Onshore Wind's Essential Role in the Renewable Energy Revolution

by

Paul Gipe
Renewable Energy Has Come of Age

Paul Gipe, wind-works.org

Noordoostpolder, The Netherlands
World Wind Capacity 2011
~230,000 MW

- Europe: 41%
- Asia: 36%
- North America: 22%
- Africa: 0%
- South America: 1%
2011 World Major Wind Markets

Thousands MW

- China: 65
- USA: 49
- Germany: 31
- Spain: 23
- India: 17

Paul Gipe, wind-works.org
World Solar PV Capacity 2011
~65,000 MW

- Germany*: 36%
- Spain*: 7%
- Japan: 7%
- USA: 6%
- Italy*: 19%
- China*: 6%
- France*: 3%
- Czech Republic*: 3%
- Rest of World: 13%

More than 3/4 from Feed-in Tariffs

Paul Gipe, wind-works.org
Germany’s Renewable Mix

- **Wind & Solar Mid-2012**
  - Wind: ~30,000 MW
  - Solar: ~30,000 MW

- **Yields ~2X Higher with Wind**
  - Wind: ~1,800 kWh/kW/yr
  - Solar: ~900 kWh/kW/yr
Daily “Smoothing” Wind & Solar

Average Daily Productivity Ratios in 2012
Wh/W.day (hour/day at rated power). Source of data: EEX

Bernard Chabot, www.renewablesinternational.net, 10 August 2012
Paul Gipe, wind-works.org
Wind or Solar? Mix is Best

- Intuitive: Wind & Solar Together Better than Each Alone
- Now We Have the Data Due to Germany
- Very Strong Daily “Smoothing”
- Extremely Strong Monthly “Smoothing”

Or, the Variability of Wind & Solar is Less Than the Variability of Wind & Solar Alone

Paul Gipe, wind-works.org
What is Optimum Mix?

• We Don’t Know
  Varies with Nation and Load Profile

• Winter Peaking Systems
  More Wind Than Solar
  Wind Peaks in Winter

Schauinsland, Germany

Paul Gipe, wind-works.org
What Does This Mean?

• Not Less Solar
• But More Wind
• Especially More Wind on Land
Offshore Wind

• Important?
  Yes--But No Panacea

• Essential?
  No

• High Risk, High Cost
  Germany: 1.7X Onshore Tariff

• Long Lead Times

Image: Google Earth
Paul Gipe, wind-works.org
Middelgrunden, Denmark
Germany’s 2020 Targets

• 52,000 MW Solar?
  World Leading--Can Easily Be Met

• 46,000 MW Wind?
  Insufficient Relative to Solar

• 36,000 MW Wind On Land?
  More Wind on Land Needed
  Growth Must Quicken
  Need Public’s Support

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Increasing Acceptance: Rule #1

Your Own Pigs

. . . Don’t Stink

Morbach, Rheinland-Pfalz, Germany

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Community Ownership

• Greater Acceptance
• More Power More Quickly
• More Money Locally
• More Jobs Locally
• More Democratic
Germany’s Most Important Export?

• Not Cars
• Not Machine Tools
• It is Energy Revolution!

Paul Gipe, wind-works.org Rockenhausen, Germany
Germany’s Most Important Export the Energiewende!

• German Intellectual Influence
  Science, Engineering, Philosophy . . .
• That It Can Be Done
• The Renewable Policy to Do It--the EEG
• The Data to Prove It Works
• Germany’s “Can Do” Attitude

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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
A Challenge
Worthy of All Great Nations

Paul Gipe, wind-works.org
Vestas V110, Denmark
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
A Lot More Renewable Energy Technology for Life*

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

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Renewable Energy

The Revolution Has Begun!

www.wind-works.org

Manawatu Gorge, New Zealand