

A photograph of a modern building with a glass facade and a curved, white, arched roof structure. The building is surrounded by greenery and a grassy area. The text is overlaid on the image.

# **The Future of Energy**

A small blue ribbon icon, symbolizing environmental awareness or sustainability.

***How Communities Can Drive Change  
Green Town – Future Cities 2010***

***September 9, 2010  
T. Arnold (Arn) Boezaart***

*Michigan Alternative & Renewable Energy Center*

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# The Global Perspective

“The ultimate answer to humanity’s energy problem rises every morning and sets every evening” — *Oliver Morton, Nature*

- Sun generates 174,000 TW of solar energy daily
- Enough energy per hour to meet global need for one year
- Sun provides light, wind, water and plant growth
- Tendency among governments, traditional utilities and public is to view renewable (fossil fuel free) energy as an oddity or fringe factor

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# The Global Challenge:

## Growing Greenhouse Effect -

- As a result of global population growth, reliance on fossil fuel and industrialization, excess solar and waste heat no longer leaves the planet as it once did.
- CO<sub>2</sub> accumulation = ecological disturbances
- Fact: Global dependence on fossil fuel creates growing health, environmental, geo-political and socio-political challenges at all levels of society

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# Pathway to New Energy Future

## Success requires a three-part strategy:

- Greater efficiency through better technology
- Commitment to targeted carbon limitation

*Incentives – Voluntary – Regulation*

- Drive down the cost of generating renewable energy – commit to reduced use of fossil fuel

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# A Fossil Free Future

- Light, wind, water and plant growth along with nuclear power are the sources for our fossil fuel-free future.
- U.S. presently generates 9% of its energy using nuclear energy
- Wind, solar, geothermal and other renew. sources combined represent < 2% of present national energy generation

# How Do We Achieve Our New Energy Future?

- Investment in Research & Development
- Regulation of fossil fuel energy generation
- Subsidy of emerging energy technology
- Priority on energy efficiency
- Scale up carbon free generation options
- New & rebuilt transmission systems
- Smart Grid development

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# Electricity Without Carbon

- Easiest way to cut carbon emission is to increase efficiency – risk is greater consumption
- Ultimately we must move to carbon-free sources of electricity. Requires new thinking about:
  - Price of carbon
  - New technologies/ innovation
  - Improved transmission systems
  - Smarter electrical grids

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# Carbon Free Generation Sources

- **Biomass** – excellent source of baseload capacity
- **Hydropower** – cost competitive with coal & gas
- **Nuclear Fission** – Highly subsidized R&D uranium / 15% of world's electrical generation
- **Wind power** – exponential growth / 35% of new generating capacity (5.3 GW) in 2007
- **Geothermal** – tech limits large scale exploitation
- **Solar** – presents significant storage challenges
- **Ocean Energy** – kinetic energy/tides & waves / UK

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# Wind: Issues & Opportunities

- More US wind-generating capacity being planned than coal and gas combined / MW's up – cost ▼
- Like hydro and solar, wind is a “fuel-less” energy
- Turbines are getting bigger, footprint smaller
- Biggest limitation: Intermittency / 20-30% capacity
- Windiest places generally least populated
- Requires infrastructure / grid development
- Offshore locations pose technical & perception challenges: Yes to wind, but ..... **NIMBY**

# The Grid: The Ultimate Balancing Act

- Electricity is an instantaneous commodity; consumed at the exact moment it is produced
- The ultimate supply chain challenge – supply and demand must match throughout the day
- First “modernized” in the 1920’s
- Last significant upgrade in the 1970’s
- Largely ignored since wholesale power deregulation in 1992 – living on borrowed time
- National grid in a perilous state of disrepair / capacity to absorb renewable energy limited

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# Moving to a Smarter Grid

## ***Q: What makes a smart grid smart?***

- An overlay of new communication and control systems on existing utility infrastructure
- Making energy technology more productive
- **The vision**: an automated network of integrated micro-grids that can monitor and correct itself
- New demand management / smart appliances
- Off-peak times storage capacity for later use
- Integration of renewable w/ traditional energy

# Consumer side of Smart Grid

***Present consumer energy focus and priority:***

– Lights on, TV working, Beer cold?

***Smart Grid consumer focus:***

- Homeowners learn about price / use of power
- Self-managed consumption and limit peak use
- In-home smart meters and energy use displays
- Dampen growth in projected energy use / EV's?
- System managed from demand side instead of solely from supply side

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# The Community Solution

*Ultimately it comes down to this:*

- One watt of light requires burning approximately four hundred watts of coal

*We must consider:*

- Enabling the deployment of cleaner, more variable resources like wind as part of a comprehensive energy portfolio, **and** .....
- Through smart grid technology, reduce the amount of existing inefficiency that is tolerated in our carbon based system

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A photograph of a modern building with a glass facade and a curved, arched roof structure. The building is surrounded by greenery and a blue ribbon is visible in the foreground. The text "Michigan Alternative & Renewable Energy Center" is visible on the building's facade.

**Thanks for your attention**

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