



# Passion & Persistence - Wind Energy

David Blittersdorf

*CEO, Earth Turbines*

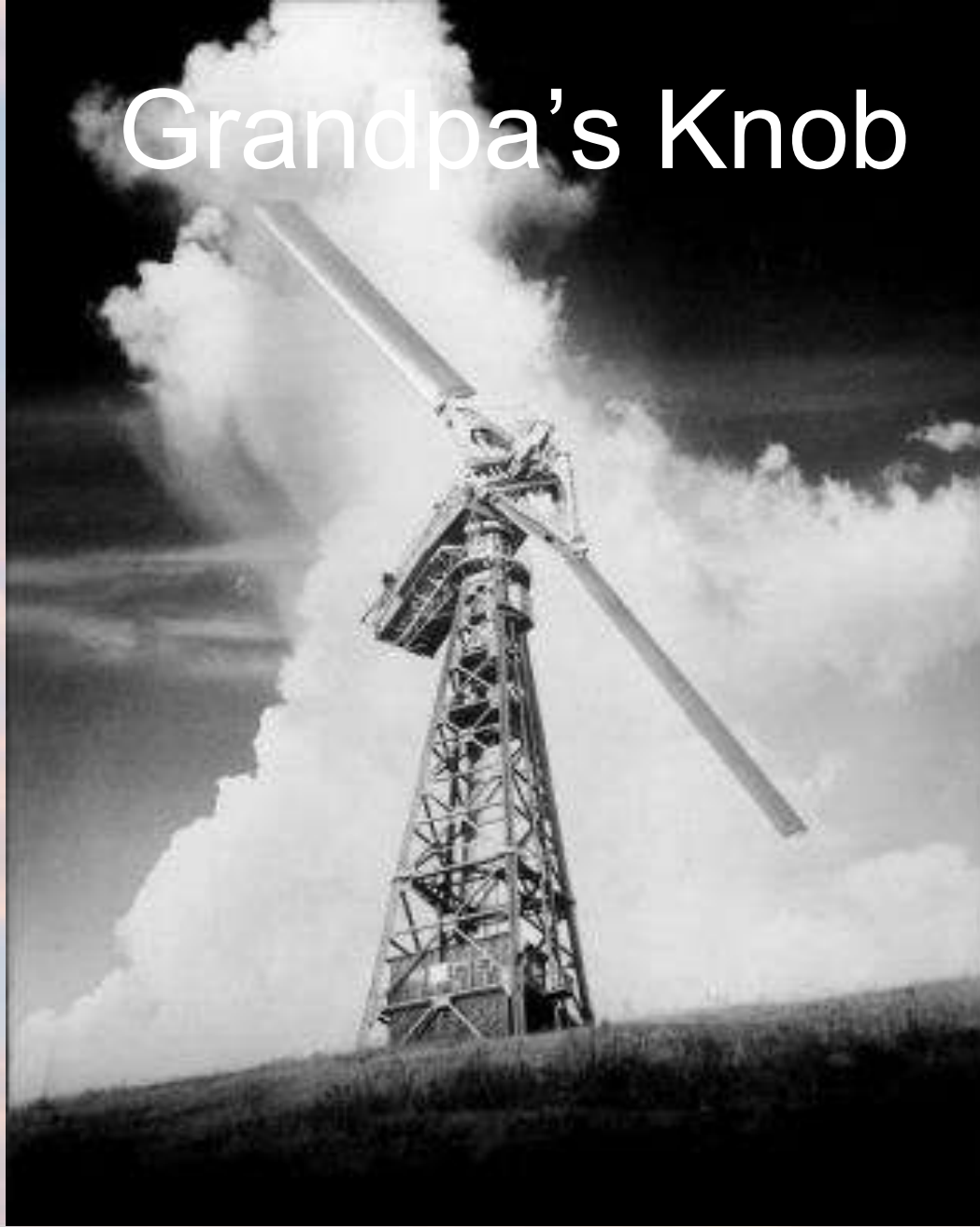
*Founder/Co-owner, NRG Systems*

[dblittersdorf@earthturbines.com](mailto:dblittersdorf@earthturbines.com)

VT Venture Network Meeting

24 September 2009

# Grandpa's Knob



- First wind turbine to feed power to the electric grid in 1940's.
- The site was in my backyard in Vermont
- Excellent book – “Power from the Wind” by Palmer Putnam



First Turbine - 1977



Engineering Student at UVM - 1980



Second Turbine – UVM Senior project - 1981



Elfin 10k Turbine -1982



NRG's 1<sup>st</sup> office in Bristol - 1982



Bristol Office/Engineering - 1984



Charlotte Apartment and NRG -1987



Our 1<sup>st</sup> house in Monkton - 1990



Hinesburg “Tin Box”– 1989 to 2004

# NRG's Green Building - 2004



75kw Solar PV & 5 kw  
wind = 53% of  
electricity (net-meter)

Day-lighting (solar)

GSHP-30 ton pond  
geothermal cooling

Radiant floor  
heating/cooling

Super energy eff. – 1/5  
use of typical  
46,000 sq ft building

Wood pellet heat &  
solar hot water



NRG's 31,000 sq.ft. 2<sup>nd</sup> building - 2008



- Manufacturer of wind measurement technology
- David founded in 1982
- Global leader: \$60M in 2008 sales
- Sells to 120 countries
- Serves large wind: \$80B industry (2008)
- Employs 105 people in Hinesburg, VT
- CEO, Jan Blittersdorf



- Manufacturer of home wind systems/solar trackers
- Started in 2006
- Wind turbine in R&D start-up
- Serves small wind: \$50M industry (2008)
- AllSun solar tracker going to market now in Vermont
- Employs 18 people in Williston, VT
- CEO, David Blittersdorf



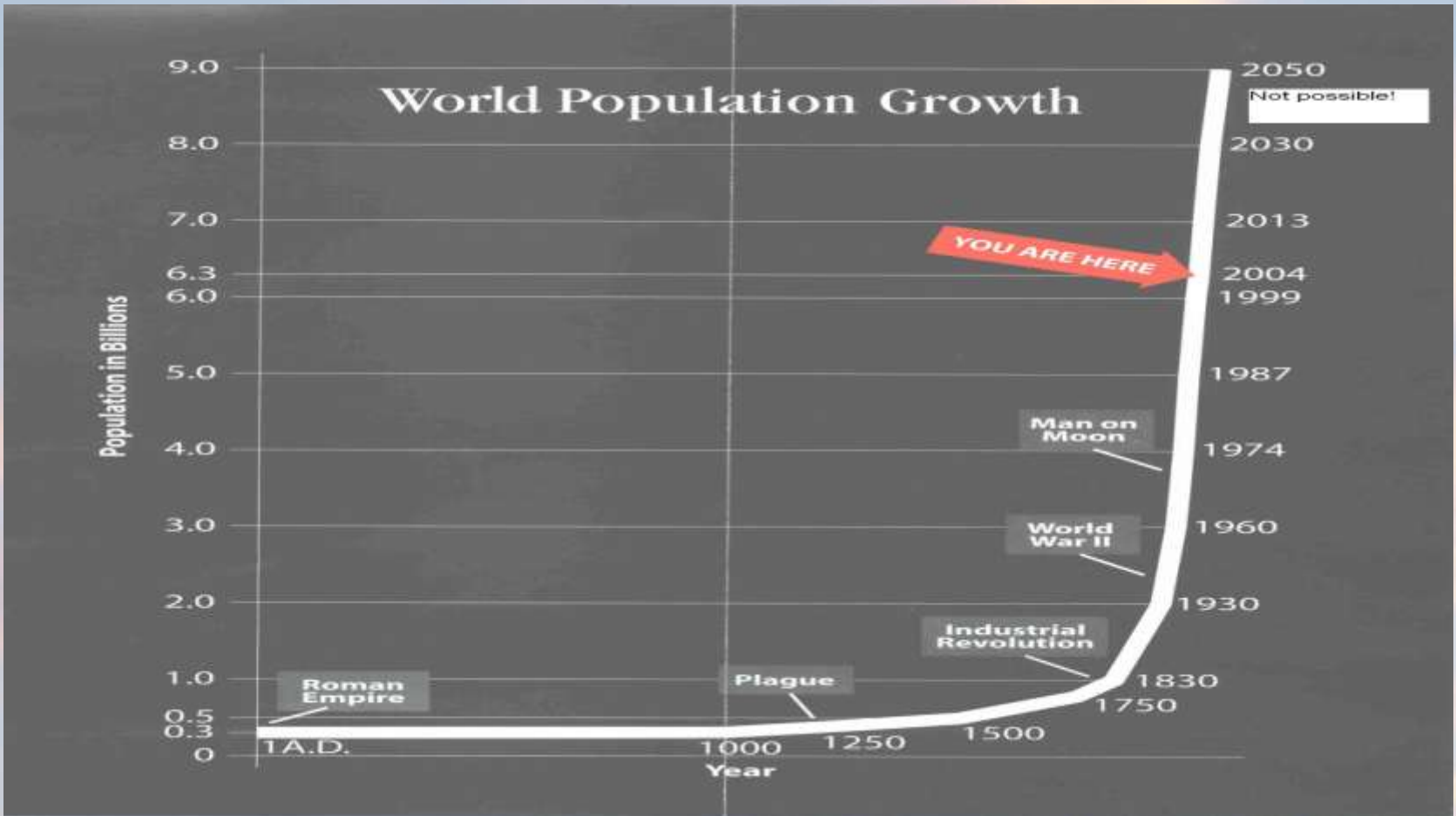
Earth Turbines  
15,000 sq.ft.  
start-up space





2.5 kw ET turbine in Shelburne, VT

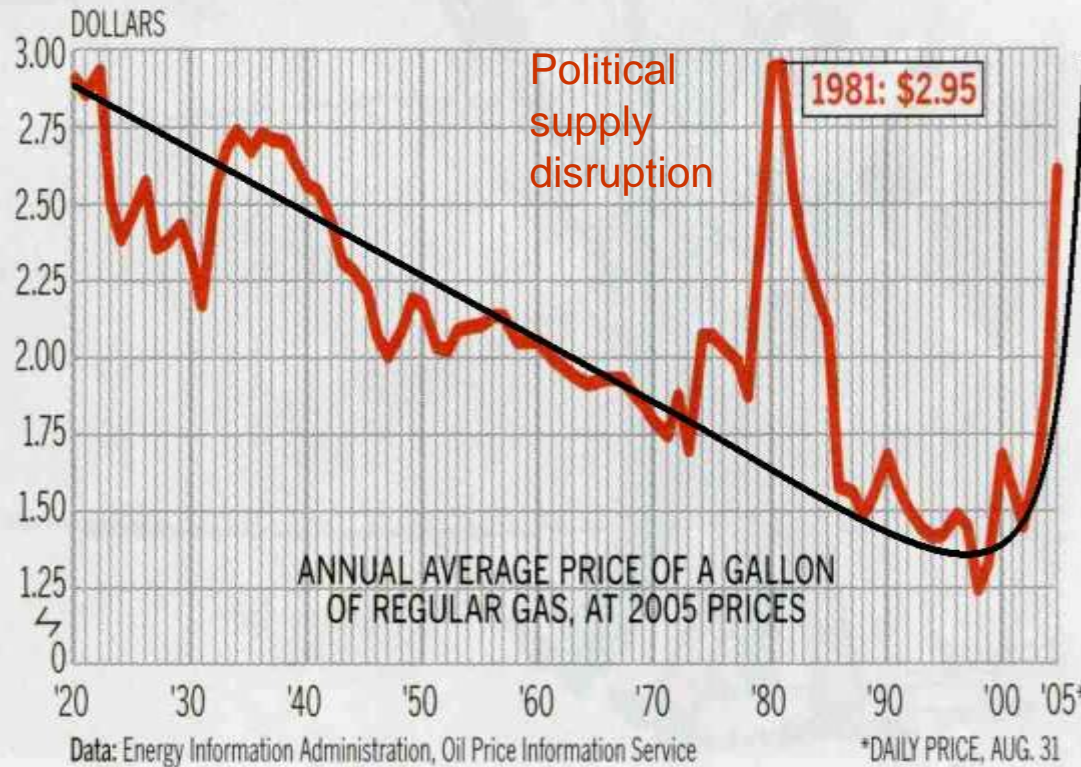
# Fossil fuel use has lead to exponential...



...Food production allowed exponential population growth, using ALL stored fossil fuels in 200 years

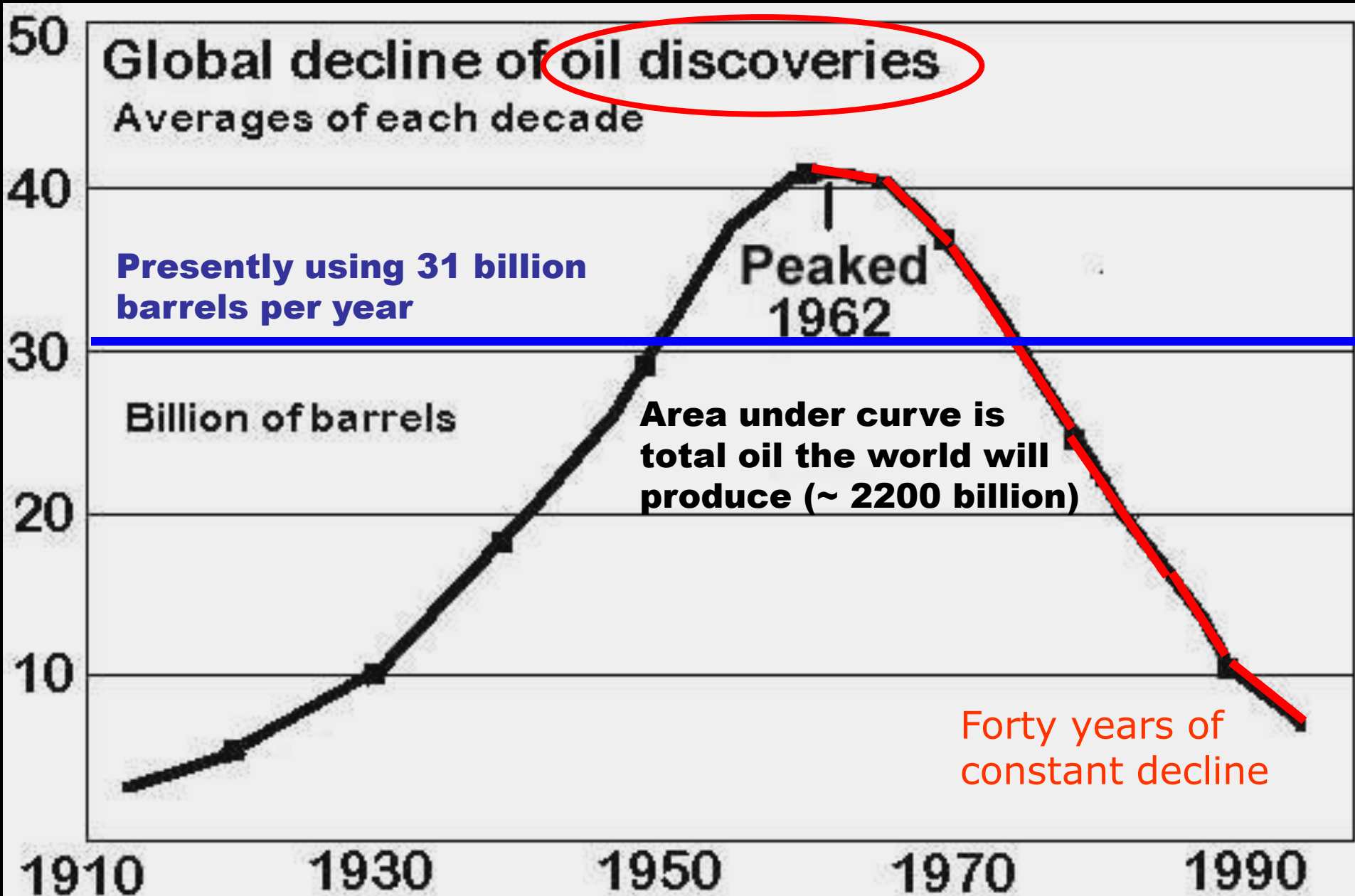
## THE BIG PICTURE

**LONG VIEW** With the recent runup, gas prices are now nearing their historic peak



September 12, 2005 | **BusinessWeek** | 13

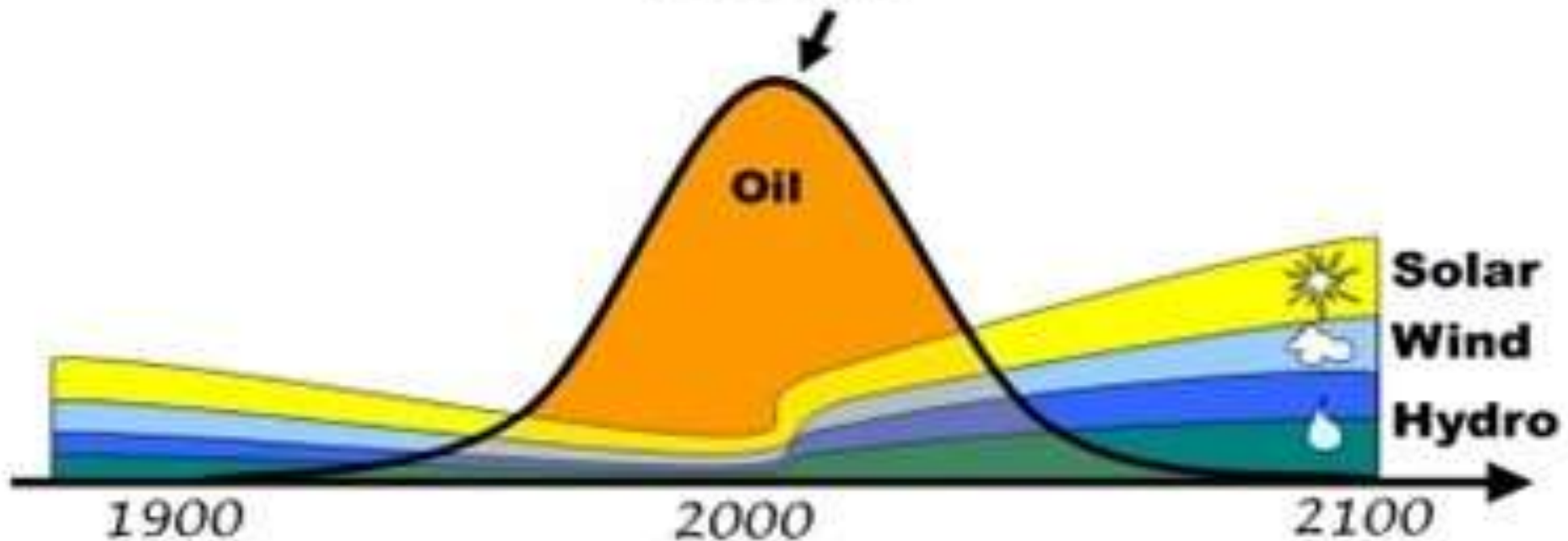
- Oil prices hit bottom in 1999
- A 100+ year trend has reversed
- This price increase in oil is based on supply peak - a first for mankind!



L. F. Ivanhoe, Coordinator, Hubbert Centre for Petroleum Studies, Colorado School of Mines

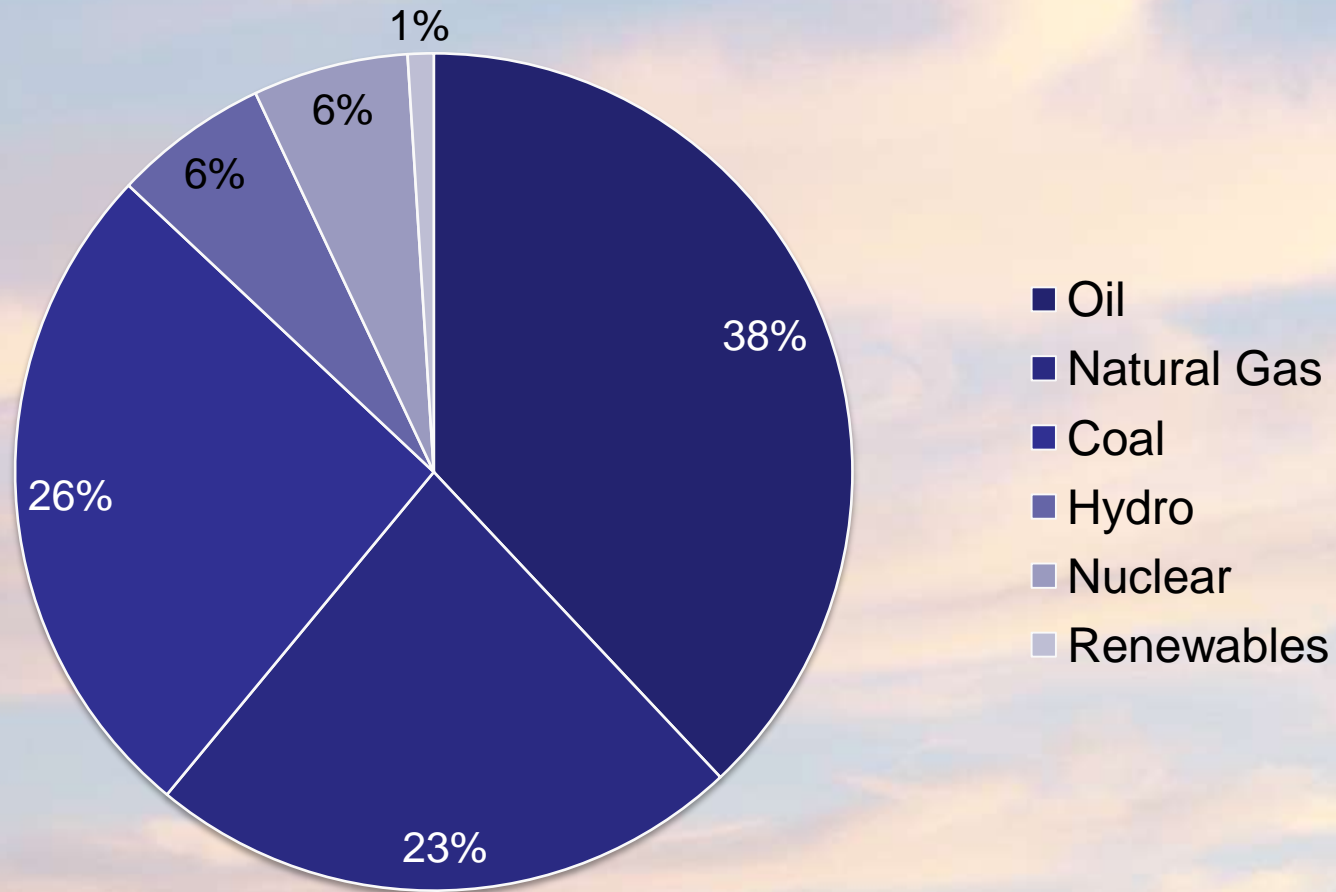
# Get ready

*We are here*

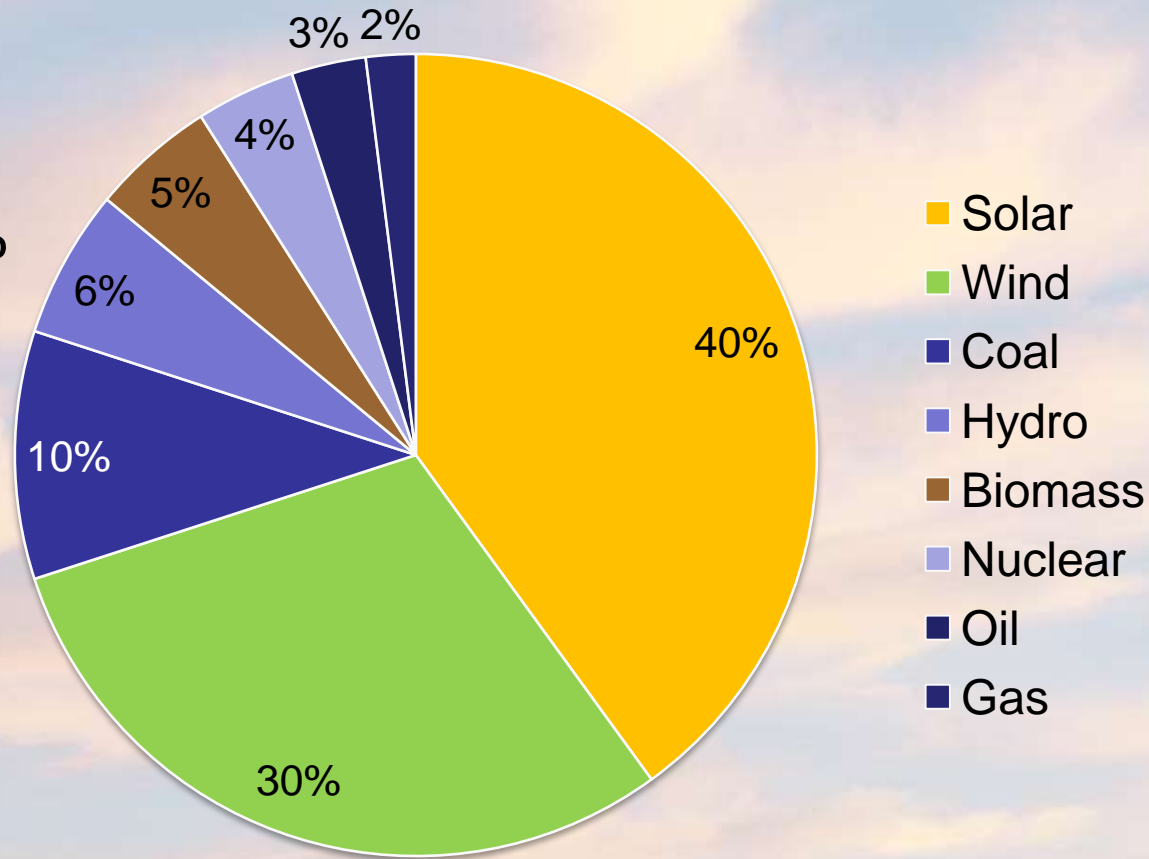


## for a low energy world

# 2004 Worldwide Energy Supply



# 2050 Worldwide Energy Supply



- Reduce carbon by 80%
- That's 5% per year
- It's required for our survival but possible ONLY if we get started in a huge way - now.

# Large Wind

- Turbine size: 1.5-2.5 MW
- Provide wholesale power at fixed prices for 30 years
- Require 15+ mph average wind sites
- Wind farms range from 20-500 MW
- Major turbine mfg: GE, Siemens, Vestas, Mitsubishi
- Major developers and financiers: Shell, BP, PPM, FPL, John Deere, T.Boone Pickens



# Community Wind

- Local ownership, local benefits
- Group net metering or Feed-in Tariffs
- Up to 2MW turbines
- Presently OK for select customers/technologies in Vermont
- Most cost effective wind power for businesses, farms and groups of homeowners



Vestas V-27 225kw

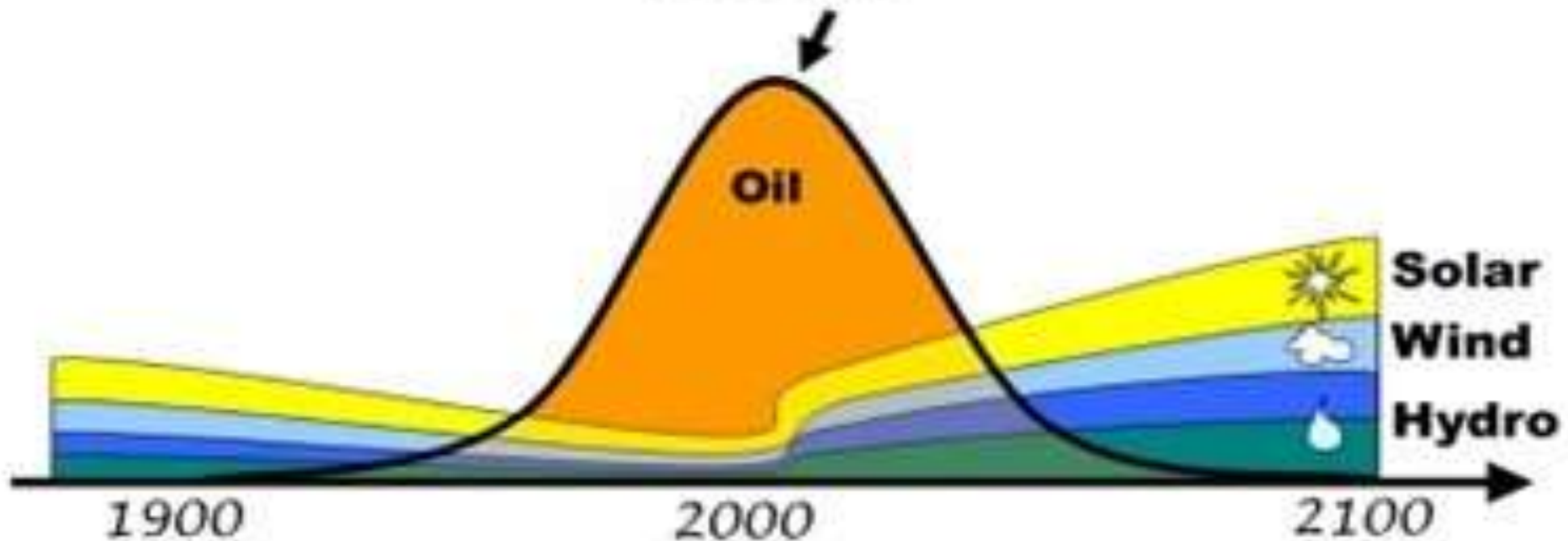
# Small and Residential Wind

- Range from 2 to 100 kW
- Net metering
- Requires 10+ mph average wind sites
- Industry tiny but good potential – scalable
- EROI low due to low volumes
- Markets need to develop
- Federal 30% tax credit
- VT rebates available now



# Get ready

*We are here*

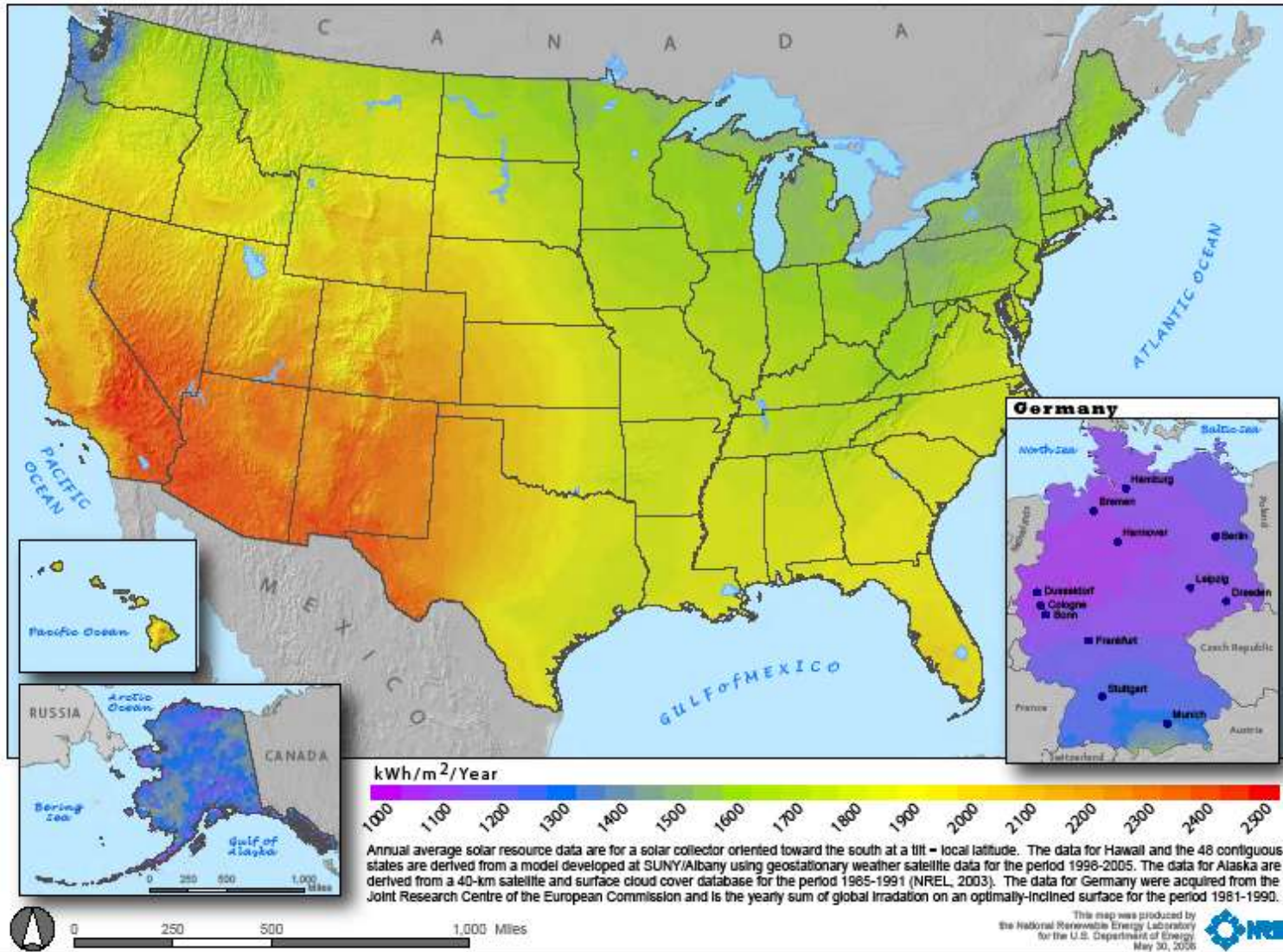


## for a low energy world

# Why Solar?

- Independence from increasing market energy prices
- “Buy” model vs. “Lease” model for energy
- Economics make sense – FAST payback and high rate of return
- Green Benefits – marketing / employee benefits
- Renewable, fixed price energy for your business for 30+ years
- Proven technology – long warranties
- Permitting in less than 45 days with the VT Public Service Board
- Vermont has plenty of sun – 20% more than the world’s solar leader - Germany

# Photovoltaic Solar Resource : United States and Germany



# Types of Solar PV

## Tracker

- Ground Mount – no roof penetrations
- No Zoning or Act 250 – permitting by the Public Service Board
- Needs open access to southern sky and good access to east and west
- Produces 35-45% more than roof mount
- Installs in a few days

## Roof Mount

- Mounts on existing structures
- Structure must be oriented to south
- No Zoning or Act 250 – permitting by the Public Service Board
- Local Building codes can interfere & VT Labor & Industry permits required for businesses
- Must accommodate wiring in structure

# Using Power vs Selling Power

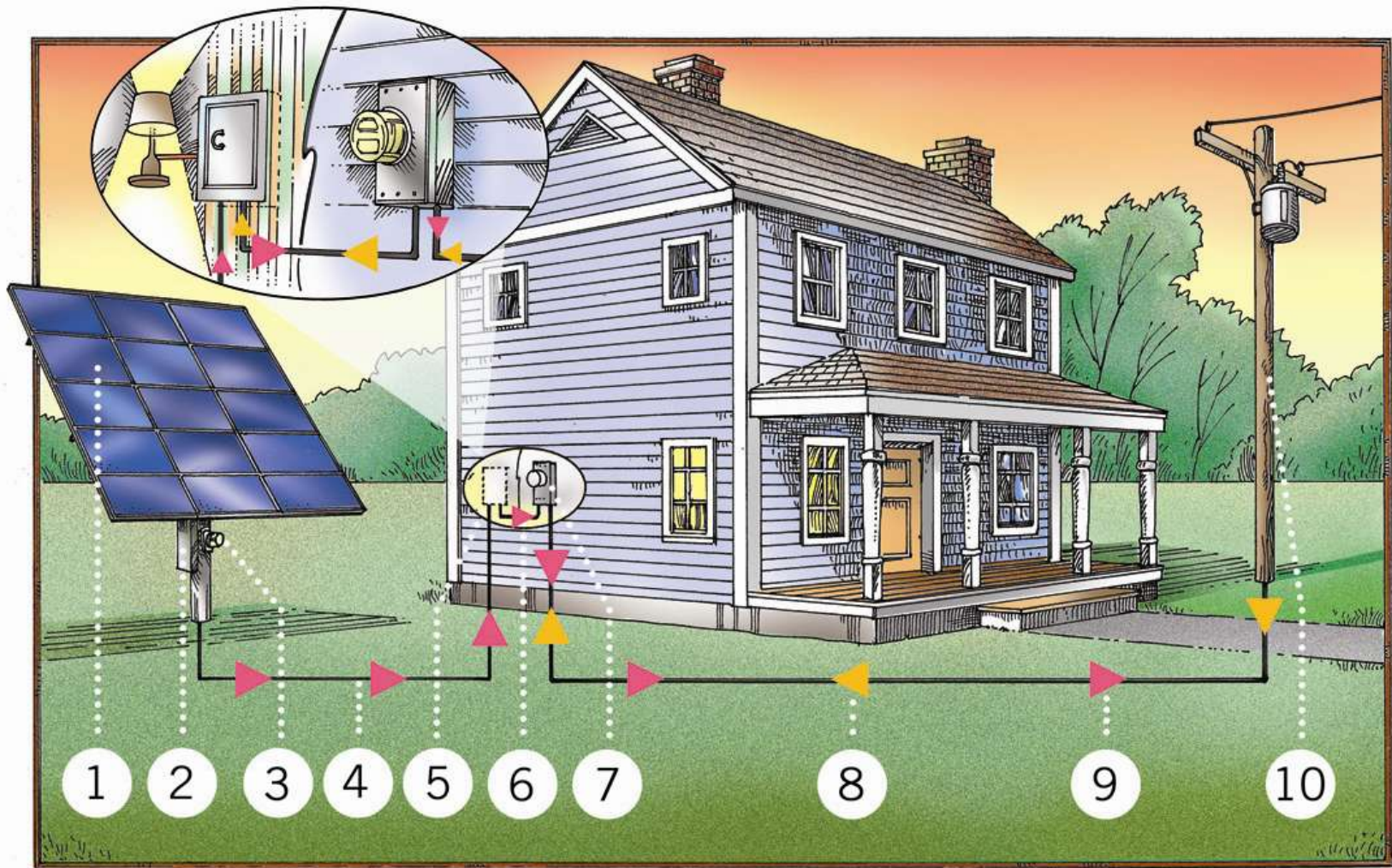
## Net Metering

- Power fed into existing panel
- Used by your facility
- Excess production turns your meter backwards
- GMP pays \$0.06 / kWh for total solar generated
- Business keeps “Green Benefit” or REC’s
- Valued at retail rates
- Group Net Metering allowed (multiple owners with same utility)

## Standard Offer

- Passed with recent Renewable Energy Bill
- Requires utilities to purchase power at rates fixed by PSB
- New meter installed – independent of your existing service
- “Green Benefits” belong to utility, not your business

# The Net-Metering Process



# Tax Credit Details

## Federal ITC

- 30% tax credit
- Can reduce AMT
- Can be carried forward 20 years
- Expires 12/31/2016

## VT Business Tax Credit

- 30% tax credit
- Can be carried forward 5 years
- Expires 12/31/2010

5 year accelerated depreciation for all renewables –  
50% 1<sup>st</sup> year bonus in 2009

# AllSun Tracker

- Grid-connected, dual axis, active system
- 35 - 45% more energy than roof-mounted solar panels
- Evergreen panels, US made with 25 year warranty
- Motech inverter with 10 year warranty
- 5 year warranty on system









# Tracker Components



- **GPS Controller** – “brains” of the tracker, controls movement and communication with ET & web
- **Tracking Assembly** – hydraulic power unit with hydraulic motor
- **Structure** – galvanized steel assembly, heavy gauge steel mast, high strength to weight ratio panel support beams
- **Electric meter** – measures solar-generated kWh
- **Base** – 3 different types depending on soil conditions

# Site Assessment and Installation



- Annual kWh consumption and cost per kWh
- Conservation and efficiency first
- 40 x 40 foot grid spacing
- Year-round direct southern exposure, preferably east and west as well
- Soil conditions
- Distance to electric panel

## AllSun Tracker available models and features:

MODEL	TOTAL WATTS	ANNUAL ENERGY PRODUCTION	DIMENSIONS
 <p><b>E 3KW</b></p>	<p><b>3,000</b> watts</p>	<p><b>ANNUAL</b> 4,320 kWh (360 kWh per month)</p>	<p><b>16.3' W</b> <b>15.7' H</b> Total height from ground = 17'</p>
 <p><b>E 4KW</b></p>	<p><b>4,000</b> watts</p>	<p><b>ANNUAL</b> 5,760 kWh (480 kWh per month)</p>	<p><b>21.7' W</b> <b>15.7' H</b> Total height from ground = 17'</p>

# AllSun Tracker 4KW – Purchase Option

Business purchases the system and receives tax benefits and Vermont rebate

	Year							
	At Install	1	2	3	4	5	6+	
Purchase Price	(32,000)							
Fed Tax Credit	9,600							
State Tax Rebate	9,600							
Depreciation Tax Shield Benefit		6,120	1,530	1,530	1,530	1,530		
GMP Incentive		336	336	336	336	336	336	
Energy Production Value	-	728	750	772	796	819	844	
Net Cash Flows	(12,800)	7,184	2,616	2,638	2,662	2,685	1,180	
		Rate of Return	23.79%					
		Payback	4 years					
		<b>Cost of Power over 25 years</b>	<b>\$ 0.004 /kWh</b>					

for illustrative purposes only - please consult a tax professional to understand how this affects you.

- 4,000 watt system at \$8/watt = \$32,000 purchase price
- Energy production value assumes estimated 3% annual increase, begins at \$0.132/kWh
- Total investment recouped in year 4
- GMP \$0.06 / kWh incentive means you would MAKE \$0.054/kWh !!!

# AllSun Tracker 4KW – Power Purchase Agreement

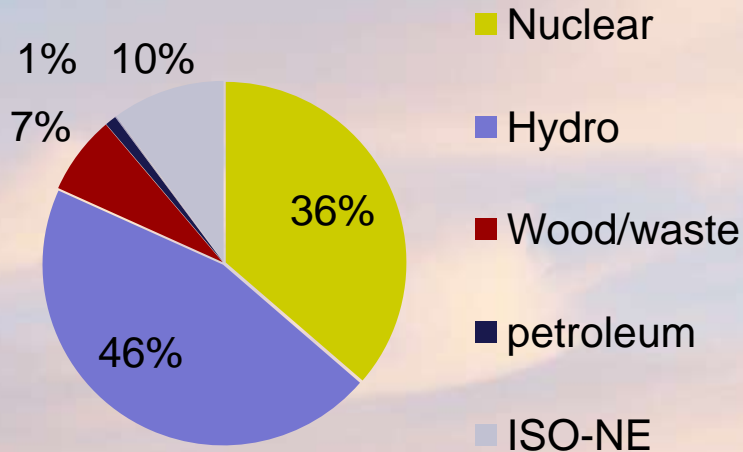
Federal and state tax credit remain with equipment owner (Earth NRG Services, LLC)

	At install	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6 +
<b>Upfront Cost</b>	(\$1,000)						
<b>Equipment Purchase</b>						(\$8,600)	
<b>Lease Payment</b>		(\$1,152)	(\$1,152)	(\$1,152)	(\$1,152)	(\$1,152)	
<b>kWh produced / year</b>		5,760	5,760	5,760	5,760	5,760	5,760
<b>GMP \$0.06/ kWh incentive</b>		\$346	\$346	\$346	\$346	\$346	\$346
<b>Electric Bill Savings</b>		\$760	\$783	\$807	\$831	\$856	\$881
<b>Annual Cash Flow</b>	(\$1,000)	(\$46)	(\$23)	\$0	\$24	(\$8,551)	\$1,227
<b>Total Investment</b>	(\$1,000)	(\$1,046)	(\$1,069)	(\$1,069)	(\$1,045)	(\$9,595)	(\$8,368)
<b>25 year avg. cost of power</b>	\$0.067	/kWh with AllSun Tracker					
<b>25 year avg. GMP rate</b>	\$0.200	/kWh					

- Purchase power for \$0.20/kWh for 5 years, then buy system for fair market value (estimated at 30% of original price)
- Electric Bill Savings assumes estimated 3% annual increase, begins at \$0.132/kWh
- Total investment recouped in year 7 after purchase

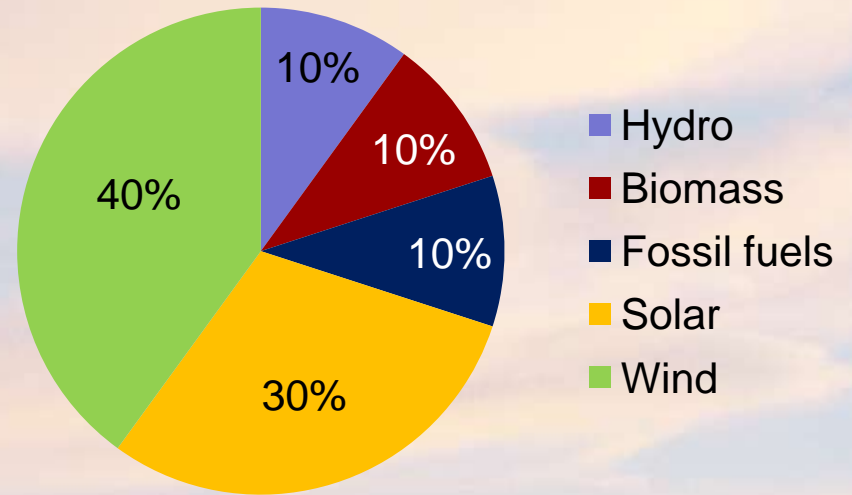
# Vermont's Electricity Supply

## Current picture 2007



700 MW average

## Future picture 2050



2100 MW average

# We have to choose our energy future

**Renewables** (all are needed but not enough to replace fossil fuels):

- *Wind*: here now, works, cost effective (cheaper than natural gas)
- *Solar*: works, costs coming down
- *Biomass*: limited supply, some pollution, CO<sub>2</sub> neutral
- *Geothermal*: part of solution – ground source heat pumping

**Oil** – Supply has peaked, oil sands/shale-low to negative energy return

**Natural Gas** – Supply has peaked in N.A., world soon (LNG is costly)

**Nuclear** – Fuel in finite supply, no waste solution, BOMBS, can kill millions, major accident every 20 years, CO<sub>2</sub> - ¼ of natural gas

**Coal** – Major CO<sub>2</sub> emitter, finite supply, acid rain, mercury –Can't use it

**Dream fuels:**

- *Hydrogen*, someday, not a source – needs renewables
- *Nuclear Fusion*, ?????, not in our lifetime, dangerous
- *Wishful thinking*, the millions of years of solar energy (fossil fuels) is almost half gone in less than 100 years, CO<sub>2</sub> limits use, can't bet our future on dreams – ENERGY SUICIDE

**Conservation & Efficiency** – Must cut energy use by ¾ worldwide

# What must be done

- 80% cut in CO<sub>2</sub> by 2050 = **5% reduction** every year for 43 years = **5% reduction in fossil fuels every year**
- A \$100/ton carbon tax to fund a new green energy system
- Finite fossil fuels should only be used to back-up renewables
- Electricity to become 60-80% of energy supply, up from ~20%. Nationalize the electrical grid
- Must move to electrified mass transit and drop the auto-centric model. No new roads, airports, gas stations, car dealers, trucks, natural gas pipelines.
- Local renewable energy at homes, farms and businesses
- Massive switch to solar water heating, and wood/biomass for heating. GSHP for electric heating/cooling. Trains, buses

# What's getting in the way?

- Misperceptions/myths
- Poor energy knowledge
- Greed over morals
- Politics vs “Doing what’s needed” – Can Obama lead the change that is needed?
- Old ways of thinking
- Past sunk costs
- **Inability to understand a finite EARTH**



# What does this mean?

- Shutdown Vermont Yankee in 2012 (~250 MW<sub>ave</sub>)
- Much, much greater conservation and efficiency
- Build in-state renewables without delay
- Shift to electricity as main energy source
- New buildings to use 80% less energy
- Changing our energy mindset, moving to distributed renewable resources, smart grid to integrate renewables

# It's possible!



## But it requires a whole new way of thinking

# Information Sources

[www.EarthTurbines.com](http://www.EarthTurbines.com) Home wind turbines

[www.AllSunTrackers.com](http://www.AllSunTrackers.com) Solar Electric trackers

[www.NRGSystems.com](http://www.NRGSystems.com) Wind Measurement & Green Building

[www.awea.org](http://www.awea.org) American Wind Energy Association

[www.REVermont.org](http://www.REVermont.org) Renewable Energy Vermont

[www.windpower.org](http://www.windpower.org) Danish Windpower

[www.simmonsco-intl.com](http://www.simmonsco-intl.com) Mathew Simmons' speeches – see  
“The Energy Crisis Has Arrived”

[www.EndOfSuburbia.com](http://www.EndOfSuburbia.com) Peak Oil & the Automobile

[www.energybulletin.net/primer.php](http://www.energybulletin.net/primer.php) Primer on Peak Oil

[www.kunstler.com](http://www.kunstler.com) The Long Emergency – New living arrangements