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, ManSEA, 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.
World Wind Energy Development & Advanced Renewable Tariffs
Overview of Worldwide Wind Development
Wind Energy Has Come of Age
Wind Energy Has Come of Age
Montefalcone, Italy
Galicia, Spain
World Wind Capacity 2004
~46,000 MW

- North America: 15%
- Europe: 75%
- Asia: 9%
- Other Continents: 1%
Wind Energy is a Real Business
$23 Billion CAD in 2004

Electricity Sales
44%

Project Development
51%

O&M
5%
2004 World Wind Capacity

7,100 MW

5,100 MW

34,600 MW
North American Wind Capacity
Wind Growing Rapidly

- **Germany**
  - 2,000 MW in 2004
  - 20,000 MW by 2006
  - 30,000 MW by 2012

- **Spain**
  - 2,100 MW in 2004

- **France**
  - 14,000 MW Filed

- **USA**: 500-2,000 MW/yr

- **Growth**: 20%-40%/yr
Installed Wind Capacity
Where Canada Stands

Megawatts (Thousands)
### 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>10%</td>
</tr>
<tr>
<td>Denmark</td>
<td>20%</td>
</tr>
<tr>
<td>Germany 2025</td>
<td>25%</td>
</tr>
</tbody>
</table>
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\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**
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
Why Now?

- **Wind Works**
  - Greater Reliability

- **Productivity Improved**
  - More Efficient
  - Taller Towers

- **Costs Declined**
  - Economies-of-Scale
We Know What Works

Eole, Cap Chat

Adecon, Pincher Creek
12.5 m, 40 kW

27 m, 225 kW
Northern Ireland

40 m, 500 kW

80 m, 1.8 MW

Kincardine, Ontario
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
Era of Distributed Generation

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

Alberta, Canada

Ontario, Canada
Distributed Wind Energy

Alberta, Canada

Montana, USA
Distributed Wind Energy

Hohe Westerwald, Germany
Distributed Wind Energy

Thy, Denmark
Distributed Wind Energy

Ostfriesland, Germany
Why the European Success?

• #1 Public Involvement
  Germany & Denmark

• #2 Advanced Renewable Tariffs
  16 EU Countries use Electricity Feed Laws
Public Involvement Through Community Power

- More Acceptance
- More Power More Quickly
- More People Involved Locally
- More Money Locally
- More Jobs Locally
Increasing Acceptance #1

“Your Own Pigs Don’t Stink”

Jutland, Denmark
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
Why Community Power?

- Participation = Greater Acceptance
- Distributed = Greater Resiliency
- Clean & Green (Mostly)
- Human Scale
- Enables Local Ownership
- New Cash Crop For Farmers
Advanced Renewable Tariffs

• What Are They?
  Political Price, Not Political Quota
  Simple Contracts

• How Do They Work?
  Simple & Comprehensible
  Little or No Administration

• Where?
# Renewable Energy Tariffs

<table>
<thead>
<tr>
<th>Existing</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Turkey (Wind)</td>
</tr>
<tr>
<td>Spain</td>
<td>Czech Republic</td>
</tr>
<tr>
<td>France</td>
<td>India</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>California SB1 (PV)</td>
</tr>
<tr>
<td>Portugal</td>
<td>Italy (PV)</td>
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<tr>
<td>Austria</td>
<td>PEI, Canada?</td>
</tr>
<tr>
<td>Brazil</td>
<td>Ontario</td>
</tr>
<tr>
<td>Greece</td>
<td>Minnesota C-BED</td>
</tr>
<tr>
<td>China (March 05)</td>
<td>Washington State</td>
</tr>
<tr>
<td>Ireland (April 05)</td>
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</tbody>
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Advanced Renewable Tariffs
Endorsements

- Ontario Liberal Party
- National Farmers Union
  Ontario
  Canada
- Great Lakes United (NGO)
- BCWEA

Ferndale, Ontario
Renewable Tariffs & Solar Photovoltaics in Germany

MW Total

Year

Renewable Tariffs Launched
Renewable Tariffs & Solar Photovoltaics in Germany

- 2004
  20,000 New Systems
  100% Growth
  CAD$3 Billion Private Investment
  Total of 110,000 Systems
  Cumulative 700 MW
  Twice as Much as Wind in Canada!

- Costs Dropped 25% Since 1999
- Second Only to Japan
Photovoltaic Market Leaders

MW Installed per Year

- USA
- Germany
- Japan

Year

0 50 100 150 200 250 300 350

90 91 92 93 94 95 96 97 98 99 '00 '01 '02 '03 '04

OSEA
German Renewable Generation

TWh Generated per Year

ARTs (EEG)  Feed Law (StrEG)

Year

90 91 92 93 94 95 96 97 98 '00 '01 '02 '03 '04 '05

0 10 20 30 40 50
Germany’s Renewable Tariffs
The Results

• Renewables from EEG 9% of Supply
• Renewables Generating 40 TWh/yr
• 45,000 Employed in Wind Industry
• 15,000 Employed in PV Industry
• 135,000 Employed in Renewables
• 110,000 Jobs in Wind by 2010
Germany’s Renewable Tariffs
The Results

- 110,000 PV Installations
- 2,000 Biomass Plants
- 6,000 Hydro Plants
- 16,500 Wind Turbines
- Total of 135,000 Generators!
Renewable Tariffs
The Philosophical Context

Geothermal: Colline Metallifere, Italy
1. Do We Want Renewables?

- **Peak Oil, Peak Gas**
  Marginal Costs Higher Than Embedded Costs
- **Nuclear Problematic**
  Ontario, New Brunswick?
- **Kyoto & Climate Catastrophe**
  France & Italy, 2003; 25,000 Dead
- **Public Support High**
  Large Crowds of Farmers in Ontario
- **Desire for New Manufacturing Jobs**
2. If Yes, Then What Works Best?

- **How To Assign Contracts (PPAs)**
  - Negotiated
  - Tendered
  - Standard Offers (Open)

- **Who Gets Contracts**
  - Elite Few or All Who Want Them?

- **How To Pay For Them**
  - RECs/ROCs/Green Tags
  - Capital or Production Subsidies
    - PTC or WPPI
  - Advanced Renewable Tariffs
3. If We Use a Market Model, Then

• You Get What You Pay For
• If You Want It You Must Pay For It
• Difference Between Cost & Price
  The Margin Determines Rate of Growth
• High or “Premium” Prices Deliver
  More Generation
  More Quickly
  More Manufacturing . . . And Jobs
What Has Worked in Europe

• What Works
  Advanced Renewable Tariffs (ARTs)
  Also Known as Standard Offer Contracts
  or Electricity Feed Laws

• Proof is in the Market
  ARTs Markets = Many Players
  Quota Markets = Few Players
  RFP Markets = No Manufacturers
Political Price-Political Amount Markets

- Feed Law, Germany
- Feed Law, Spain
- Quota-RFP, Britain
- Quota-RPS, Italy

![Graph showing wind capacity and jobs](image)

- Wind Capacity
- Jobs

Thousands

OSEA
Elements of Success in Europe

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

![Graph showing renewable tariffs launched in Spain and Germany over the years.](image)
Renewable Tariffs or Standard Offer Contracts

- Trend in North America?
  - PEI (<1 MW, Draft)
  - Ontario (<10 MW Draft)
  - Minnesota C-BED (Introduced)
  - Washington State (Passed Senate)
  - Schwarzenegger’s California (Introduced)
- Major Push from China’s Renewables Law
- Desire for Manufacturing Jobs
- More Awareness that ARTs Deliver Results
Renewable Tariffs or Standard Offer Contracts Should

- Be Simple, Comprehensible, & Transparent
- Allow Simplified Interconnection
- Have Prices Sufficient to Drive Development
- Have Lengths Sufficient for Profitability
- Have Prices Differentiated by Technology
- Have Prices Differentiated by Resource (for Wind)
German Wind Tariffs
Reference Yield Method

Year
0 2 4 6 8 10

Euro Cents/kWh
0 2 4 6 8 10

150%
100%
60%

Year
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

OSEA
Potential Economic Benefits of Renewable Tariffs
# Wind Energy Tariffs

--A Job Creation Engine

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Indirect</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td></td>
<td></td>
<td></td>
</tr>
<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>
Ontario Job Growth from Wind with ARTs

Person-Years of Employment

- Service
- Manufacturing

Year

2005 2006 2007 2008 2009 2010 2011 2012

0 5,000 10,000 15,000 20,000 25,000 30,000 35,000

OSEA
What ~40 TWh of German Renewables Would do in Ontario Today

- Conventional: 110 TWh/yr (73%)
- Renewables: 40 TWh/yr (27%)
External Costs of Generation

$\text{CAD/kWh}$

- **Oil**: $0.08$
- **Coal**: $0.09$
- **Natural Gas**: $0.04$
- **Wind**: $0.00$

EU financed international study: ExternE
Premium Cost for Wind Energy in Ontario with ARTs in 2012

- Total Price: $0.120/kWh
- 8,000 MW
- 10% of Supply
- OSEA Tariff Cost: $0.004/kWh
Renewable Tariffs are About People—and Opportunity
Renewables:

When You Look Closely . . .

. . . Worth Every Cent
Renewable Energy
For Today and for Tomorrow
Technology for Life*

*from N.F.S. Grundtvig