

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

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

St. Olaf College V82, Northfield, Minnesota

# Advanced Renewable Tariffs New Policy Option for North America by Paul Gipe

Paul Gipe, [wind-works.org](http://wind-works.org)



Noordoost polder, the Netherlands

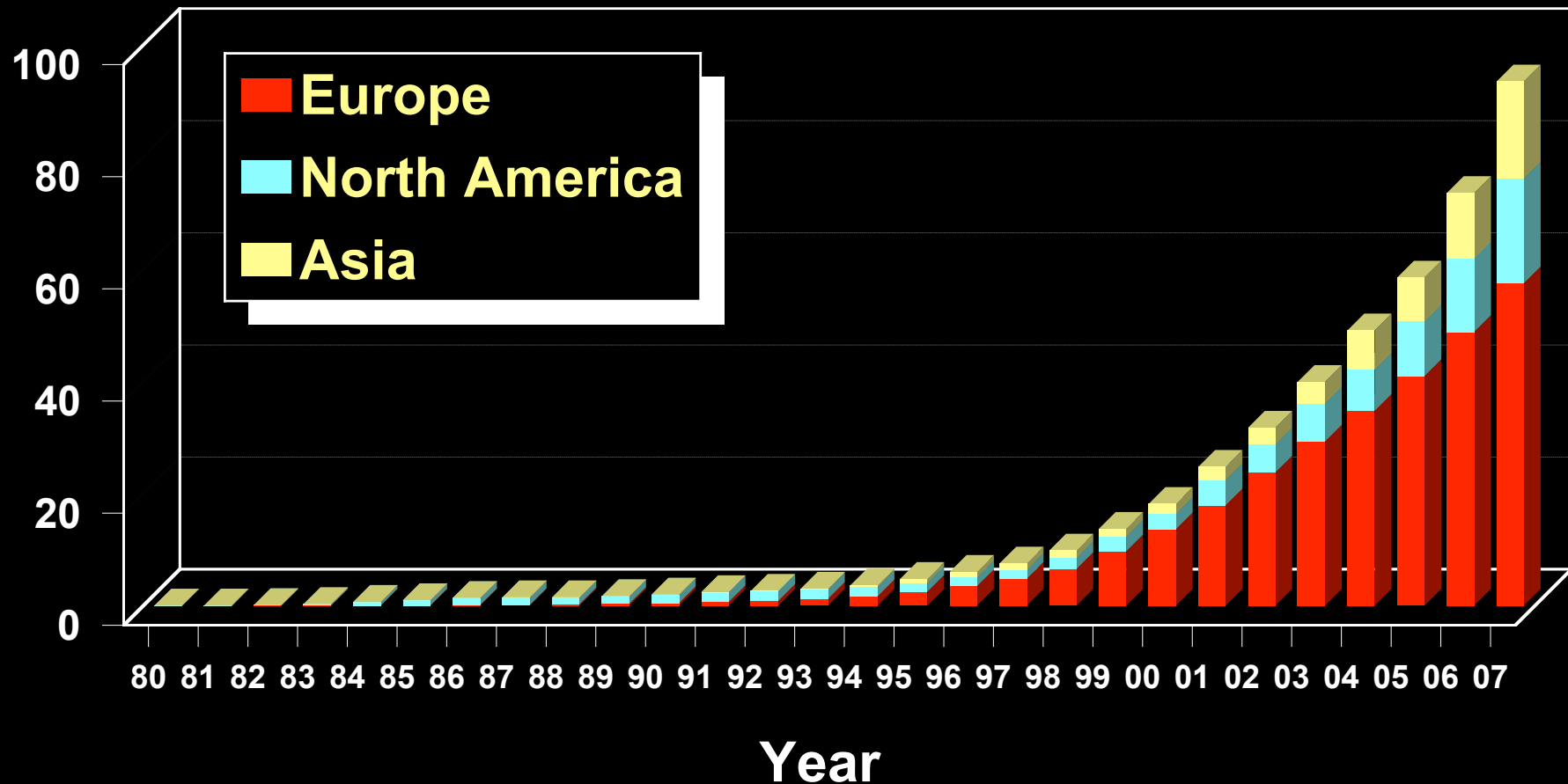
# Renewable Energy Has Come of Age

Paul Gipe, [wind-works.org](http://wind-works.org)



# 2007 World Wind Capacity

Megawatts (Thousands)



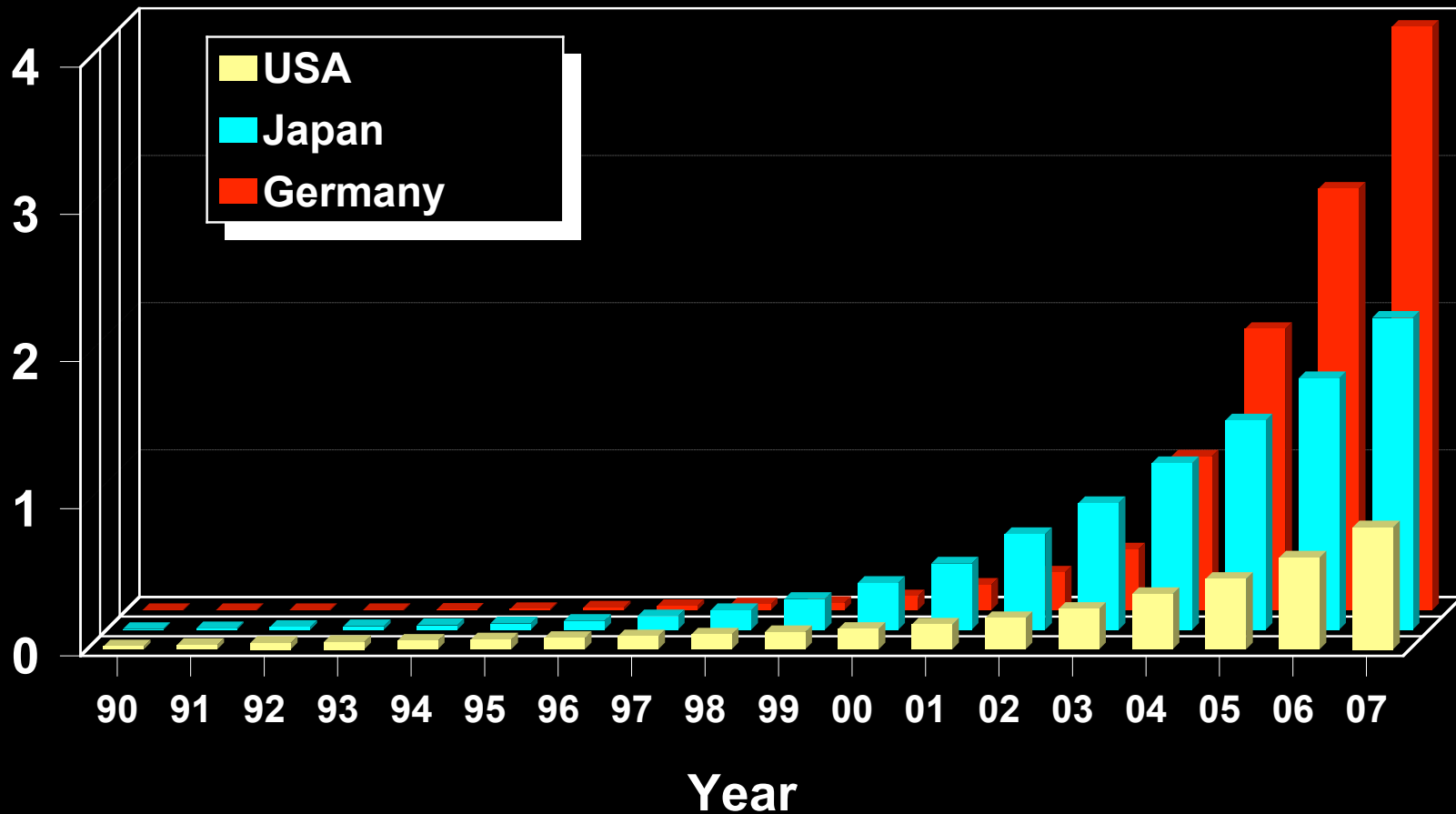
# Freiburg -- Germany's Solar City



Paul Gipe, [wind-works.org](http://wind-works.org)

# Solar Photovoltaic Development

Total Installed MW (Thousands)



Lackawanna, New York

# **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](http://wind-works.org)



# Profound Issues Confront North America's Energy Future

- Climate Change Not Only Issue
- Transportation (Liquid) Fuels  
Very Little Public Transit
- Domestic Supplies Declining

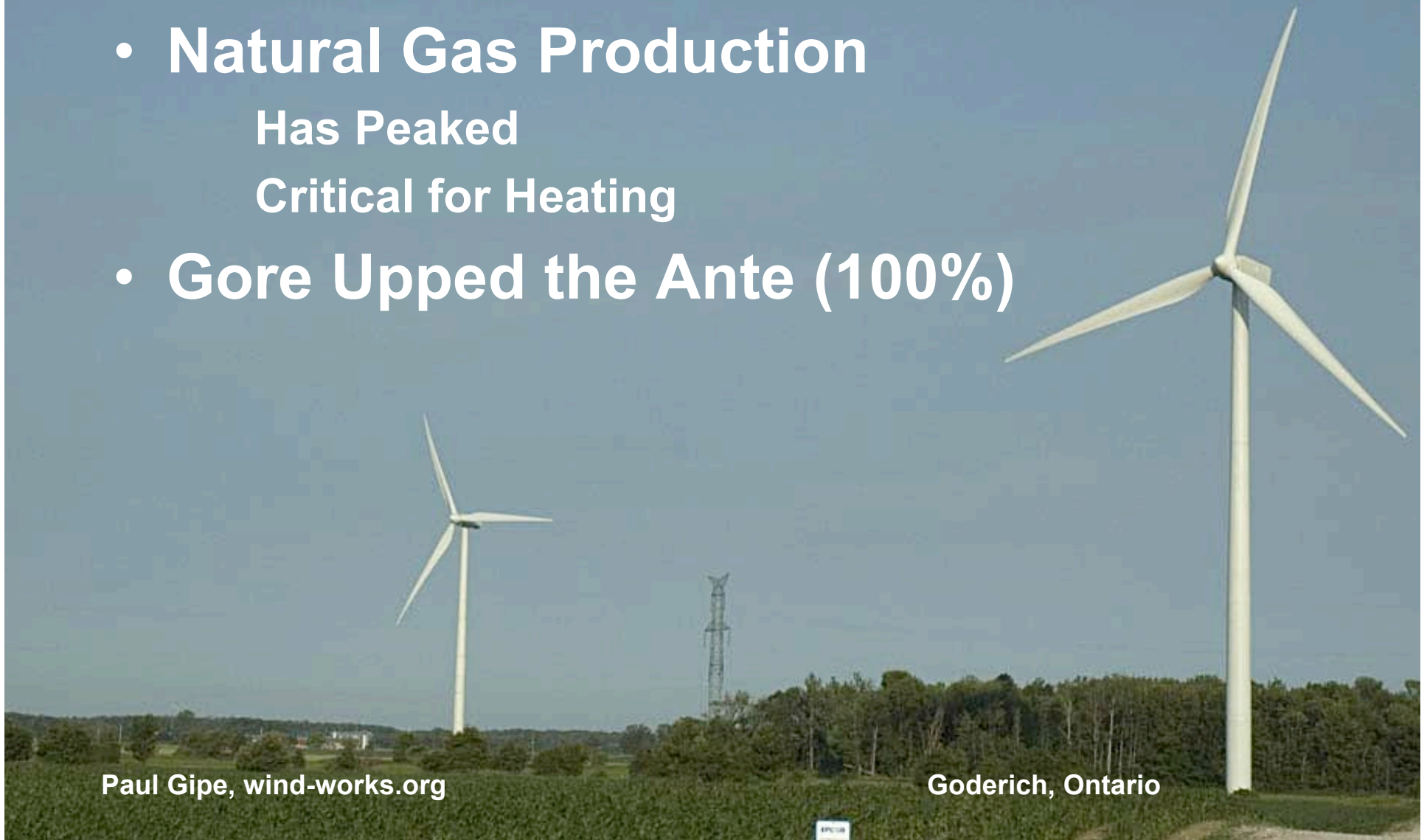


# Profound Issues Confront North America's Energy Future

- **Natural Gas Production**  
Has Peaked  
Critical for Heating
- **Gore Upped the Ante (100%)**

Paul Gipe, [wind-works.org](http://wind-works.org)

Goderich, Ontario



# North America Needs Massive Reconstruction of its Infrastructure

## Renewable Energy Development Can Reindustrialize the North American Economy

Paul Gipe, [wind-works.org](http://wind-works.org)

Noordoostpolder, the Netherlands



# North American RE Market Growth

- Exciting, Yes
- Significant, Yes
- Not Nearly Enough  
by Any Standard



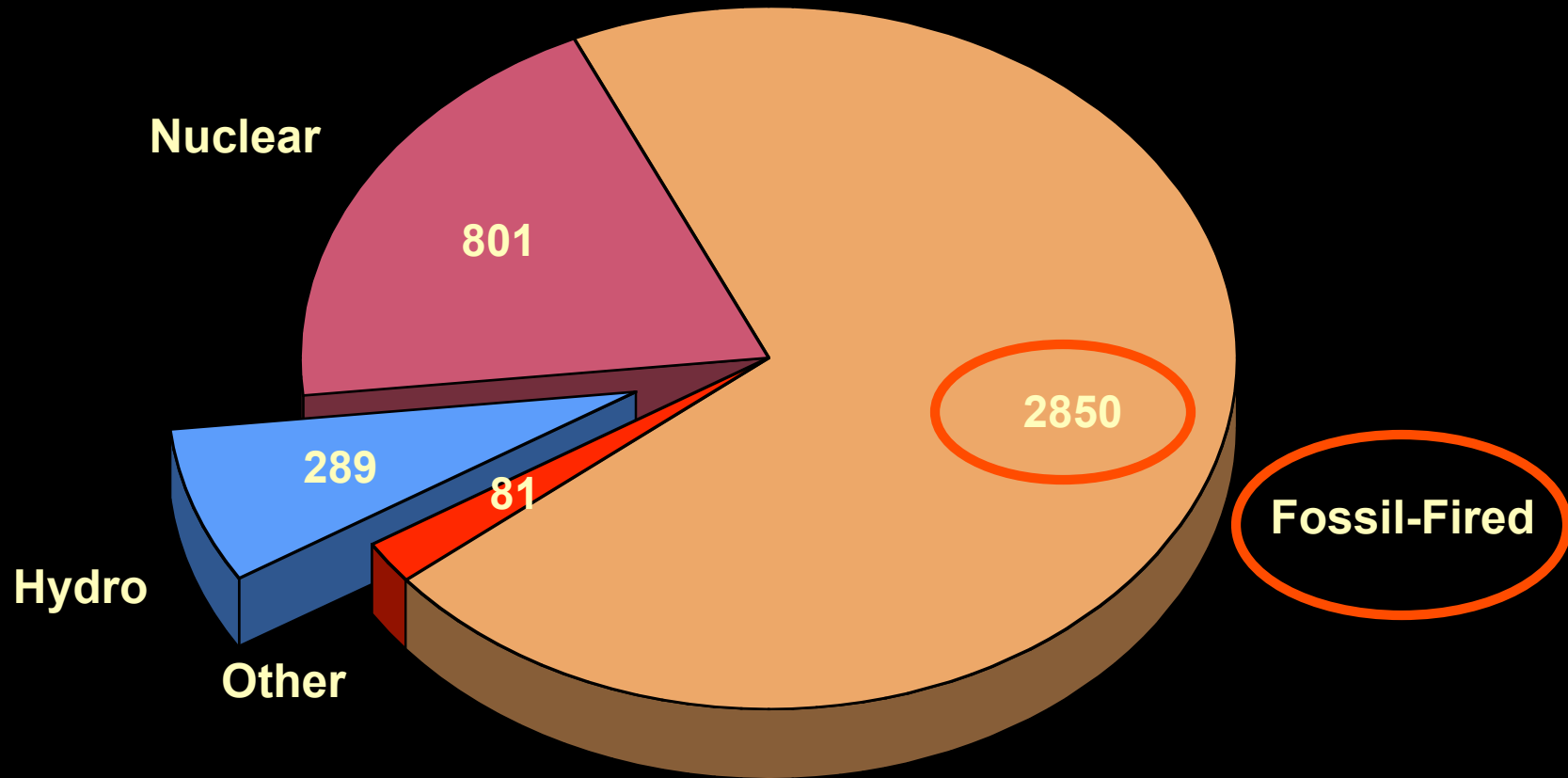
Höhe Westerwald, Germany

# Some Fun With Numbers

Paul Gipe, [wind-works.org](http://wind-works.org)



# US Electricity Generation ~4,000 TWh/yr



# Scale Needed: North America

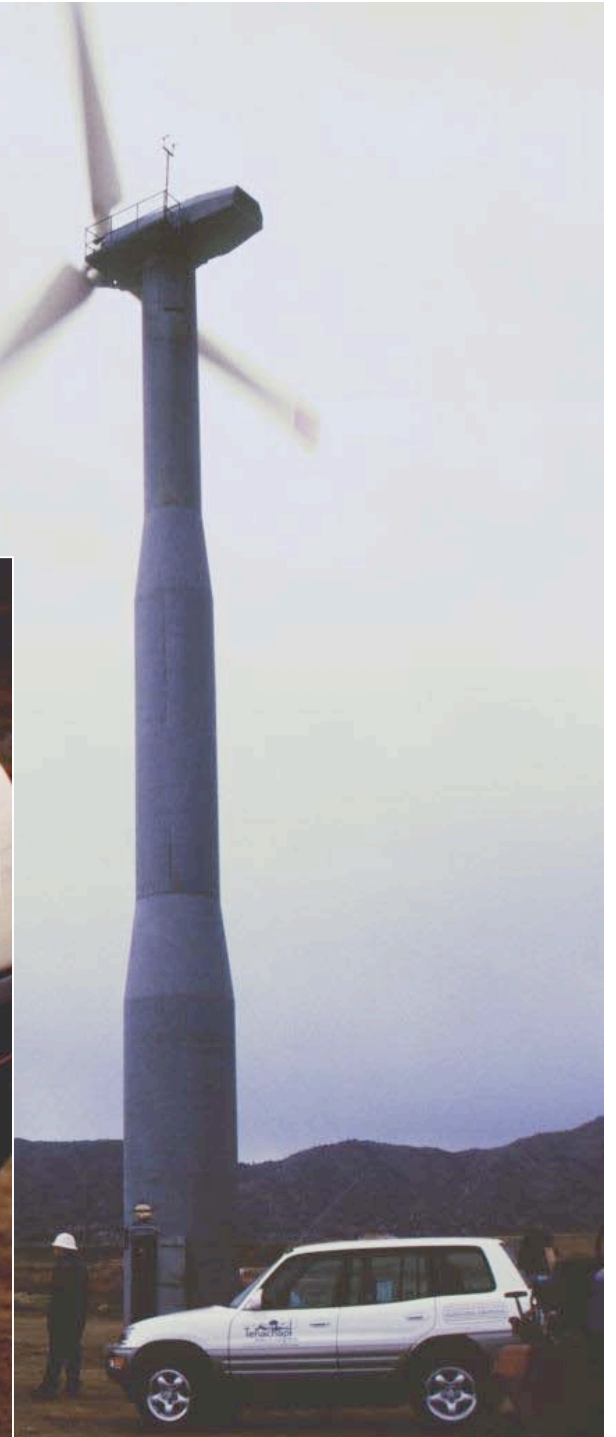
Thermal Generation	MW
Canada	75,000
USA	<u>1,500,000</u>
Total	1,600,000



Paul Gipe, [wind-works.org](http://wind-works.org)

Buffalo Ridge, Minnesota

# Electric Vehicle Charging



# Scale Needed: North America

Passenger Vehicle Miles	MW
Canada	50,000
USA	<u>750,000</u>
Total	800,000

Paul Gipe, wind-works.org

Bowling Green, Ohio



# Scale Needed: North America

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



# 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**

# USA & Canada 100% Renewable?

**Yes! It Can Be Done!**

**But Not With Current Policies**



Paul Gipe, [wind-works.org](http://wind-works.org)

Cowley Ridge, Alberta

# North America Better Than Germany?

- More Land
- More Wind
- More Hydro
  - For Backup & For Storage
- Fewer People



# 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**



Paul Gipe, [wind-works.org](http://wind-works.org)

Buffalo Ridge, Minnesota

# North America is Capable of Huge National Undertakings

Cleveland, Ohio

- TVA, BPA, WPA
- Ontario Hydro, Hydro Quebec
- Civil Rights, Anti-Smoking



Paul Gipe, [wind-works.org](http://wind-works.org)

# Why the European Success?

## #1 Community Involvement

Germany & Denmark

## #2 Advanced Renewable Tariffs

18 EU Countries use Electricity Feed Laws



# Solar PV Growing Rapidly

- 2007: 8,000 MW Worldwide
- 2,500+ MW/yr
- \$20+ Billion
- Major Markets

Germany--1,000+ MW/yr

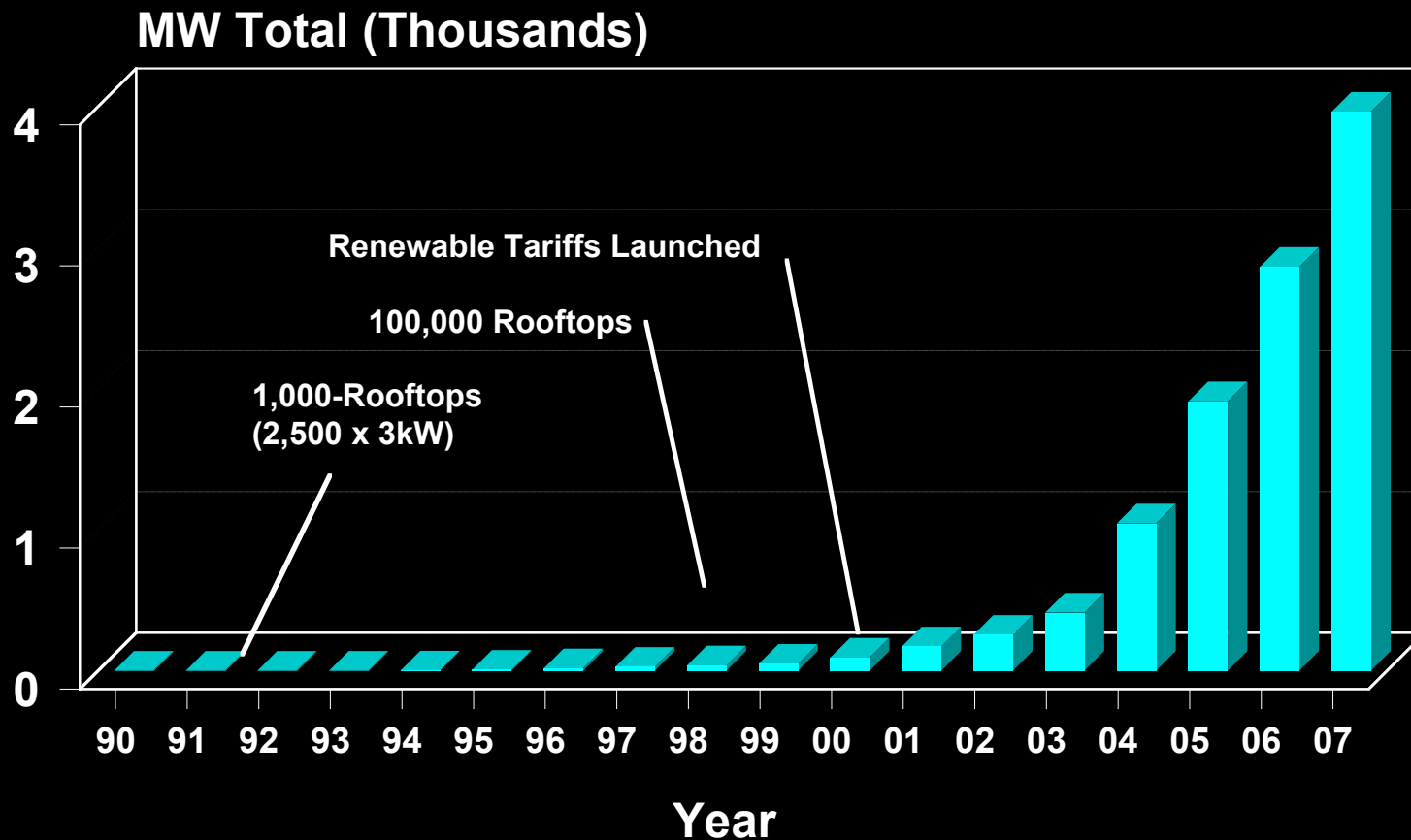
Spain--400 MW/yr

Japan--250 MW/yr

California--100 MW/yr

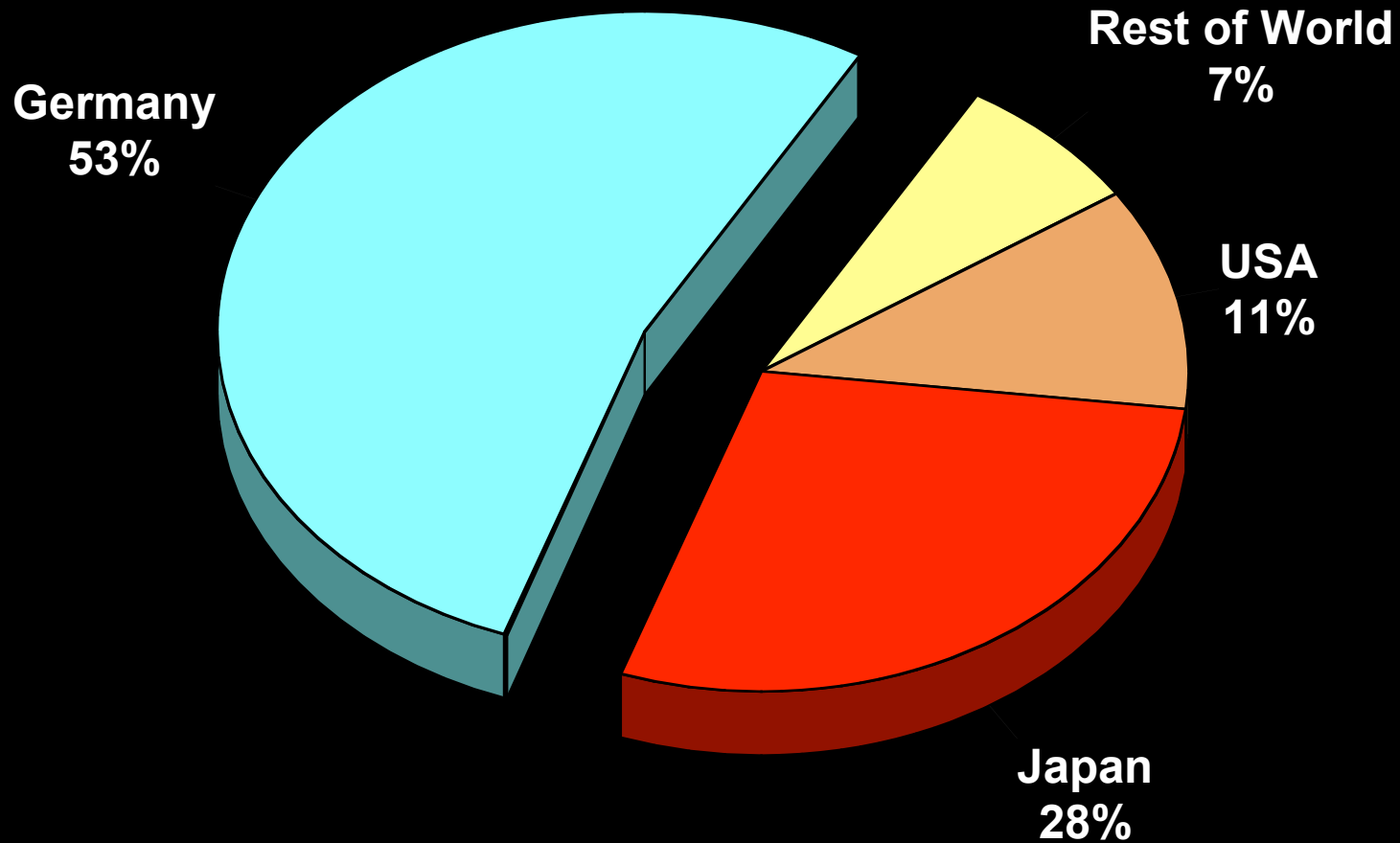


# Renewable Tariffs & Solar Photovoltaics in Germany



# World PV Capacity 2007

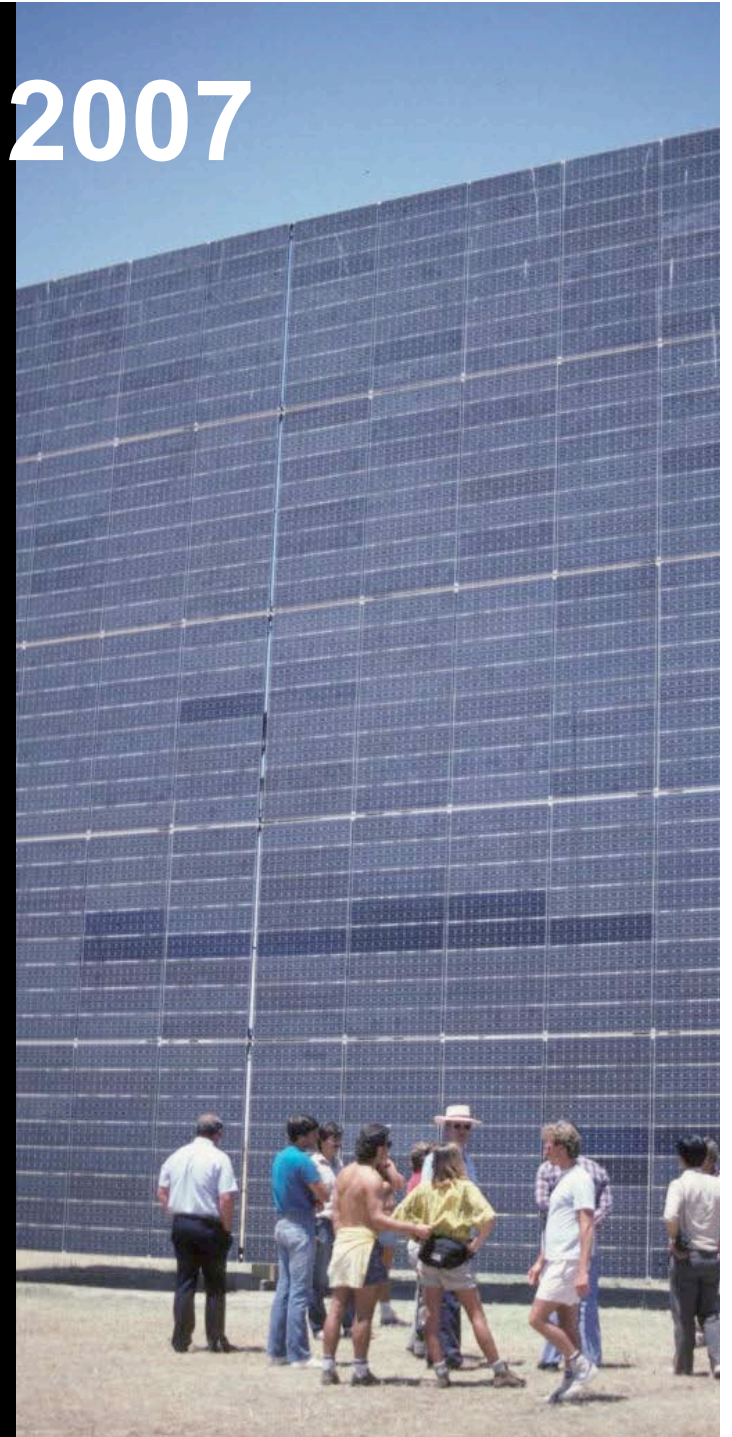
~8,000 MW



# Solar PV in Germany 2007

- **150,000 New Systems**
- **€6 Billion**
- **Total of 450,000 Systems**
- **~1,100 MW in 2007!**
- **Total 4,000 MW**
- **~2% Supply in Bavaria**
- **~1% Supply in Germany**

Paul Gipe, [wind-works.org](http://wind-works.org)



# German Homeowners

- **500 MW on Home Rooftops/yr**
- **2,000 MW+ Total**
- **2 TWh/yr**
- **~ €1 Billion/yr Revenue**
- **Anyone with a Roof Can Do Solar in Germany!**



# German Farms--Solar PV Crop

- ~700 MW on Barn Rooftops in 2007
- ~1,500 MW Total in 2007 (€9 Billion)
- ~1.5 TWh/yr (€700 Million)



# Germany's Renewable Tariffs The Results (2007)

- Renewables 14% of Supply
- Renewables 8.5% of Primary Energy
- 70,000 Employed in Wind Industry
- 40,000 Employed in PV Industry
- 8,000 Employed in Biogas Industry
- 250,000 Employed in Renewables
- €32 (~\$50) Billion Turnover

# 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](http://wind-works.org)



# Renewable Tariff Design

- Simple, Comprehensible, & Transparent
- Priority Access & Purchase
- Prices Sufficient for Development
- Lengths Sufficient for Profitability
- Fair But Not Undue Profit
- Price Differentiation

Paul Gipe, [wind-works.org](http://wind-works.org)

Altamont Pass, California



# Renewable Tariffs Contract Length

Country	Wind	Solar	Hydro	Biomass
France	15	20	20	15
Germany	20	20	20	20
Ontario	20	20	20	20
Portugal	12	12	12	
Spain (2007)*	>15	>25	>25	>20

**Longer Contracts Reduce Initial Price.**

# Renewable Tariffs Inflation Adjustment

	Inflation Adjustment
Germany	0%
Ontario RFP	15%
Ontario SOC	20%
Prince Edward Island	26%
France	60%
Spain	50-75
Greece	100%
Ireland	100%

**Higher Inflation Adjustment Reduces Initial Price.**

# Renewable Tariff Design

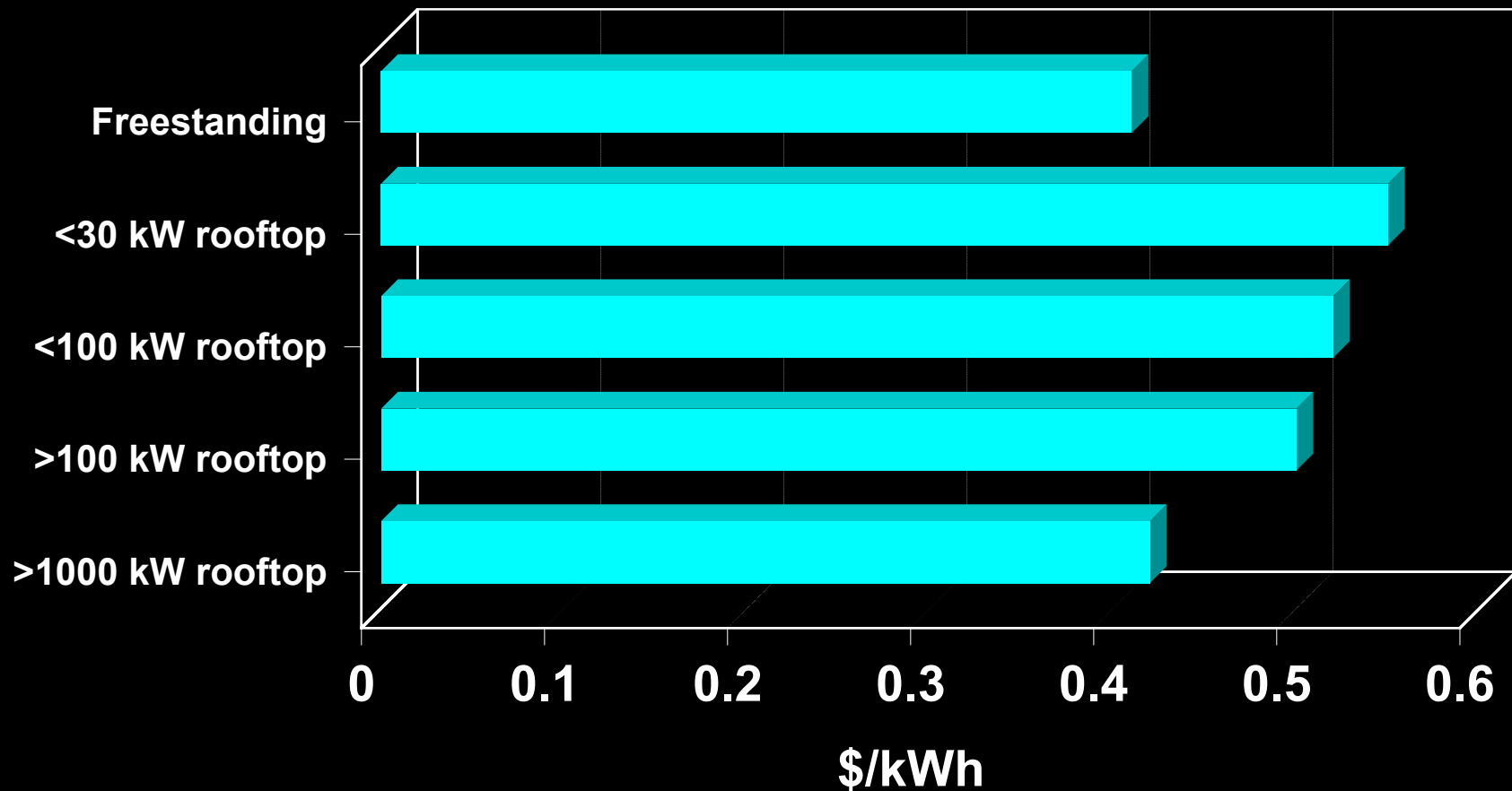
## Price Differentiation

- For Different Technologies
- For Different Applications
- For Different Sizes
- For Different Regions
- For Different Resource Intensities

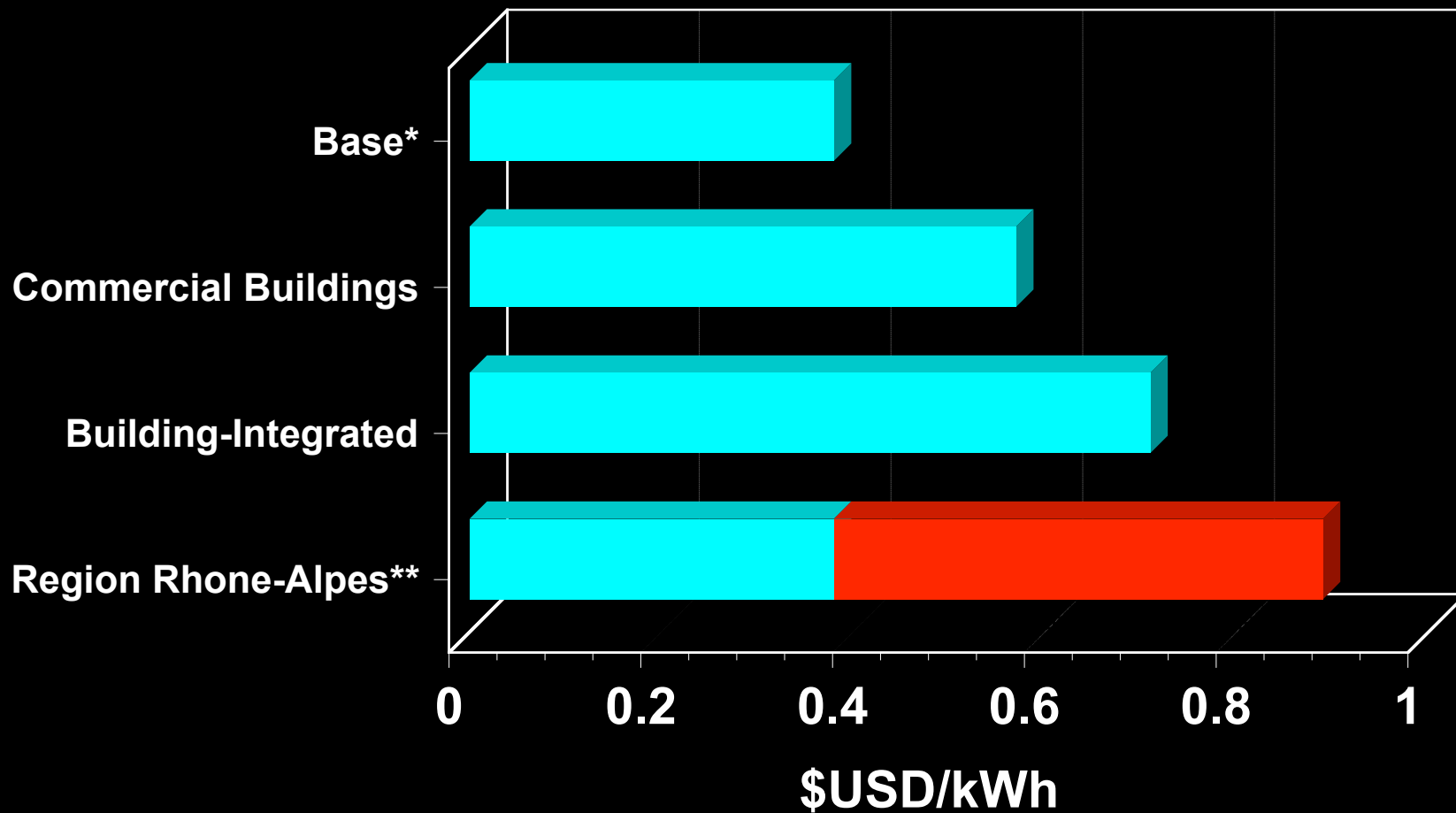
Paul Gipe, [wind-works.org](http://wind-works.org)



# German Solar PV Tariffs 2009



# French Solar PV Tariffs



\*Plus 50% tax credit on hardware.

\*\*Regional Tariff Term: 6 years.

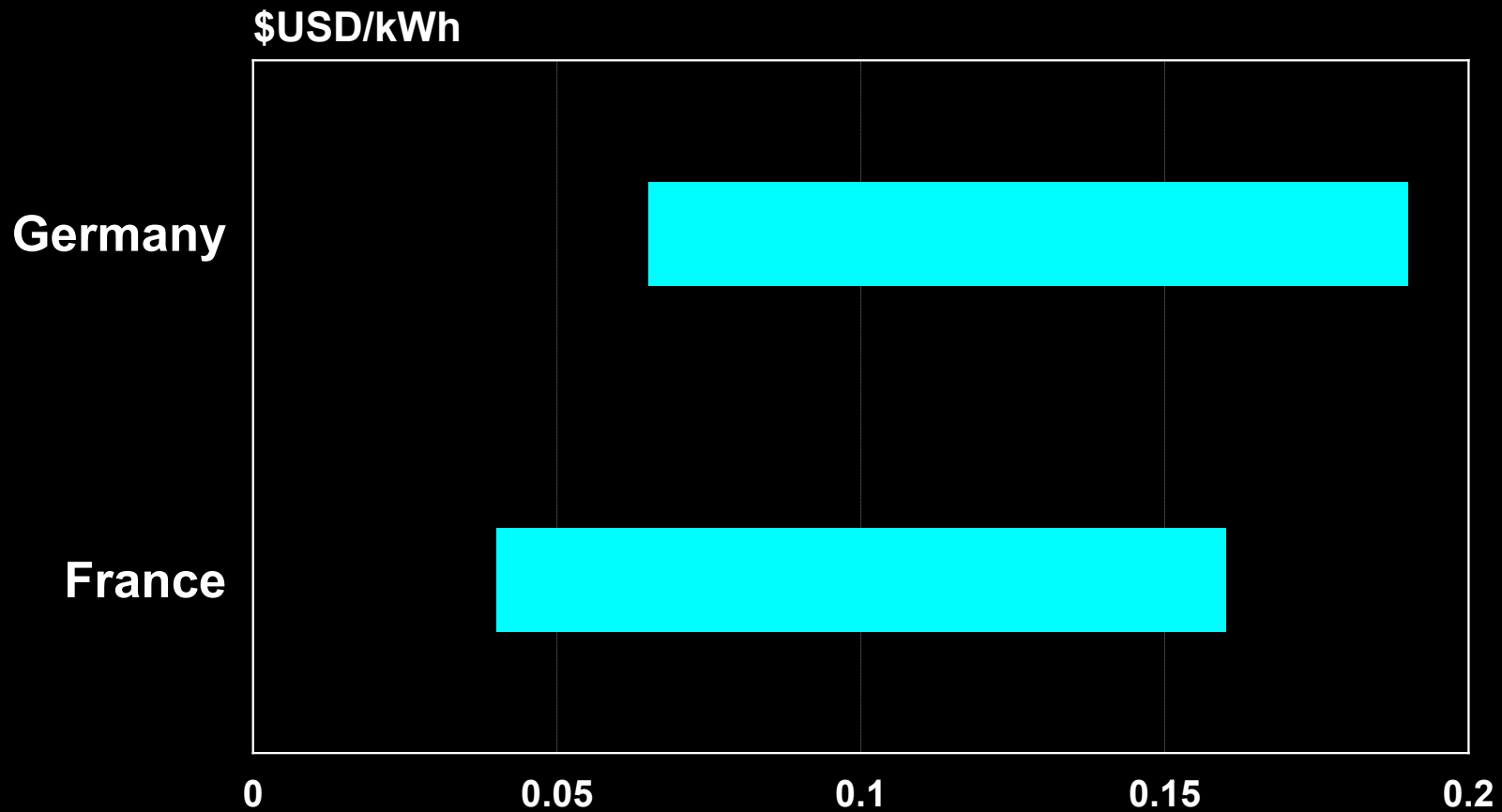
Paul Gipe, wind-works.org

# Prices Paid for Wind Energy in Europe

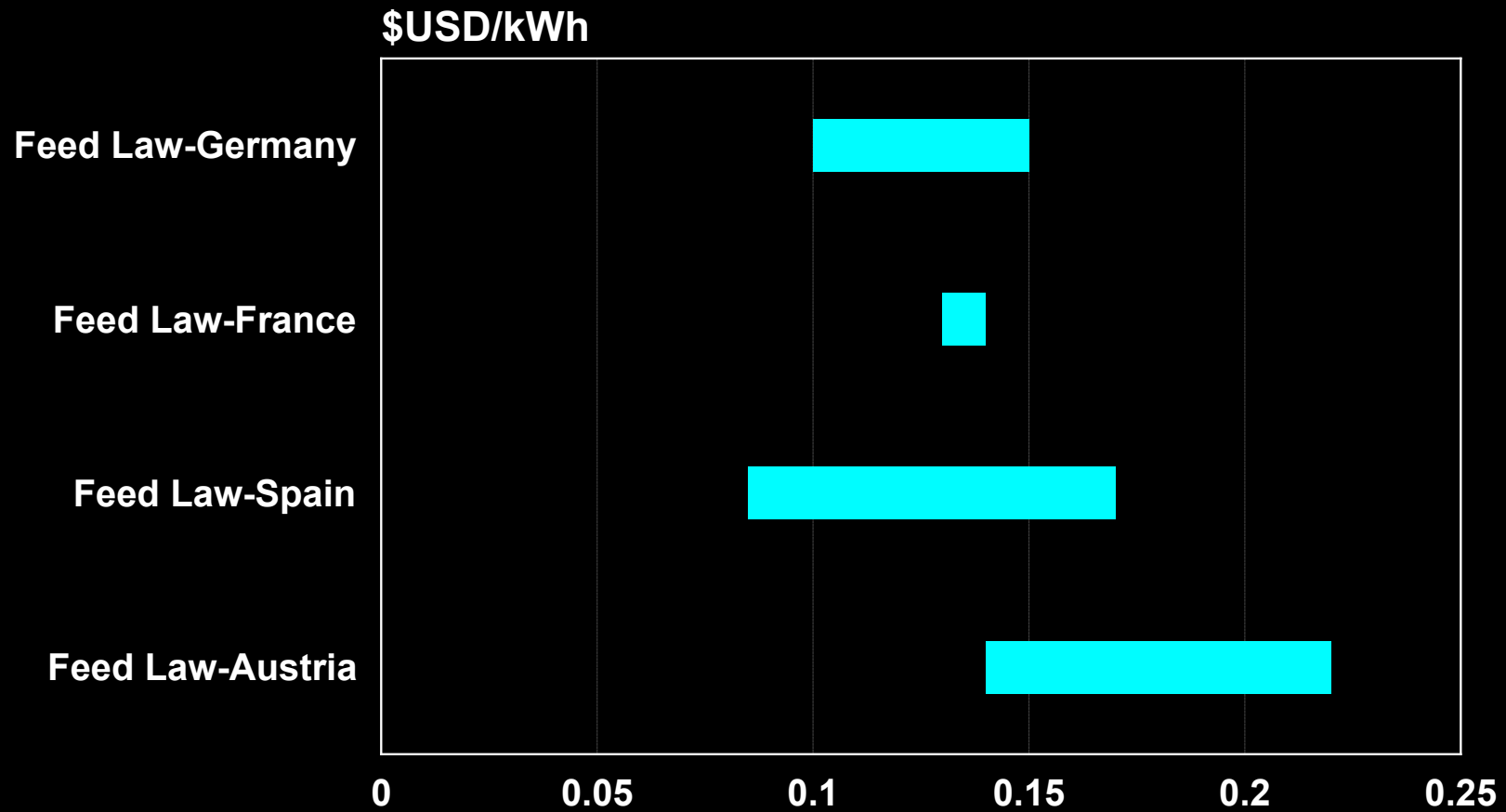


2009

# Prices Paid for Offshore Wind Energy in Europe



# Prices Paid for Biomass in Europe





# **Renewable Tariff Design Price Regulation**

- **Provides Predictable Results**
- **Provides Rapid Results**
- **Provides Opportunity for All Players**  
    **. . . And For All Technologies**
- **Provides Opportunity Geographically**
- **Provides Dispersed Wind Development**

**From Bernard Chabot, ADEME**

# Differentiated Tariffs for Wind

- **Distributed Benefits**

Only Accrue From Distributed Generation

Differentiated Tariffs = Distributed Wind

- **Reduces Pressure on Windiest Sites**

Profitability Still Higher at Windy Sites

- **Reduces NIMBYism**

By Enabling Greater Participation

Paul Gipe, [wind-works.org](http://wind-works.org)

San Geronio Pass, California



# Differentiated Tariffs for Wind

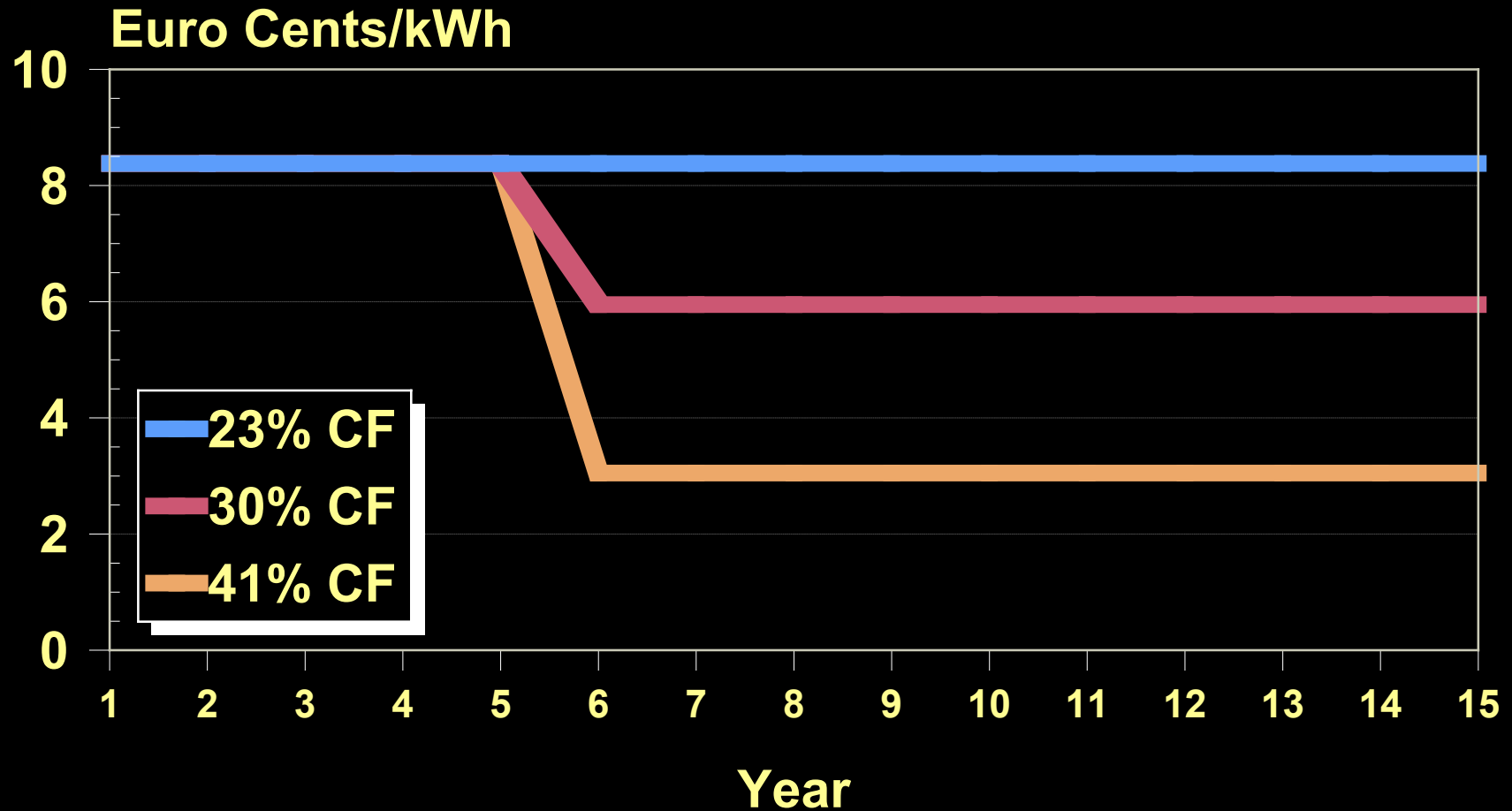
- **Increases Program Flexibility**
  - Lessens Pressure to Get Prices Right the First Time
- **Reduces Development Risk**
  - Determining Final Price After 5 Years of Operation
- **Spreads Opportunity to All**
  - Not Just to Elite Few
- **Provides Fair Profits at Modest Wind Sites**
- **Limits "Excessive Profits" at Windy Sites**

# French Wind Tariffs

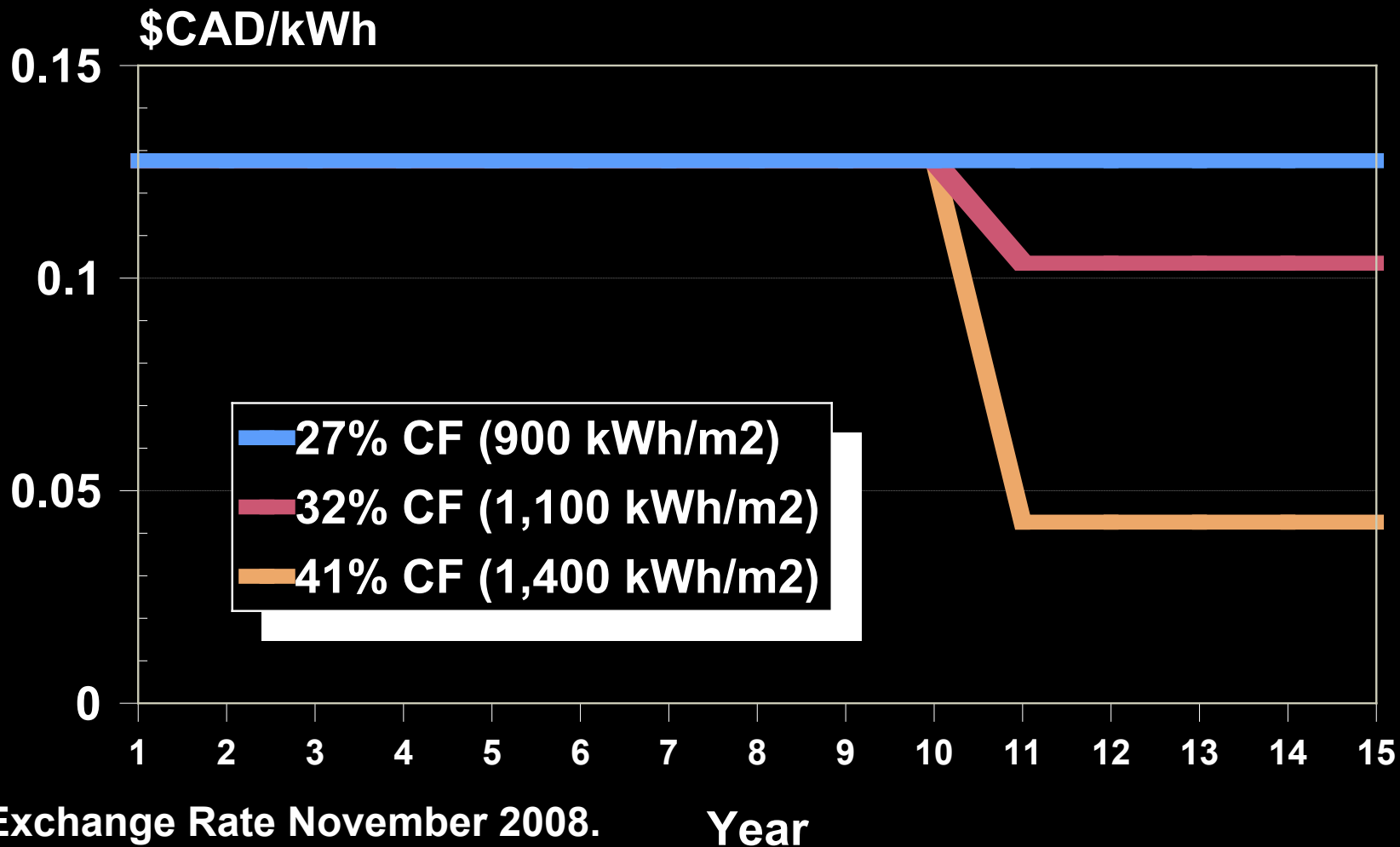
## Resource Productivity Method

- Fair Profits at Medium Wind Sites
- Not “Undue” Profits at Windy Sites
- Price Adjusted for Inflation 60%
- Profitability Index Method (Chabot)

# French Wind Tariffs Pre-2006 Average Price vs Initial Price



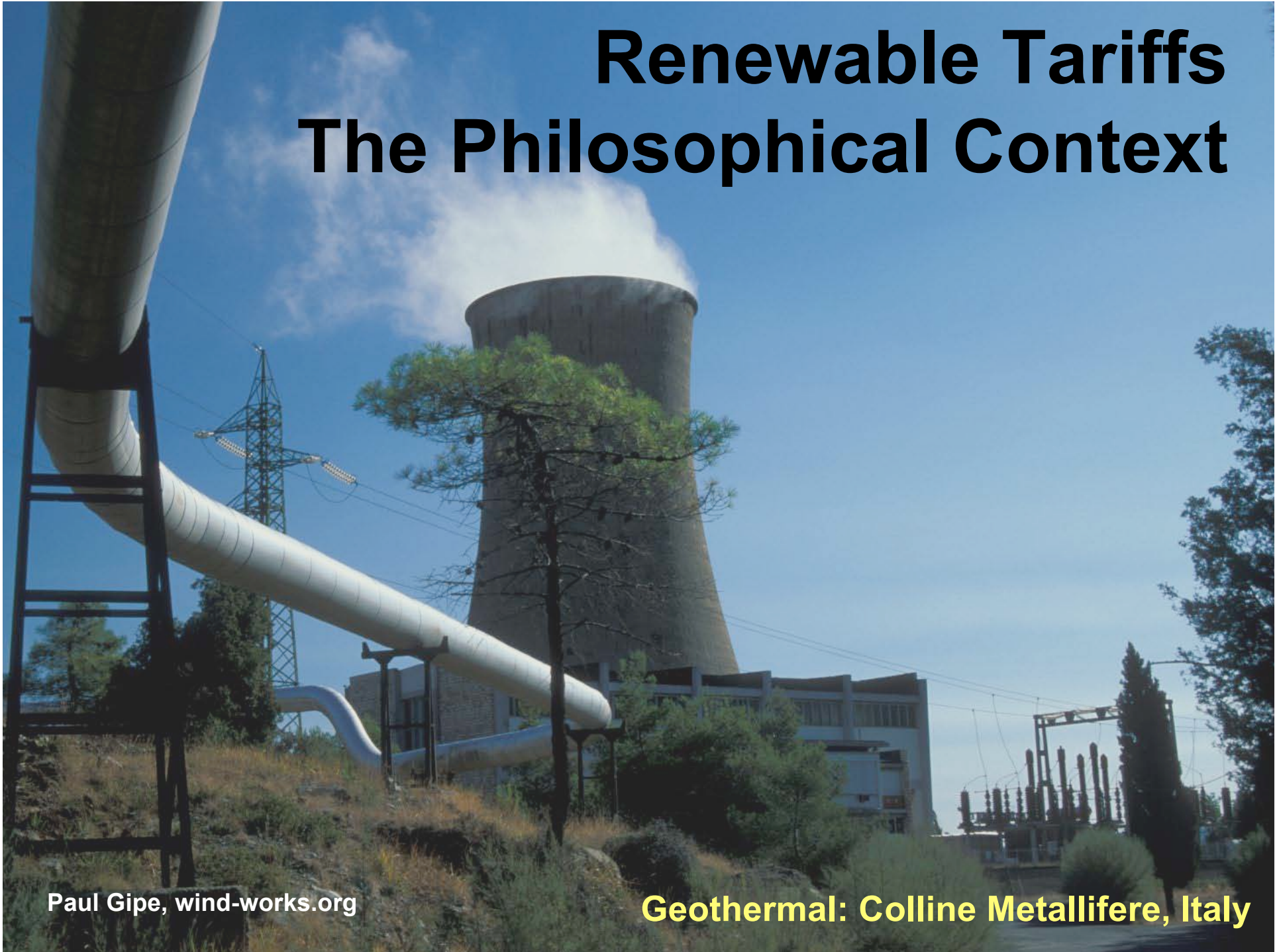
# French Wind Tariffs 2006



# Renewable Tariffs The Philosophical Context

Paul Gipe, [wind-works.org](http://wind-works.org)

**Geothermal: Colline Metallifere, Italy**



# Do We Want Renewables?

- Peak Oil, Peak Gas
- Climate Catastrophe  
Europe, 2003: 52,000 Dead
- Public Support High  
at Level Not Seen in 20 Years
- Desire for New Jobs



# If Yes, Then What Works Best?

- **Who Gets Contracts (PPAs)**  
Elite Few or All Who Want Them?
- **How To Pay For Them**  
RECs/ROCs/Green Tags  
Subsidies (PTC, EcoEnergy)  
Advanced Renewable Tariffs

# 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  
Margin Determines Rate of Growth
- High or “Premium” Prices Deliver  
More Generation More Quickly and More Jobs



# Market Mechanism Status

- **Quotas (RPS & Tendering)**

  - Typically Anglophone Countries
  - Timid Targets Seldom Met

- **Renewable Tariffs**

  - Typically Non-Anglophone Countries
  - Aggressive Targets

# Aggressive Targets Require Aggressive Measures

Ferndale, Ontario

## German Renewable Energy Targets

	2010	2020	2030
Electricity	12.5%	27%	45%



# Myths to Dispel

- **Renewables are Free or Cheap**  
But They Are Affordable & Worth It
- **Feed-in Tariffs Too Expensive**
- **Feed-in Tariffs Not Market Mechanism**

Paul Gipe, [wind-works.org](http://wind-works.org)

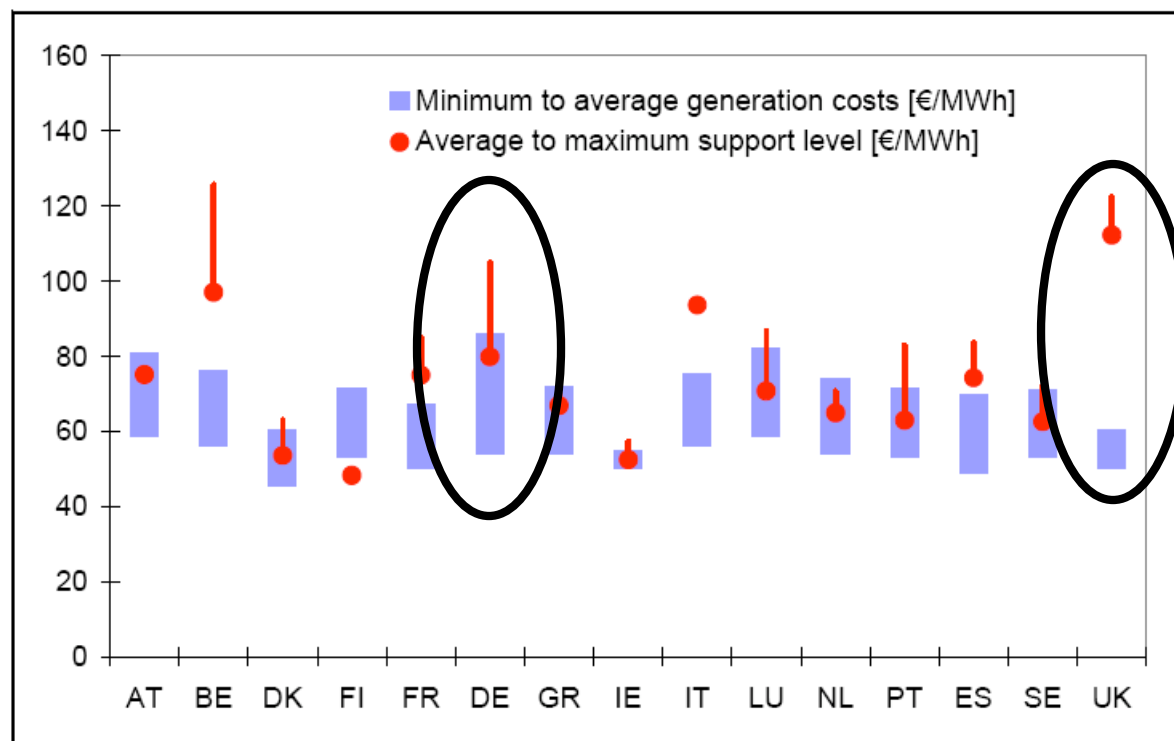
Husum, Germany

# Political Price-Political Quantity Market Mechanisms

	Price	Quantity
Feed Law	Political	Market
Quota/RPS /Tendering	Market	Political

**Both are Market Mechanisms**

# EU Policy Mechanisms



**Figure 4:**  
Price ranges (average to maximum support) for direct support of wind onshore in EU-15 Member States (average tariffs are indicative) compared to the long-term marginal generation costs (minimum to average costs). Support schemes are normalised to 15 years.

# **Stern Climate Change Review**

**“ . . . Comparisons between . . . tradable quotas and feed-in tariff price supports suggest that feed-in mechanisms achieve larger deployment at lower costs . . . ”**

**“ . . . analysis suggests that competition is greater . . . ”**

STERN REVIEW: The Economics of Climate Change, Chapter 16: Accelerating technological innovation, [http://www.hm-treasury.gov.uk/media/9A3/57/Ch\\_16\\_accelerating\\_technological\\_innovation.pdf](http://www.hm-treasury.gov.uk/media/9A3/57/Ch_16_accelerating_technological_innovation.pdf), ISBN number: 0-521-70080-9, page 366, 2006.



# IEA: Quota & Feed-in Tariff Cost of European Wind (2005)

	USD/kWh
Quotas & TGC	0.13-0.17
Feed-in Tariffs	0.09-0.011

Quotas & TGC: \$0.04-\$0.06/kWh more costly.

# Ernst & Young Germany and Britain Cost of Renewables (2006)

- Germany: 4x more energy generated
- Germany: @ 1/5 relative cost  
of GB Renewable Obligation Certificates

Paul Gipe, [wind-works.org](http://wind-works.org)

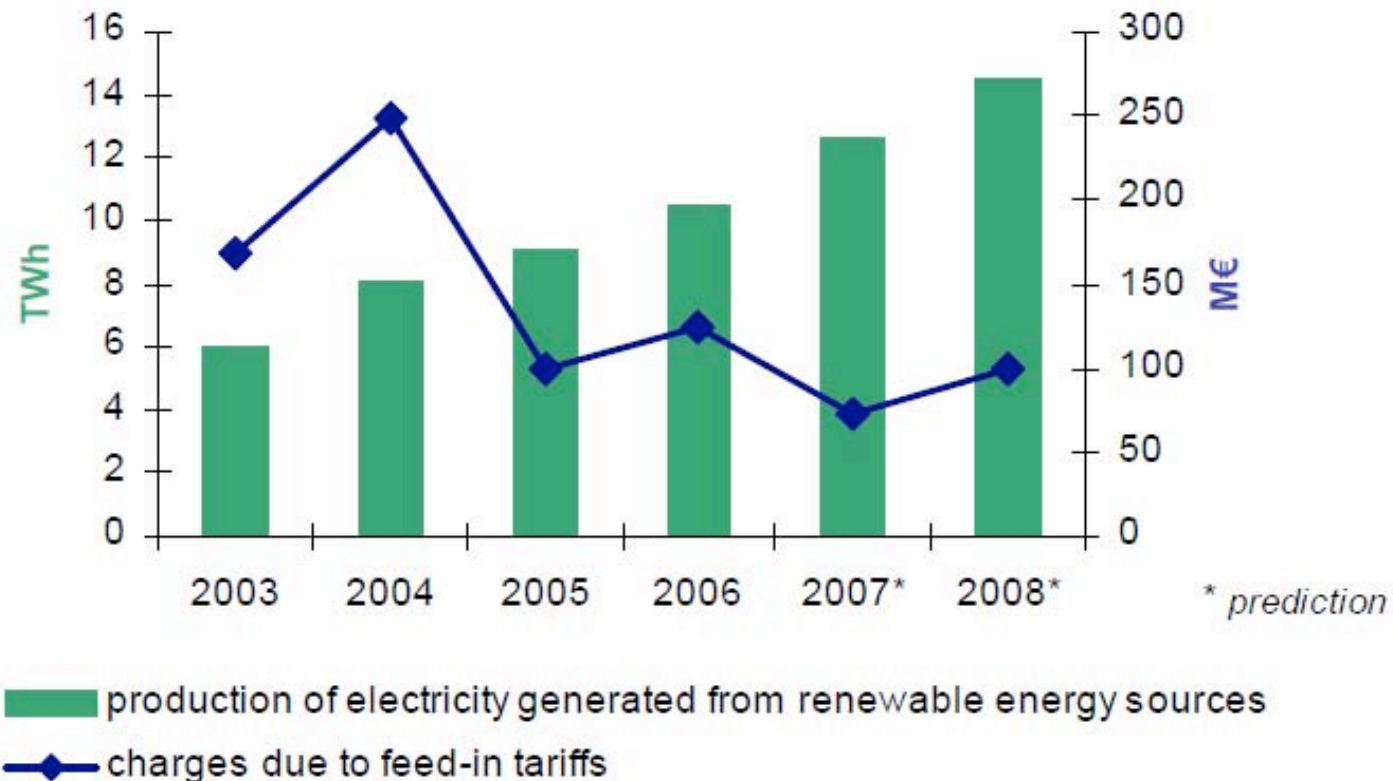
Eifel Highlands, Germany

# Cost of ARTs Relative to ROCs

	France	UK
<b>TWh 2006</b>	<b>10.5</b>	<b>12.9</b>
<b>Overcost (Million Euros)</b>	<b>124</b>	<b>611</b>
<b>CO2 Mitigation (Euros/t)</b>	<b>39.5</b>	<b>86</b>
<b>Overcost (Euros/kWh)</b>	<b>0.012</b>	<b>0.047</b>
<b>Relative Cost</b>	<b>0.25</b>	

# Over Cost of French ARTs Declining

Figure 9 – Amount of energy from renewable sources and costs linked to the feed-in tariffs



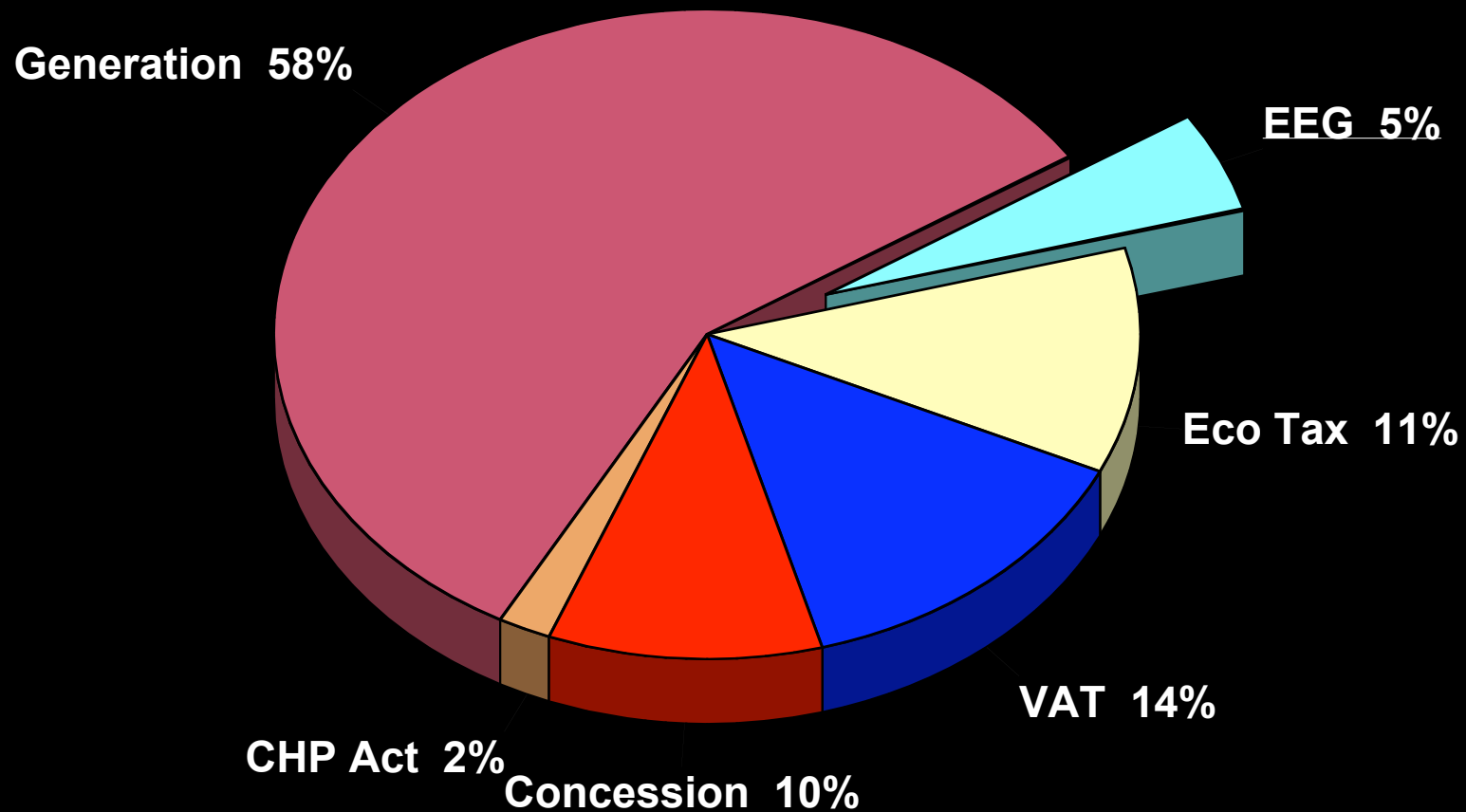
Source: Energy Regulation Commission, 2008, author's calculations.

Cécile Bordier, Caisse des Dépôts, Dec. 2008

Overcosts, 2008: ~0 due to increase in electricity costs. Bernard Chabot, Nov. 2008.

# Cost of German EEG (2007)

## ~\$50/yr/household



# Often Overlooked The Value of Predictability

- **Renewable Tariffs are Bankable**  
More Important Today Than Ever!
- **Renewable Tariffs Provide Stable & Predictable Income Streams**

Paul Gipe, [wind-works.org](http://wind-works.org)

Wieringermeer Polder, the Netherlands



# Barriers to Renewable Tariffs

- **Philosophical: Cost vs Value**  
Cost of Generation Plus Fair Profit
- **Sticker Shock**  
Imbedded Costs of Heritage (Old) Resources  
Natural Gas: Future Cost?  
Nuclear: Cost Estimates & Reality
- **Unfamiliarity**
- **Tax Subsidies Distort Market**  
Complicate Program Design

# Challenges in North America

- **Piecemeal Policy Approach**

Too Slow

Existing Policy Momentum

RPS for Wind, Subsidies for Solar

- **“Cheap Energy Contract”**

Cheaper Today

--More Expensive Tomorrow





# Renewable Tariffs in North America .. Unthinkable?

- **Yes--Just 4 years ago**  
    **“You’re Absolutely Nuts!”**
- **Today? No**
- **Now Possible**
- **Growing Trend**  
    **in both USA & Canada**

Paul Gipe, [wind-works.org](http://wind-works.org)



Gaspé, Quebec

# Market Mechanisms Status

- Renewable Tariffs Developing Momentum

Paul Gipe, [wind-works.org](http://wind-works.org)

Montjoyer, France

# The Mood Has Changed

- Ontario Moved First



Paul Gipe, [wind-works.org](http://wind-works.org)

Montfort, Wisconsin

# Ontario's Standard Offer Program

The Most Progressive Renewable  
Energy Policy in North America  
in Two Decades



Paul Gipe, [wind-works.org](http://wind-works.org)

Goderich, Ontario

Toronto, Ontario

# Why?

- **All Renewables**  
First in North America
- **Open To All Players**  
First in North America
- **Differentiated Tariffs**  
Two (Solar & Everything Else)  
First in North America
- **Simplified Contracts**

Paul Gipe, [wind-works.org](http://wind-works.org)



# The “Ontario Model”

- **Adapted European Models to Ontario**

Examined German, French, Spanish Systems

- **Focused on Wind & Solar**

Hydro & Biomass Placeholders

- **OSEA Criteria**

Enabling Community Ownership

(Farmers, Homeowners, First Nations, Small Businesses)

- **Adapted French Wind Tariffs**

Used Specific Yield Not Capacity Factor

Used Chabot PIM to Determine Tariffs

# Why German & French System?

- **Enables Community Participation**  
More People Can Benefit
- **Broader Geographic Distribution**  
More People Can Benefit

Paul Gipe, [wind-works.org](http://wind-works.org)

Schauinsland, Baden-Württemberg, Germany

# Co-Op & Farmer-Owned Wind

	Farmer	Co-op	Corporate
<b>The Netherlands</b>	<b>60%</b>	<b>5%</b>	<b>35%</b>
<b>Germany</b>	<b>10%</b>	<b>40%</b>	<b>50%</b>
<b>Denmark</b>	<b>64%</b>	<b>24%</b>	<b>12%</b>
<b>Great Britain</b>	<b>1%</b>	<b>1%</b>	<b>98%</b>
<b>Spain</b>	<b>0%</b>	<b>0%</b>	<b>100%</b>

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



# Ontario's Standard Offer Program

- **<44kV, <10 MW**
- **Wind, Solar, Hydro, Biomass**
- **Inclusive--Open to All**
- **No Program Cap**



# Ontario's Standard Offer Program

- Wind, Hydro, & Biomass: \$0.11/kWh
- Solar PV: \$0.42/kWh
- Inflation Adjustment: 20%  
Except for Solar PV (Punitive?)
- 20-Year Contracts

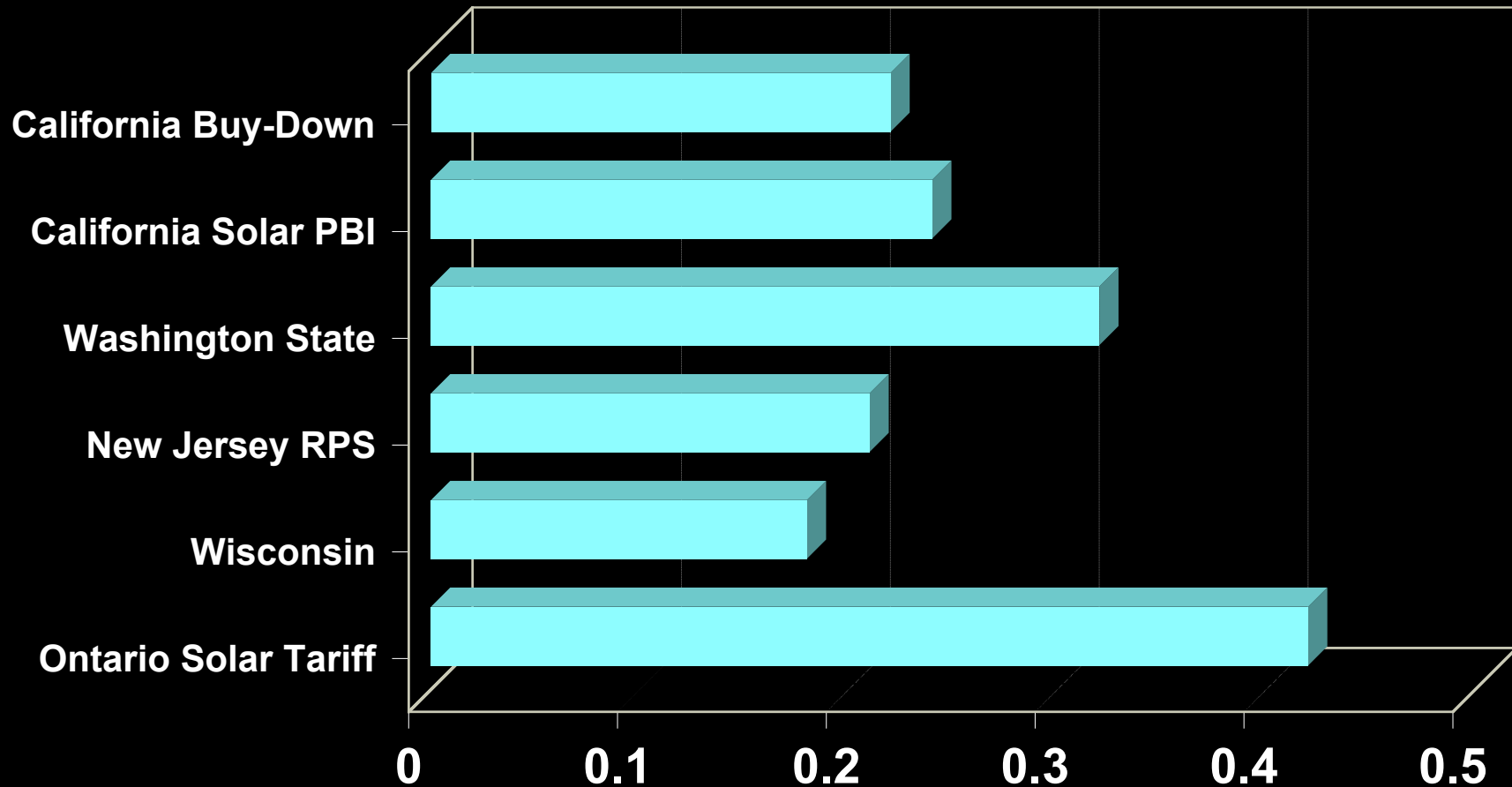
# Ontario's Standard Offer Program What's Next?

- Under Review (Green Energy Act)
- Revisiting
  - Prices
  - Price Differentiation
  - Differentiated Tariffs for Wind
  - Inflation Indexing (60%)
- Add Offshore Wind?
- Add Solar Thermal?  
\$0.14-\$0.25/kWh

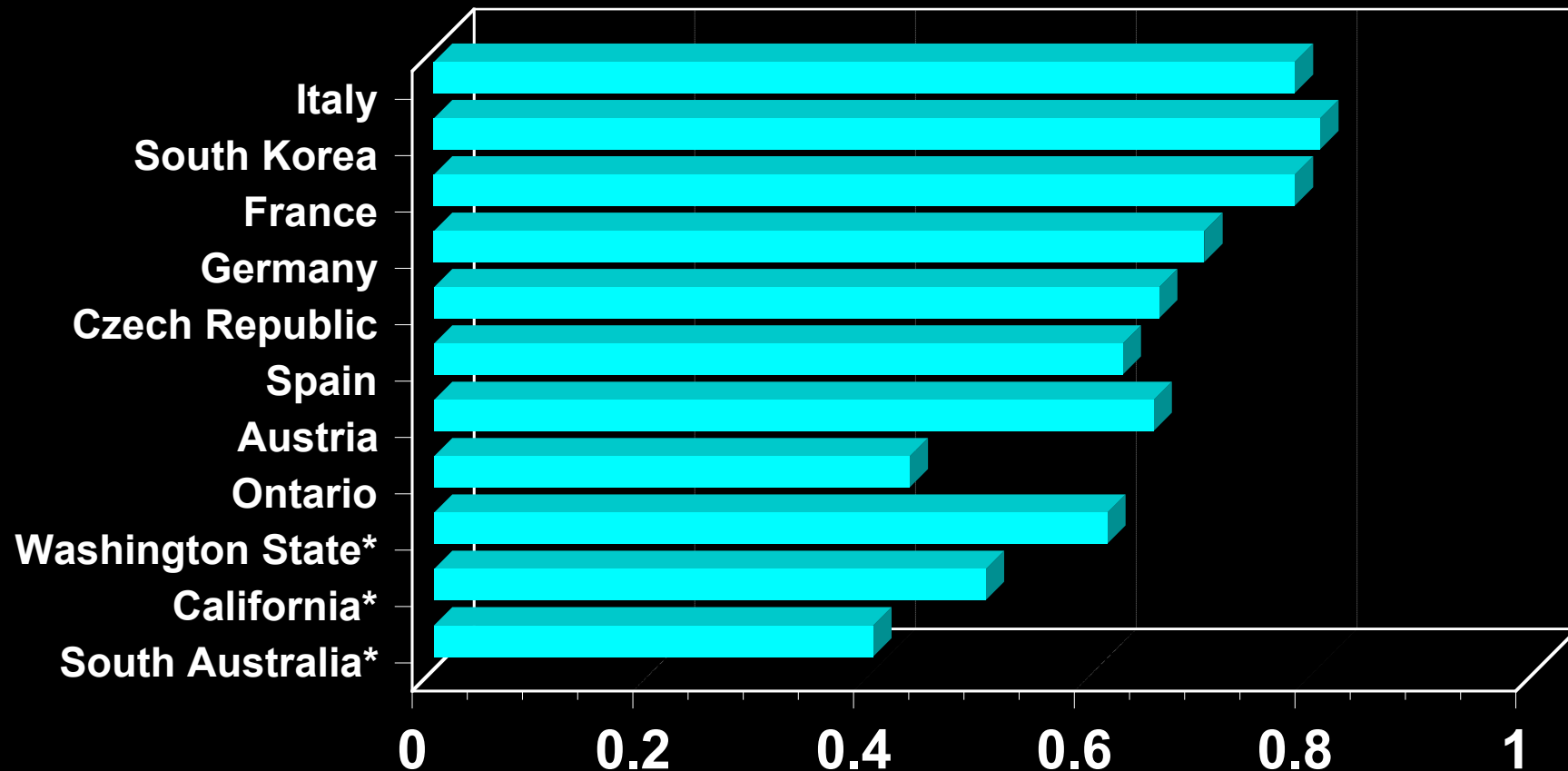


# Ontario Solar Tariff North American Comparison

\$ CAD/kWh Over 20 Years



# Solar PV Tariffs Worldwide



\*Limited duration with net-metering.

\$/kWh

# ARTs Feature Comparison

	Germany	France	Spain
ARTs	Yes	Yes	Yes
Cost-Based Tariffs	Yes	Yes	Yes
Program Limits	No	Yes	Yes
Term	20	15-20	25+
Inflation	No	Yes	Yes
Solar Tiers	5	5	3
Wind Offshore	Yes	Yes	No
Wind Tiered Tariffs	Yes	Yes	No
Wind Tiers	Continuous	Continuous	n/a
Community Power	Yes	Yes	No

# Grassroots Movement Has Begun

- **Explosion of Interest**
- **Groups Active Across Canada**
- **Local Groups Now Active Across US**  
Most Within the Past 12 Months!
- **Public Out in Front**  
Demands Aggressive Action
- **Tipping Point Reached?**

# **“Change” in the Air?**

- **Obama Elected**  
**Was Once Unthinkable**
- **CEC Recommends Feed-in Tariffs**  
**California May Move Quickly in 2009**
- **California Cities Now Considering**  
**Palm Desert, . . . Los Angeles?**
- **Gainesville, Florida Municipal Utility**  
**First True Solar PV Tariff in USA (March)**



Ferndale, Ontario

# Renewable Tariffs Are In Play

- British Columbia, New Brunswick
- Michigan, Illinois, Indiana!
- Minnesota & Rhode Island
- California--Feed-in Fever
- US House & US Senate

Paul Gipe, [wind-works.org](http://wind-works.org)



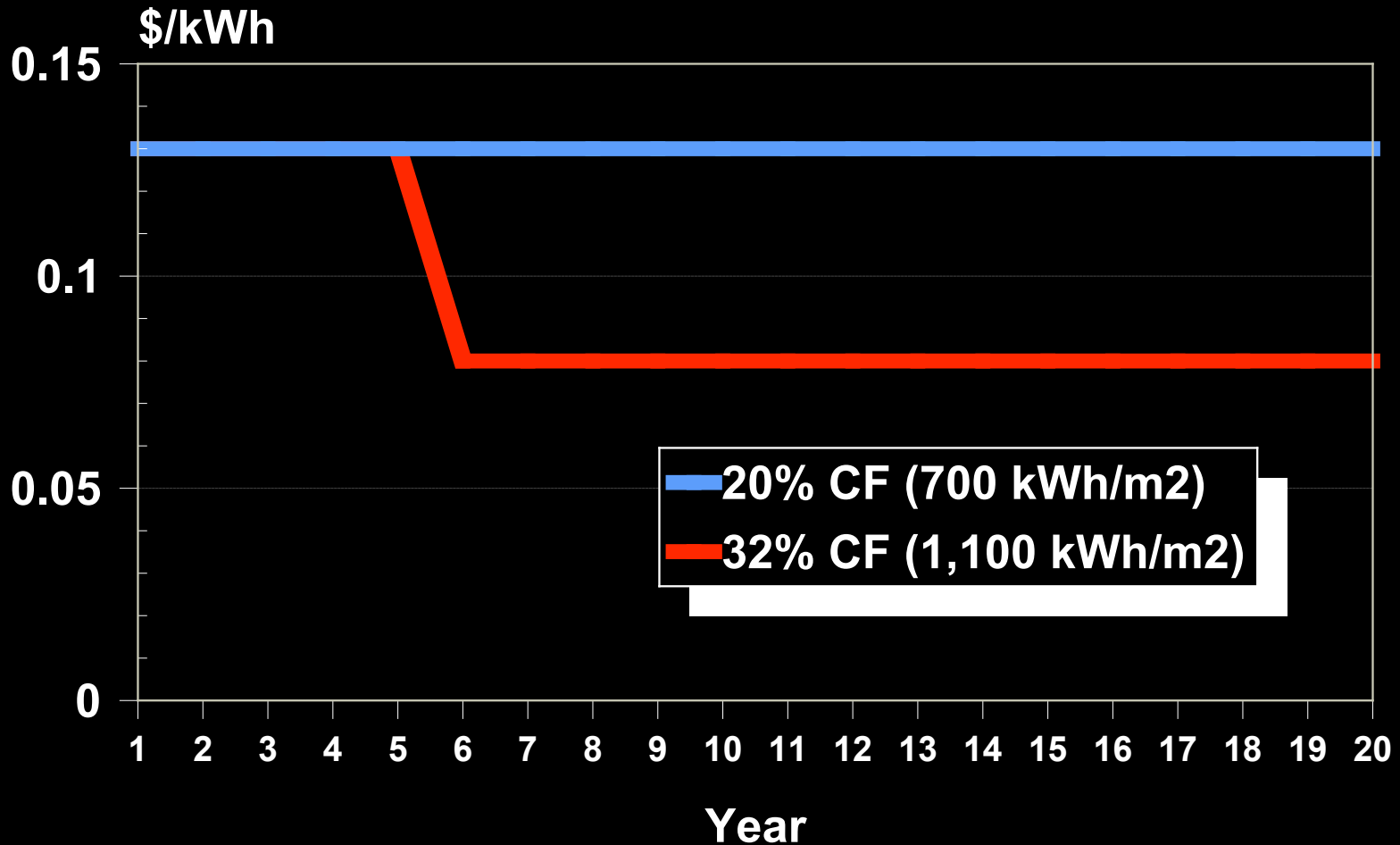
Mackinaw City, Michigan

# Michigan's Renewable Energy Sources Act

- **Reduce Price Volatility**
- **Reduce Long-Term Prices**  
**Pay Little More Now**  
**Avoid Paying More Later**
- **Reduce CO<sub>2</sub> Gases**
- **Create New Jobs**

Paul Gipe, [wind-works.org](http://wind-works.org)

# Midwest Wind Tariffs 2009



**Does Not Include Federal Production Tax Credit.**

# Midwest Solar PV Tariffs

<b>Project Size</b>	<b>\$/kWh</b>
<b>&lt;30 kW</b>	<b>0.50</b>
<b>&gt;30 kW&lt;100 kW</b>	<b>0.45</b>
<b>&gt;100 kW&lt;1,000 kW</b>	<b>0.40</b>
<b>&gt;1,000 kW</b>	<b>0.35</b>

**Includes Federal Investment Tax Credit.**

# Strategy--Operating in Parallel

- **Run Alongside Existing Programs**  
**With RPS & Solar Subsidies (ITC)**
- **Don't Disrupt Existing Markets**  
**We Need All RE As Quick As Possible**
- **Build Track Record**
- **Use Renewable Tariffs**  
**for Meeting RPS Targets**

# Strategy--Hybrids

- **Domestic Content Requirement?**  
Washington State
- **Distributed Generation Only?**  
Voltage Caps?
- **Project Size Caps?**  
20 MW (California)-50 MW (Spain)
- **Community Ownership**  
Minnesota, New Brunswick





# Move From A Culture of Consumption to A Culture of Conservation

--Ontario Premier Dalton McGuinty

Paul Gipe, [wind-works.org](http://wind-works.org)

Montfort, Wisconsin

# Feed-in Tariffs

**“Turn farms, homes, and businesses into entrepreneurs”**

**--Terry Tamminen, Former Chief Policy Advisor to Governor Arnold Schwarzenegger**

Paul Gipe, [wind-works.org](http://wind-works.org)

Goderich, Ontario







# Move From A Nation of Consumers to A Nation of Producers

Paul Gipe, [wind-works.org](http://wind-works.org)

Lackawanna, New York

**“Nothing is as powerful as an idea  
whose time has come.”**

**-- Victor Hugo**

\*Loose translation of “On résiste à l'invasion des armées; on ne résiste pas à l'invasion des idées.

Paul Gipe, [wind-works.org](http://wind-works.org)

A photograph of a geothermal plant in Mammoth Hot Springs, California. The plant features several large, rectangular solar collectors or heat exchangers arranged in rows. In the background, there are large, rugged mountains under a clear blue sky. The foreground shows some trees and a road.

# California Lt. Governor Garamendi

**“We know what works. Seems to me we use what works.”\***

**\*Lt. Governor John Garamendi, GACC, San Francisco, CA, 2008.**

**Geothermal Plant, Mammoth Hot Springs, California**

**Paul Gipe, [wind-works.org](http://wind-works.org)**

Gaspé Peninsula, Quebec

# No Time for Half-Measures

## No Time to Lose

Paul Gipe, [wind-works.org](http://wind-works.org)



# We Need A Lot More Wind . . .

Matane, Quebec



Paul Gipe, [wind-works.org](http://wind-works.org)

Hinesburg, Vermont

# . . . And A Lot More Solar



Paul Gipe, [wind-works.org](http://wind-works.org)

# A Challenge Worthy of Great Nations

Paul Gipe, [wind-works.org](http://wind-works.org)

Vestas V110, Denmark



# Renewable Tariffs-- New Policy Option for North America

[www.wind-works.org](http://www.wind-works.org)

Manawatu Gorge, New Zealand

