



Future of Our Energy System

Swiss – US Energy Innovation Days

August 23, 2017

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Overview

Today I will discuss:

1. **Energy as the key to a sustainable future**
2. **Barriers to advancing renewable energy**
3. **The role of government and public policy**
4. **Conclusion: a positive outlook for the future**

1. Energy: The Key to a Sustainable Future

- ▶ **If we solve the energy problem, we solve the sustainability/climate change problem.**
- ▶ With a growing global population and increased energy use, energy demand has increased substantially.
- ▶ Production, transportation, and everyday processes that we depend on are very energy-intensive.
- ▶ Energy use is not going away; most people like the way they live. But our use of energy needs to be made more efficient and less destructive.



1. Energy: The Key to a Sustainable Future

- ▶ We need to end our dependence on fossil fuels to develop a long-term sustainable economy.
 - Fossil fuels emit carbon dioxide and other pollutants when they are used.
 - Extracting these fuels from the earth damages the earth's ecosystems.
 - These fuels are finite and as they become more difficult to extract and more scarce, they will become more expensive.
- ▶ Renewable energy has the potential to transform the energy business.
- ▶ A renewable economy requires massive public and private investment in basic and applied research, and a similar investment in infrastructure.

1. Energy: The Key to a Sustainable Future

- ▶ We are only a breakthrough or two away from a new age of decentralized energy technology.
 - ▶ According to the DOE's National Renewable Energy Laboratory, renewable electricity generation from technologies that are commercially available today, in combination with a more flexible electric system, is more than adequate to supply 80% of total U.S. electricity generation in 2050 while meeting electricity demand on an hourly basis in every region of the country.
- ▶ **No technological challenge is more important for the future of our world.**



2. Barriers to Renewable Energy

There are a number of barriers to advancing renewable energy.

▶ **Technologies still need advancing.**

- We need to develop small, low-cost solar cells, and batteries for storing electricity once it is generated.
- Large-scale implementation of smart-grid technology could accelerate the trend to renewable energy, and could expand the market rapidly.

▶ **Our infrastructure is not set up for distributed generation.**

- We need major upgrades to basic infrastructure and current grid systems need greater capacity.
- Decentralized, distributed generation of energy is less vulnerable to catastrophic, large-scale disruption.

2. Barriers to Renewable Energy

▶ There are a number of political obstacles.

- Tremendous political pressure around energy development.
- Critical nations are still at odds on energy due to differential economic development.
- Investment in fossil fuels is massive and global, and the industry has not been shy about converting its economic power to political power.

▶ Short-term versus long-term gains

- Renewable energy requires capital and may involve higher costs in the short and middle term.
- The absence of standardized information about renewable energy is a barrier to growth.



2. Barriers to Renewable Energy

- ▶ While energy efficiency and renewable energy organizational capacity is growing worldwide, it is dwarfed by the capacity devoted to fossil fuels.
- ▶ We need more skilled labor in solar and wind.
- ▶ The good news is, a number of companies are building efficiency services.



3. The Role of Government & Public Policy

- ▶ Government and public policy could accelerate or impede the pace of change.
- ▶ The rule of law does not inhibit commerce; it makes it possible, but regardless of government's stance it is easy to see the market appeal of low cost, completely decentralized energy.
- ▶ Government intervention can speed the process of innovation and create certainty about key elements of the market in the future.



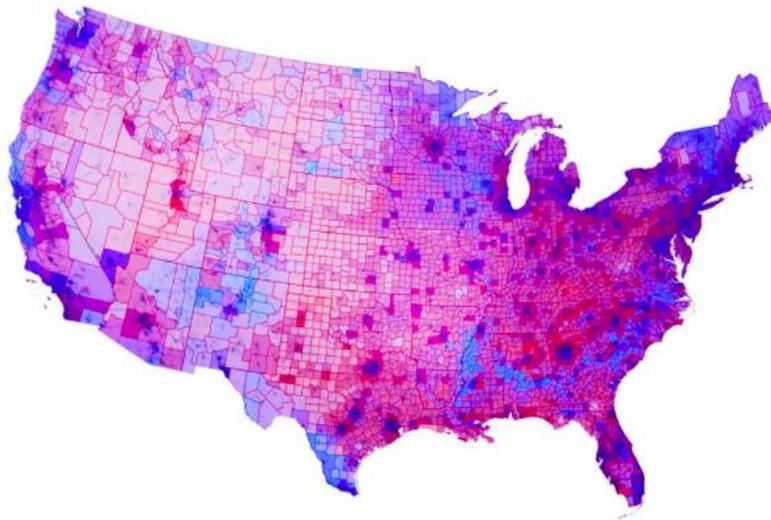
3. The Role of Government & Public Policy

- ▶ To move us in the right direction, government can:
 - Fund basic science research
 - Set and enforce regulations
 - Subsidize renewables as they now subsidize fossil fuels
 - Transfer sustainability technologies to the developing world
 - Develop a set of generally accepted metrics
 - Build effective public-private partnerships
- ▶ Government should use the tax system to encourage investment in renewables.
 - Tax credits known as **Renewable Energy Credits (RECs)** are used to encourage development and use of renewable energy facilities.
 - Beyond that, direct access to low cost capital is needed to develop new products.

3. The Role of Government & Public Policy

The need for innovation to meet ambitious standards will provide organizational support for engineers to build something new.

- ▶ Lack of adequate federal policy can be countered by other strong institutions:
 - State and local governments, hospitals, universities, and private sector companies



4. Conclusion

- ▶ The nature of economic life is changing and it is very important that we look forward instead of backward.
 - The U.S. energy sector added 300,000 jobs in 2016 – most were in energy efficiency and renewable energy.
- ▶ The polls indicate that the market for renewables is already in place. The issue is not **if**, but **when**.
- ▶ The energy future, like the rest of our economic future, depends on technological innovation and ingenuity.



4. Conclusion

- ▶ **The transition to renewable energy is the most important element of a sustainable economy and planet.**
 - Solve the energy problem and you solve the problems of water, food, climate change and ecosystem destruction.
- ▶ To update our energy system we need to fund more basic and applied energy research.
- ▶ I believe state and local environmental action can counter lack of federal leadership.

