netherlands</td>
<td>Ireland</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>Washington State</td>
<td>Turkey (Wind)</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td></td>
<td>Ontario</td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy (PV)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Advanced Renewable Tariffs

• Momentum in North America
  - Prince Edward Island (Canada)
  - Washington State
  - Minnesota C-BED
  - California (PV)
  - Ontario (<10 MW)

• Desire for Manufacturing Jobs

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Freyssenet, France
Renewable Tariff Design

- Simple, Comprehensible, & Transparent
- Simplified Interconnection
- Prices Sufficient to Drive Development
- Lengths Sufficient for Profitability
- Prices Differentiated by Technology
- Prices Differentiated by Resource
## Wind Energy Tariffs --A Job Creation Engine

<table>
<thead>
<tr>
<th>Europe</th>
<th>Direct</th>
<th>Indirect</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>7,500</td>
<td>37,500</td>
<td>45,000</td>
</tr>
<tr>
<td>Denmark</td>
<td>8,600</td>
<td>4,300</td>
<td>13,000</td>
</tr>
<tr>
<td>Spain</td>
<td>7,000</td>
<td>15,000</td>
<td>22,000</td>
</tr>
<tr>
<td>Total</td>
<td>80,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Enercon, Aurich, Germany
German Farms . . .
. . . Solar PV Cash Crop

- 200 MW on Barn Roof Tops in 2005
Schönau, Germany

German Churches . . .
. . . Protecting Creation
Germany’s Renewable Tariffs
The Results (2005)

- Renewables 10% of Supply
- Renewables Generating 60 TWh/yr
- 45,000 Employed in Wind Industry
- 30,000 Employed in PV Industry
- 8,000 Employed in Biogas Industry
- 170,000 Employed in Renewables
- €16.4 Billion Turnover
Germany’s Renewable Tariffs
The Results

- Renewables ~60 TWh/yr
- 200,000 PV Installations
- 2,000 Biomass Plants
- 550 MW Farm Biogas, 10 TWh/yr
- 6,000 Hydro Plants
- 18,000 Wind Turbines
- Total of 235,000 Generators!
External Costs of Generation

Oil
Coal
Natural Gas
Wind

$CAD/kWh

EU financed international study: ExternE

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Climate Change
External Costs Avoided

€/kWh

32$/tC/YOLL
32$/tC/VSL
590$/tC/YOLL
590$/tC/VSL

Olav Hohmeyer, U. Flensburg
Paul Gipe & Assoc.
Renewable Energy
Is About People--
and Opportunity

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Advanced Renewable Tariffs for Ontario Projects <10 MW

- 20 Year Contracts
- <44kV
- Wind, Solar, Hydro, Biomass
- Inclusive--Open to All
- No Program Cap
Prices Paid for Solar PV in Europe

Euro Cents/kWh

Feed Law-Germany
Feed Law-France
Feed Law-Spain
Feed Law-Italy
Quota-Britain
Feed Law-Austria
Feed Law-Ontario
Advanced Renewable Tariffs
A Question of Equity

• Feed Laws are Fair
• Nearly All Can Play
  Farmers, Ranchers, First Nations, & Co-ops
How Renewable Tariffs Can Benefit Farmers

• #1 Royalties, or
  Lowest Risk--Lowest Reward
  % of Gross Revenue (2-4%)

• #2 Ownership
  Risk Born Directly
  Wind & Technology Risk
  Political Risk
  Highest Reward
  Farmer Retains Profit

Cros de Georand, France

Paul Gipe & Assoc.
Paderborn Co-op
Royalty Sharing Among Farmers

Landowners

Land & Lease Agreement

Land. Assoc.

Planning Agreement

Ltd. Co.

Wind Plants

WP 1

WP 2

WP 3

WP 4

Lease Agreement
on Wind Plant Location
PEI Royalty Revenue Sharing

70% of Royalties

20% of Royalties

10% of Royalties

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## Royalties & Land Rents

<table>
<thead>
<tr>
<th>Location</th>
<th>1-10</th>
<th>10-20</th>
<th>20-30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal Germany</td>
<td>5-8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior Germany</td>
<td>3-5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cielo Wind Power, NM</td>
<td>6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cappeln Germany</td>
<td>4%</td>
<td>5.9%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Indian Mesa, TX</td>
<td>4%</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Woodward Mesa, TX</td>
<td>4%</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>US BLM, CA</td>
<td>4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freiburg, Germany</td>
<td>3.8%</td>
<td>5.4%</td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>2.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td>1.5-2.5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Potential per Farm

- Turbines Use Only ~5-10% Land Area!
- Potential to Significantly Boost Farm Income
Potential per Farm

- 2MW Turbine, 80 m Ø, 80 m Tower
- ~$4 million Installed
- ~3.5 million kWh/Year (~6 m/s)
- ~$350,000/yr @ $0.10/kWh
- Simple Payback: 11 Years
- After Payback: ~$350,000/yr
Renewable Tariffs--New Policy Option for North America

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Wind Energy is Compatible
With Most Existing Land Uses
... With Rural Residential

Yorkshire, England

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Ebeltoft, Denmark

... With Harbours

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KaiserWilhelmskoog, Germany

. . . With Row Crops

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Minnesota, USA
... With Tourism

Paul Gipe & Assoc.
. . . With Grazing

Roquetaillade, France

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Noordoost Polder, the Netherlands
. . . With Schools

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Forest City, Iowa
With Vineyards
. . . With Religious Sites

Montefalcone, Italy

White Deer, Texas

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... With Some Parks Depending Upon the Level of Protection

Wellington (Brooklyn), NZ

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... With Outdoor Recreation
With Walking & Jogging

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Dunkerque, France
With Hiking
Wind Turbines

. . . Sell Beer, Bier, Birra, Cerveza

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Sell Clothes
Promote Community
Pave the Sidewalk
And the Way to the Future

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Wellington (Brooklyn), NZ
Renewables:
When You Look Closely . . .
. . . Worth Every Cent

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Renewable Energy
For Today and for Tomorrow
Technology for Life*

*from N.F.S. Grundtvig
Renewables Work!

www.wind-works.org

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