

Beyond Biofuels: Renewable Energy Opportunities for US Farmers

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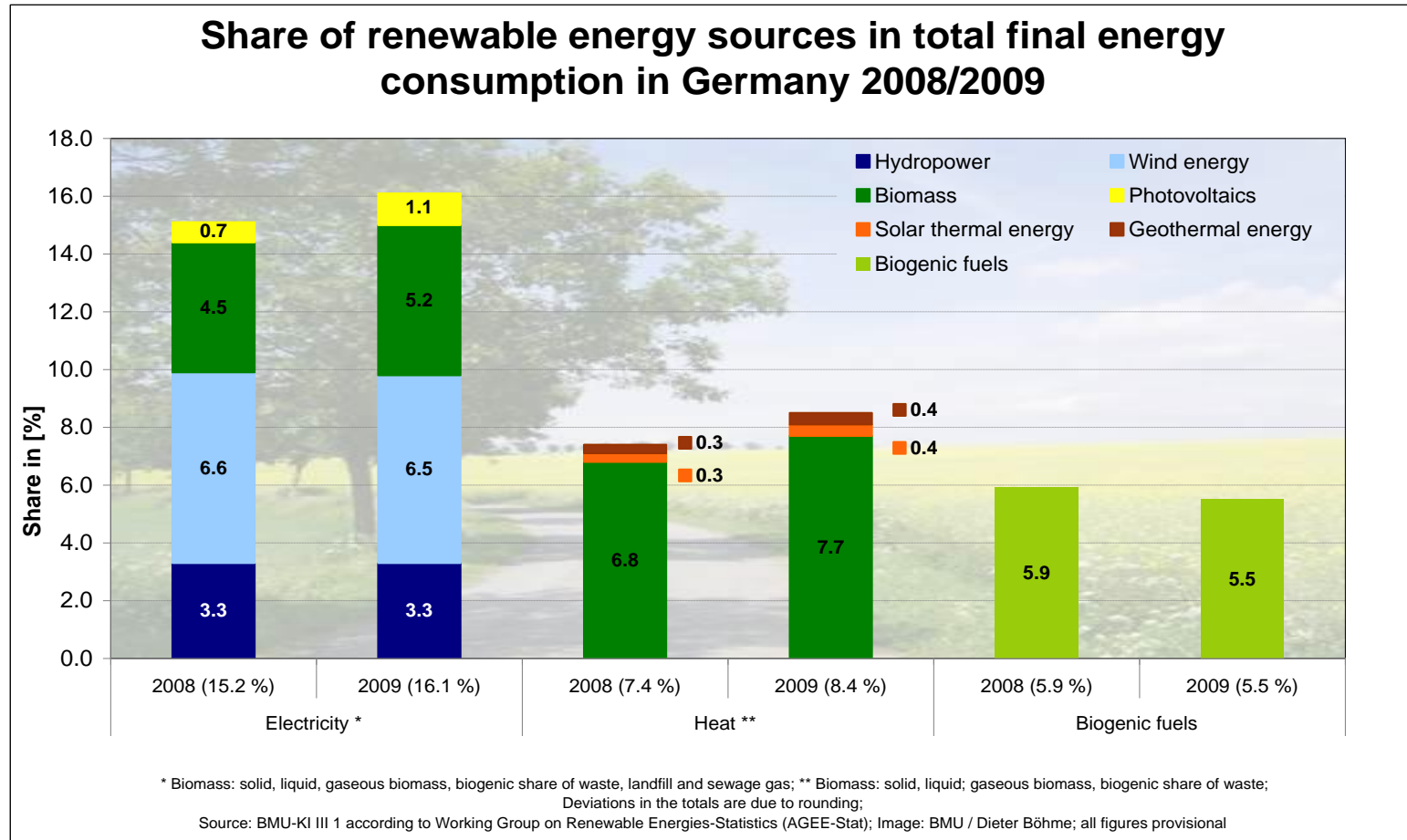
Part 1: How German Farmers Harvest the Fields, the Wind and the Sun



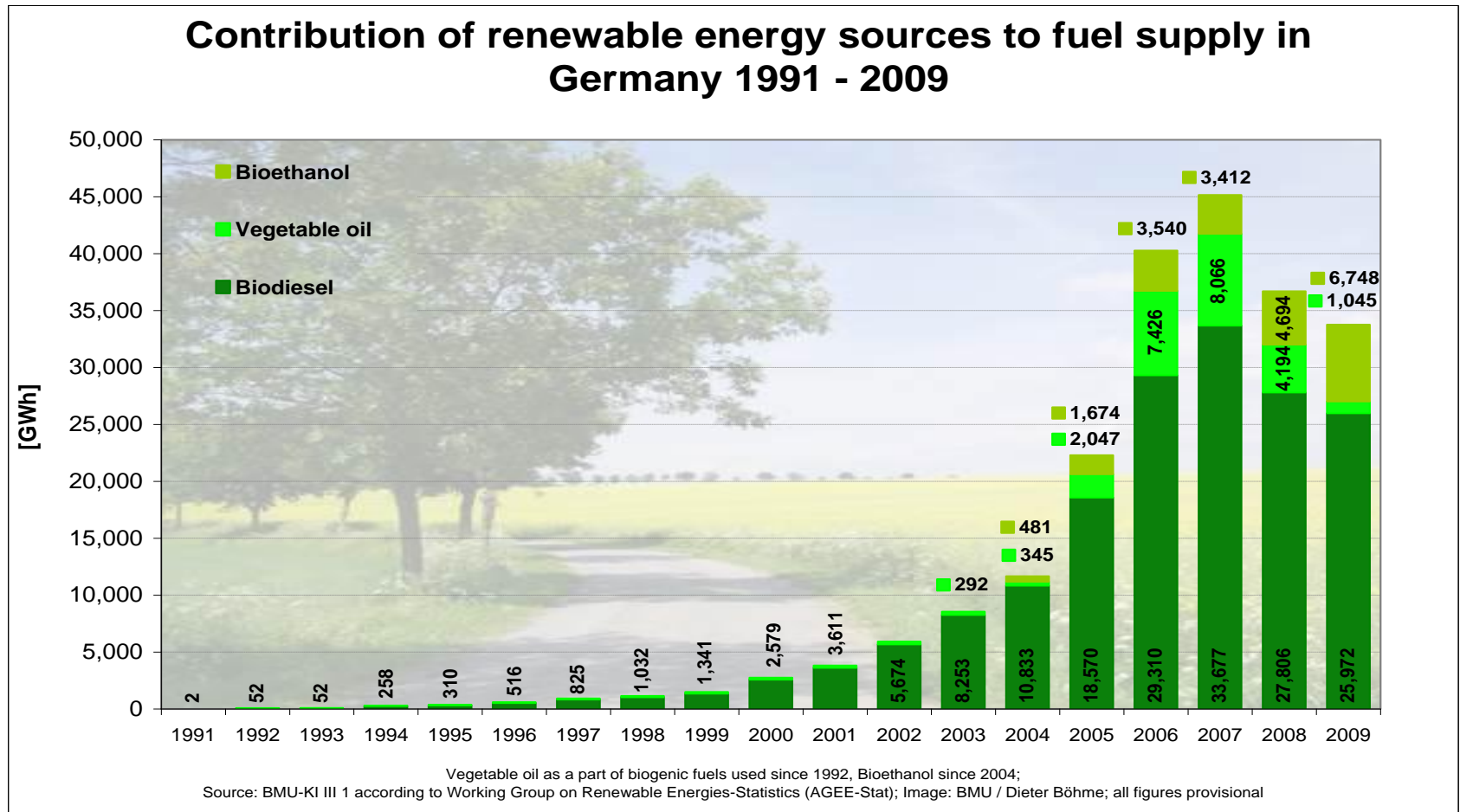
Why is Germany moving aggressively towards renewable energies?

1. Fighting climate change
2. Global markets for green technologies
3. New and well-paying jobs
4. Energy security (e.g. Russian natural gas)

Germany – renewables across all sectors

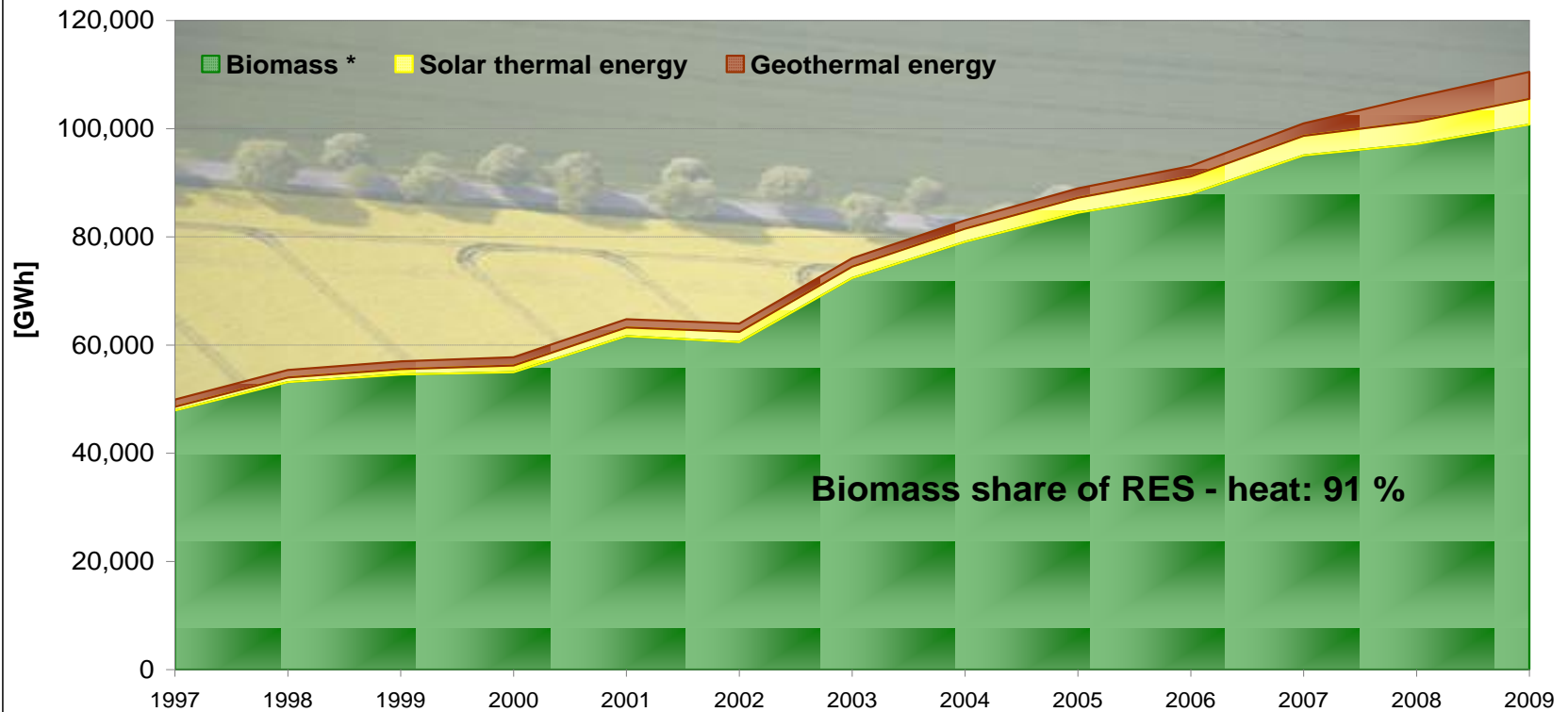


Germany – renewables for transport



Germany – renewables for heating

Contribution of renewable energy sources to heat supply in Germany 1997 - 2009



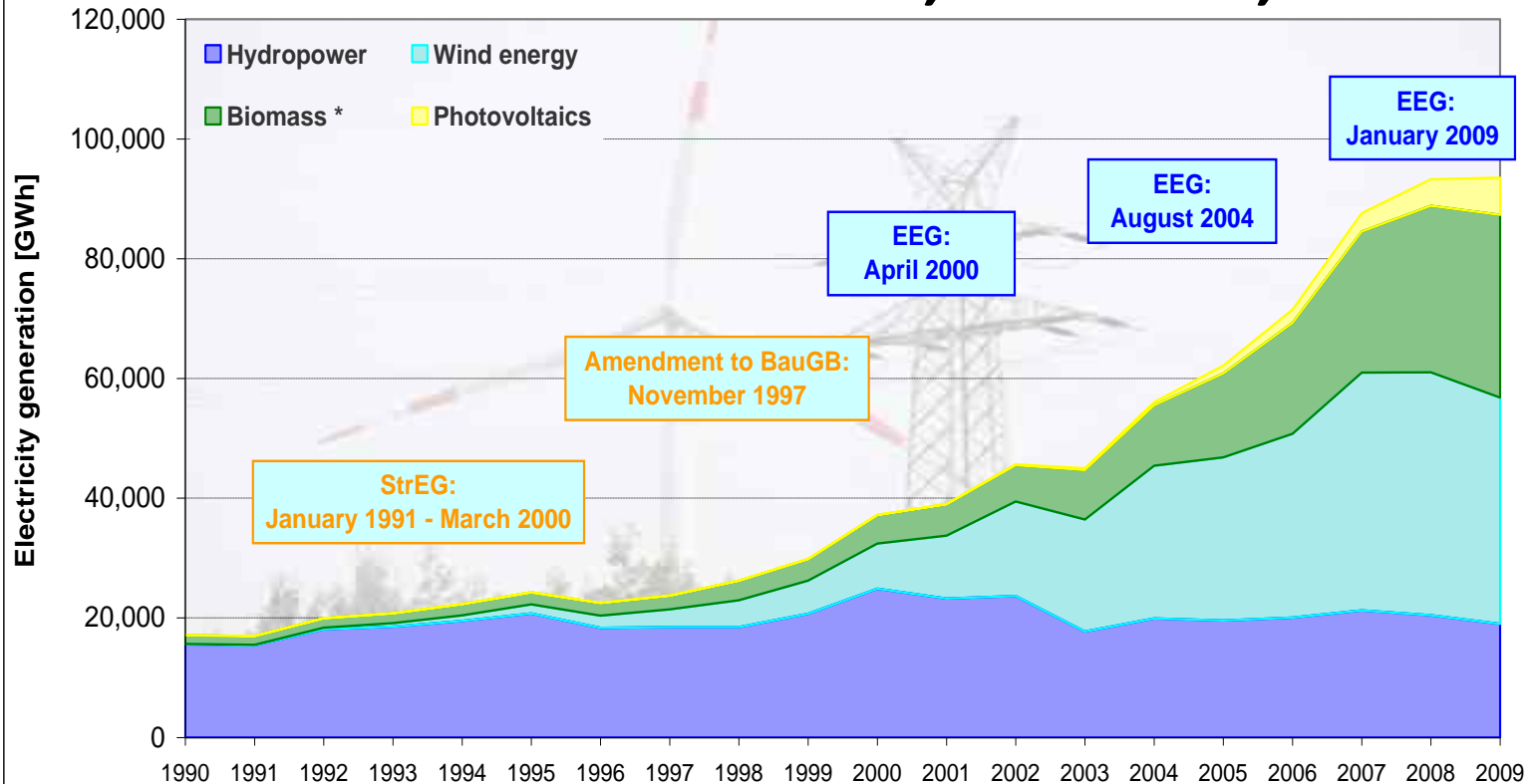
Biomass share of RES - heat: 91 %

* Solid, liquid, gaseous biomass, biogenic share of waste, landfill and sewage gas;

Source: BMU-KI III 1 according to Working Group on Renewable Energies-Statistics (AGEE-Stat); Image: BMU / Brigitte Hiss; all figures provisional

Germany: renewable electricity

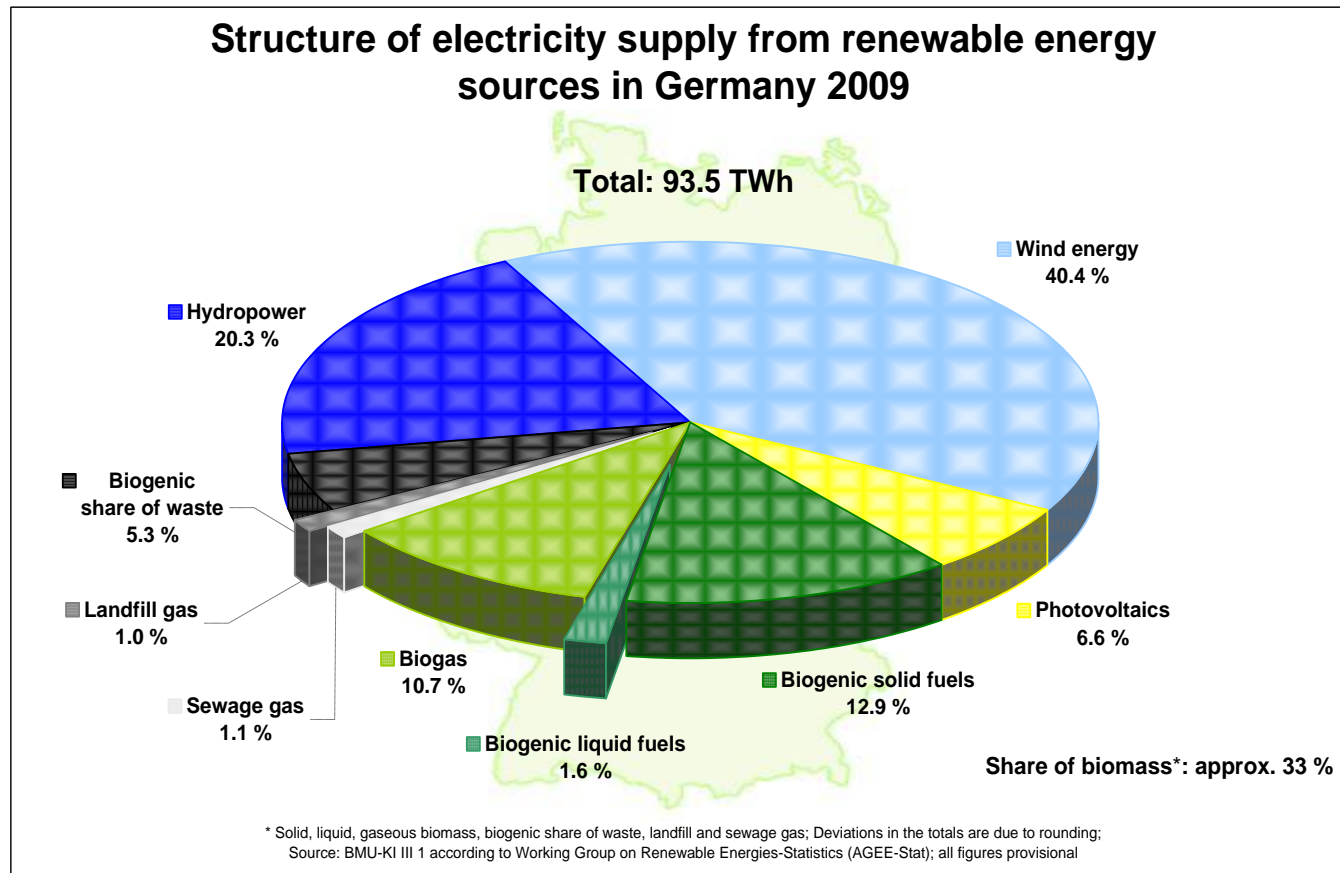
Feed-in tariffs drive wind, biomass, solar



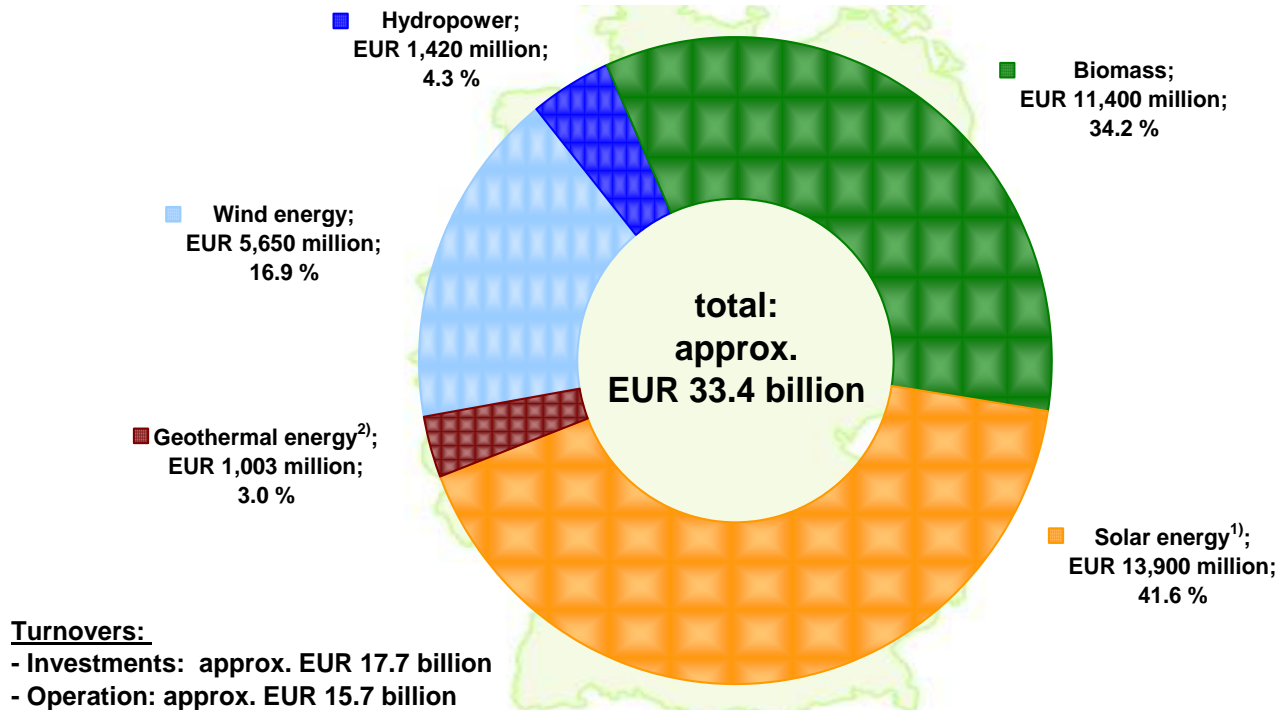
* Solid, liquid, gaseous biomass, biogenic share of waste, landfill and sewage gas;

Electricity from geothermal energy is not presented due to the negligible quantities of electricity produced; StrEG: Act on the Sale of Electricity to the Grid; BauGB: Construction Code; EEG: Renewable Energy Sources Act; Source: BMU-KI III 1 according to Working Group on Renewable Energies-Statistics (AGEE-Stat); Image: BMU / Christoph Edelhoff; all figures provisional

Germany: renewable electricity

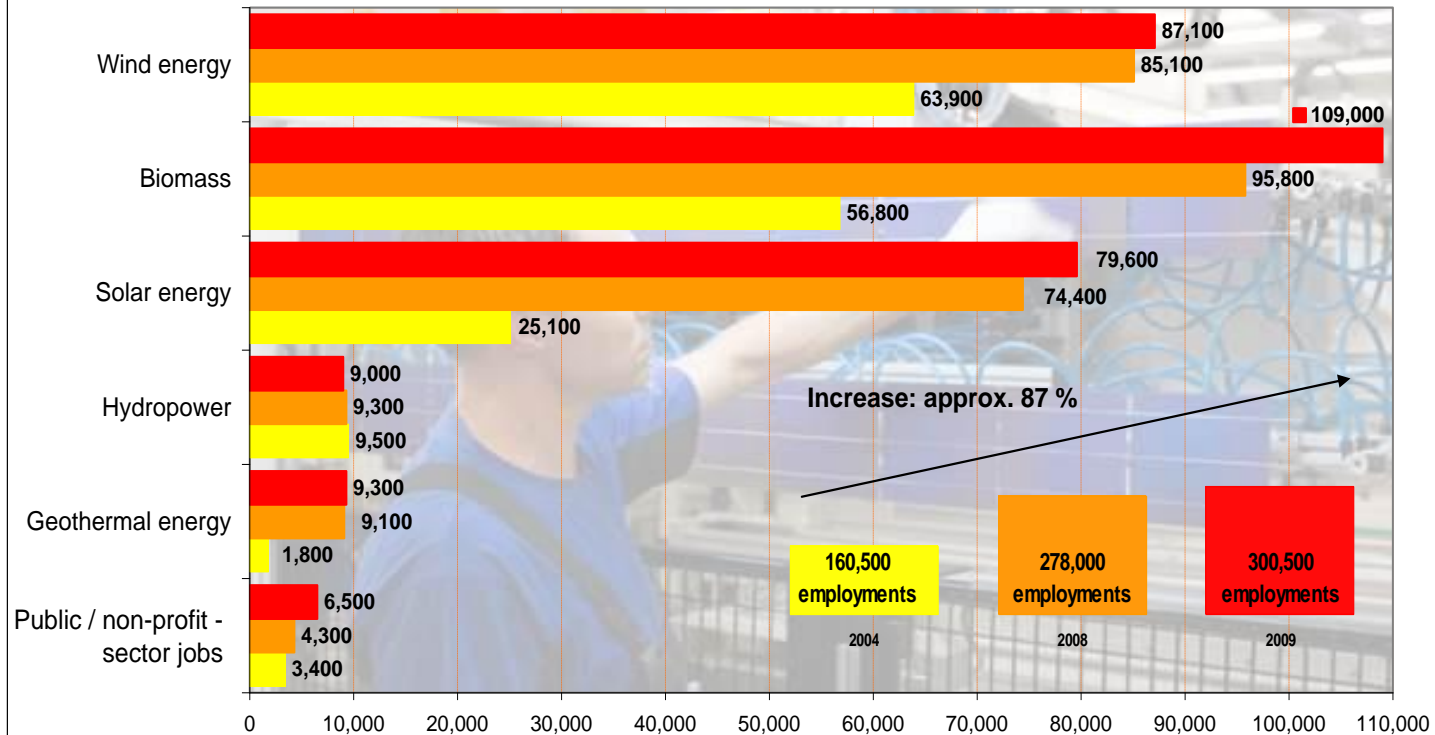


Renewable energies = good business



¹⁾ Photovoltaics and solar thermal energy; ²⁾ Large plants and heat pumps; Deviations in the totals are due to rounding;
Source: BMU-KI III 1 according to the Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW); all figures provisional

Renewable energies = new jobs



Figures for 2008 and 2009 are provisional estimate;
Source: BMU-KI III Projekt "Gross employment from renewable energy in Germany in the year 2009, a first estimate"; Image: BMU / Christoph Busse / transit

Farms & renewables: Photovoltaic

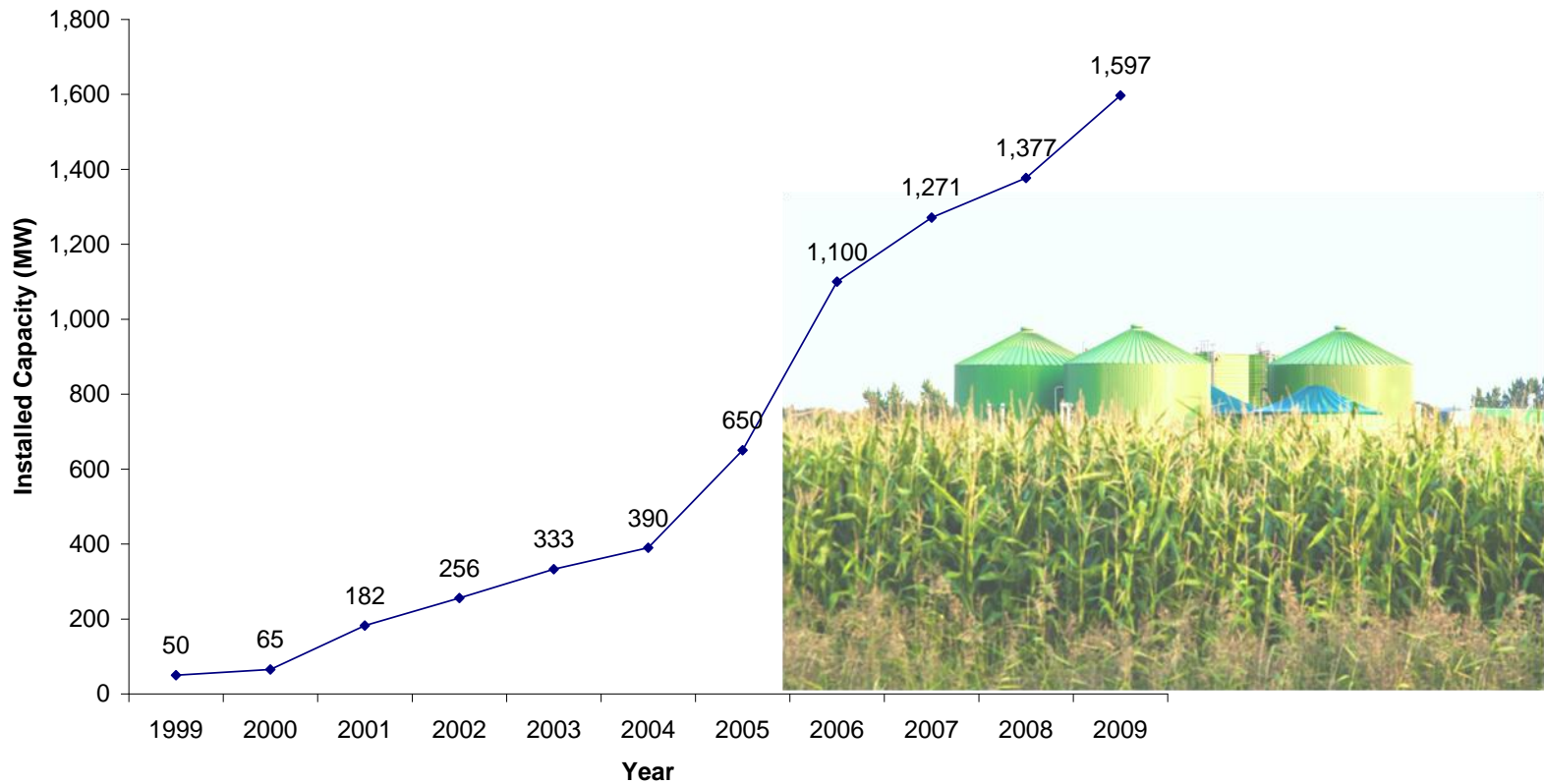


German farmers install
each year 200-250 MW of
PV (US: 207MW in 2007)

Farms & renewables: Wind

- more than 20,000 windmills (2009)
- Early driven by farmers in the 1990ies
- Windy northern Länder with strongest growth
- Schleswig-Holstein: 40% RE today, 100% by 2020
- Community-owned windfarms (45% of market by 2005)

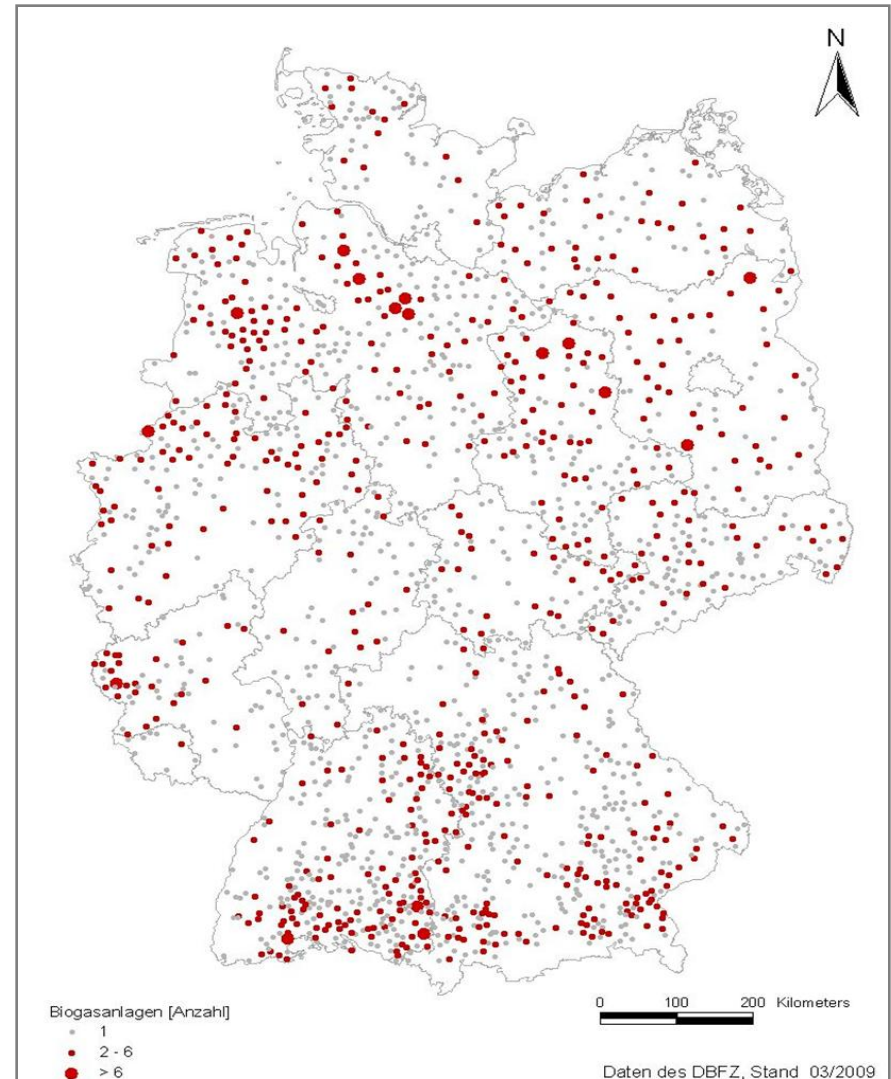
Farms & renewables: Biogas



Sources: German Biogas Association 2010

Farms & renewables: Biogas

- 5,000 installations in 2010
- Small (<190 kW) and large
- Power 3.8 mio households
- Germany is leading the EU in biogas production
- Biogas as complimentary energy to wind and pv



Source: German Biomass Research Center 2009



Conclusion Part 1:

What are the drivers for German farmers to invest in renewable energies?

Driver #1: comprehensive climate and energy policy with ambitious targets

- > targets for 2020:

- 40% less GHG emissions (270 Mio. Tons)
- 30% share of renewable energy in electricity
- 14% share of renewable energy in heating
- (EU energy package: 20-20-20 by 2020)

-> Policies:

- carbon taxes in 1999
- feed-in tariffs in 2000
- Cap & trade in 2005 etc.

Driver #2: pro-active German Farm Bureau and renewable energy industry

- Deutscher Bauernverband (DBV) is lobbying for ambitious renewable energy policies
- DBV is recognizing climate change as a threat
- renewable energy industry is well-organized (e.g. German Biogas Association in 1992) and collaborating

Driver #3: Social catalysts in Germany

- Machinery syndicates (>250) work as rural cooperatives and advise farmers, aggregate orders, and organize installations & maintenance.
- Banks: solid calculation by farmers, safe (=good) business for the banks.

Driver #4: Rural Communities striving for 100% renewables

- Regional economic development: farmers, planners, craftsmen
- Jühnde was the 1st village to be energy independent in power and heat (biogas for CHP, additional wood chips in winter)
- www.100-ee-kongress.de by Federation of German Municipalities (DStGB)



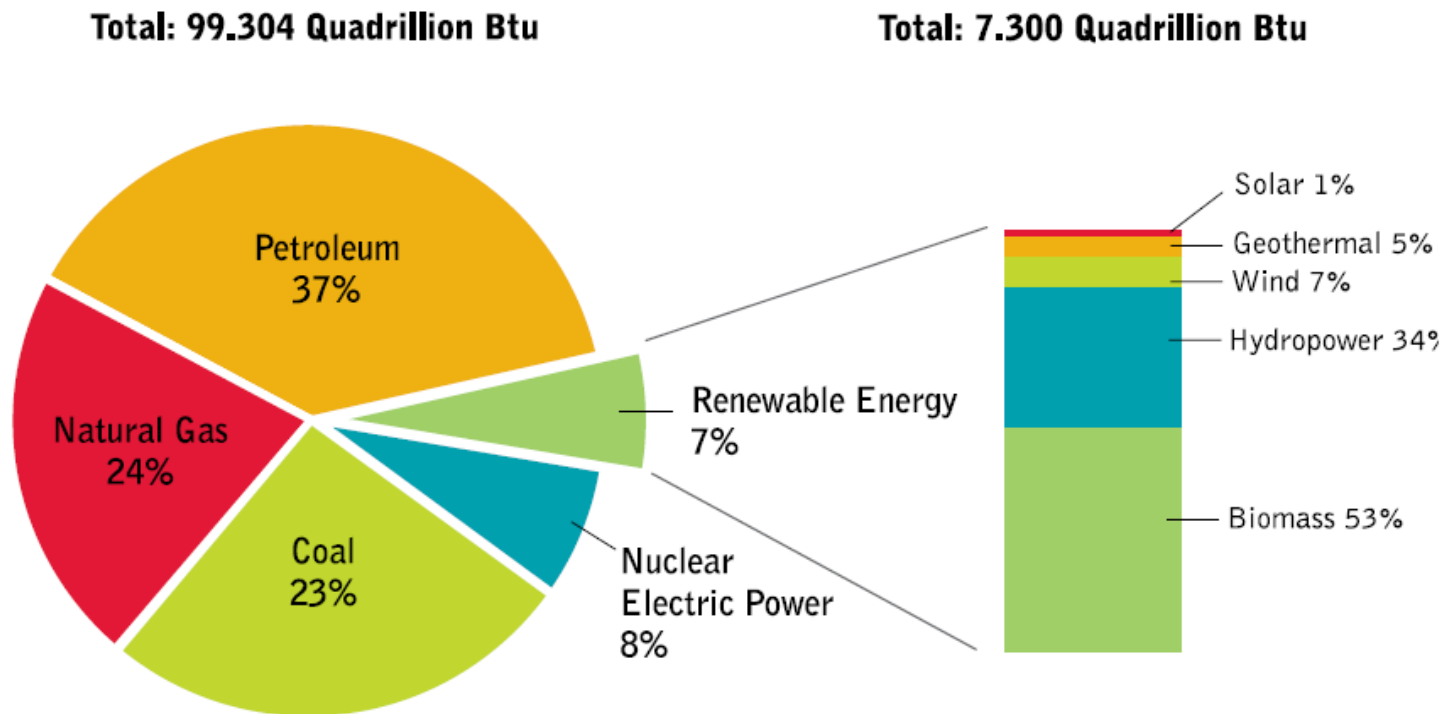
Summary: German farmers are becoming energy entrepreneurs, because

1. A comprehensive national climate and energy strategy, including a feed-in tariff (FIT) for investment certainty
2. Pro-active farm bureau and renewable energy industry lobby (German Biogas Association: 1992)
3. Social catalysts like banks and machinery syndicates
4. Communities striving for 100% RE regions

Part 2: How US Farmers Can Profit From Wind, Biomass, and Solar



The Role of Renewable Energy in the Nation's Energy Supply, 2008



Source: U.S. EIA.

Renewables on American Farms

- **Situation:** Ethanol is the biggest renewable energy success story in the US, with wind, solar, biogas and biodiesel resources being underutilized.
- **Challenge:** American farmers could reap benefits of the same level as their German counterparts, if the right political and social support mechanisms were in place and barriers removed.



Wind & Solar Power

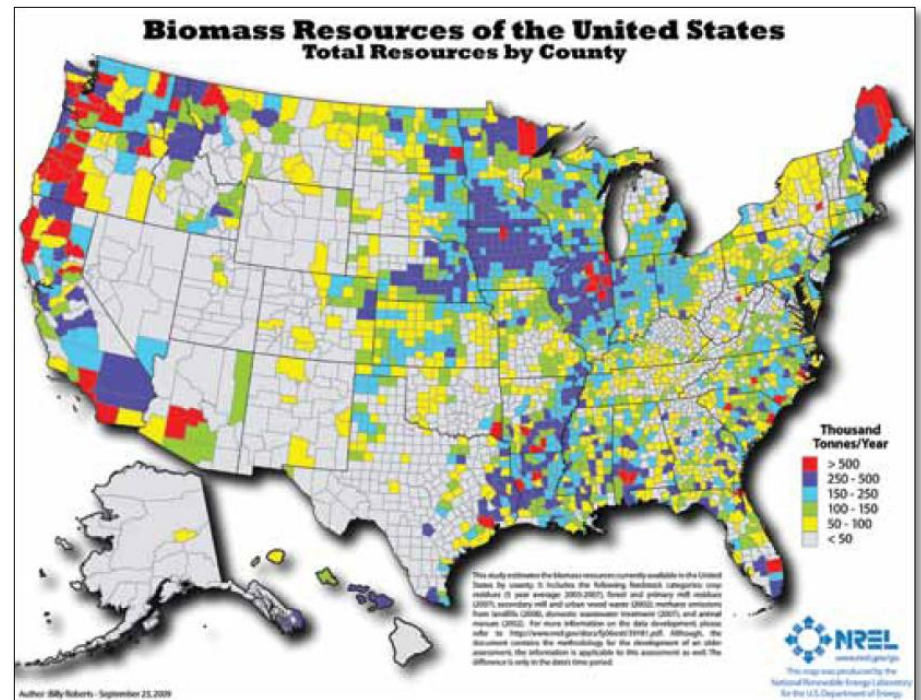
- In 2009, farmers & local landowners owned 638 MW (1.8%) of total installed wind capacity.
- Farmers more likely to lease land to wind farms than own turbines themselves: lost revenue opportunity.



- Policies: RPS, PTC boom-bust cycles.
- No estimates of PV on farms, but ~200 MW were installed in the U.S. in 2007.
 - German farmers alone install the same amount annually.

Biomass

- DOE/USDA determined that the U.S. has the capability of supplying 1 billion dry tons of biomass from farms by 2030.
- Biomass was 4% of total US energy consumption (2008).
 - At 6%, bioenergy could generate \$20 billion in new income for farmers.



Source: NREL.

Biomass for Transportation

Ethanol

- U.S. is the largest producer of ethanol in the world, with 53% in 2008.
- 6.7 billion gallons consumed in 2007
- ~5% of non-diesel motor fuel (2007)



Biodiesel

- U.S is the 3rd largest producer of biodiesel in the world, following Germany and France in 2008.
- 0.358 billion gallons consumed in 2007
- ~0.7% of total diesel fuel (2007)

Biomass for Electricity and Heat

- Biomass share of net renewable electricity generation: 13.1%
Biomass share of net electricity generation: 1.37% (2009)
- Recent study: electricity from biomass is a more efficient transportation fuel than ethanol (Campbell et al, 2009).
- Little data on bioheat, but thermal uses of biomass could reduce GHG emissions earlier than through electricity generation.

Biogas

Farm Type	Numbers of Ads	Installed Capacity (kW)
Dairy	120	42,307
Swine	22	2,909
Poultry	3	675
Beef	2	2.600
Total	147	48,491

In comparison, 5,000 anaerobic digesters in Germany.

Part 3: Differences Between Germany and the United States



Germany Driver #1: Comprehensive climate and energy policy with ambitious targets...

- However, in the US, energy policies are often developed at a state level....
 - 29 States + DC have an RPS.
 - Growing interests in FiTs at state and municipal level....
- Lack of targets on federal level (except biofuels)
- Federal policies lack continuity and differ greatly between administrations.



Germany Driver #2: A pro-active German Farm Bureau and renewable energy industry ...

- In the US, major farm lobbies have traditionally been skeptical of climate change.
- Some US farm lobbies not convinced that climate legislation is affordable.
- However, there are differing views among major farm lobbies.
- Lack of cohesion among renewable energy associations
- Growing support for a RES, especially with a broad definition of biomass.



Germany Driver #3: Social catalysts in Germany ...

- US biofuels industry is strongly supported from crop-specific political organizations...
- US banks are generally geared towards a few, large-scaled projects.



Germany Driver #4: Rural Communities striving for 100% renewables ...

- Community owned projects only account for 2% of total wind capacity in the US...
- Rural electric cooperatives in the US, though they traditionally generate electricity from coal sources, are slowly gaining an interest in power from renewable sources.....



Part 4: Concluding Remarks and Recommendations



Recommendations



- US Farmers and their representatives should advocate for state renewable energy policies (specifically feed-In tariffs)
- US agriculture lobbies should support a comprehensive national climate and energy strategy.
- Rural communities should develop strong stakeholder networks.
- The US should diversify feedstocks used for biofuels.

Suggestions for further research and action

- Raise awareness of farmers and rural communities with an outreach campaign.
- Increase farmer-to-farmer exchanges.
- Develop a biogas roadmap for the US.
- Create sustainability criteria for biomass in power, heat, and transport.
- Support research on policy options.
- Evaluate the benefits of renewable energy, distributed generation and energy independence with quantitative analysis.

Thank you!

Beyond Biofuels: Renewable Energy Opportunities for US Farmers.

A Transatlantic Comparison on a
Growing Business for Agriculture

Wilson Hambrick Arne Jungjohann Amanda Chiu Hilary Flynn

