The Plainfield & Cornish Energy Committees'
RENEWABLE ENERGY EDUCATIONAL SERIES

What is Ready for 100% Action?

Why Now?

What does it mean for our towns?

What is Ready for 100% Action?

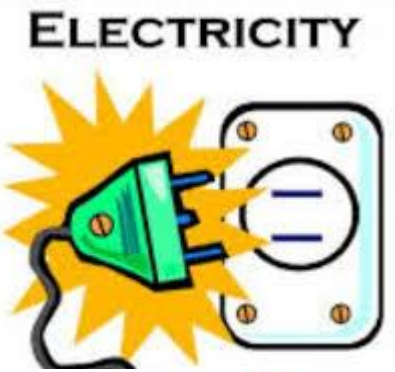
Our towns would commit to adopting 100% clean, renewable and sustainable energy for all our energy needs.

Form of Action: Town Warrant Article – Vote at 2018 Town Meeting.

All 3 energy sectors:

READY FOR 100% ACTION

- Electricity



- Heat

- Transportation

Target Dates:

- 100% renewably powered electricity by 2030.
- 100% renewably powered heat and transportation by 2050.
- *Residences, municipal buildings, businesses, churches, etc.*

Why Now?

Why Now?

It's the smart thing to do.

Why Now?

It's the smart thing to do.

It's about planning ahead.

Why Now?

Our current energy path is not sustainable.

Environmental cost of putting 30 billion tons of carbon into the atmosphere every year.

Something needs to be done to alter the direction our climate is moving in.

Why Now?

Fossil fuels are a limited resource

The only remaining reserves of fossil fuels are in the most difficult and expensive locations to reach

Fossil fuel prices will become increasingly volatile

Why Now?

Switching to renewable energy is the smartest thing we can do to ensure a safe, stable and enduring future.

Now is the time to take action. The longer we wait, the more it will cost & the more difficult it will be.

Why Now?

Technological advances in renewable energy are growing at a rapid pace.

Cities, nations and corporations around the globe are adopting renewable energy plans.

Renewable energy solutions will be the dominant model in the very near future worldwide.

What is clean, renewable and sustainable energy?

Anything that is naturally replenished and has minimal impacts on the environment.

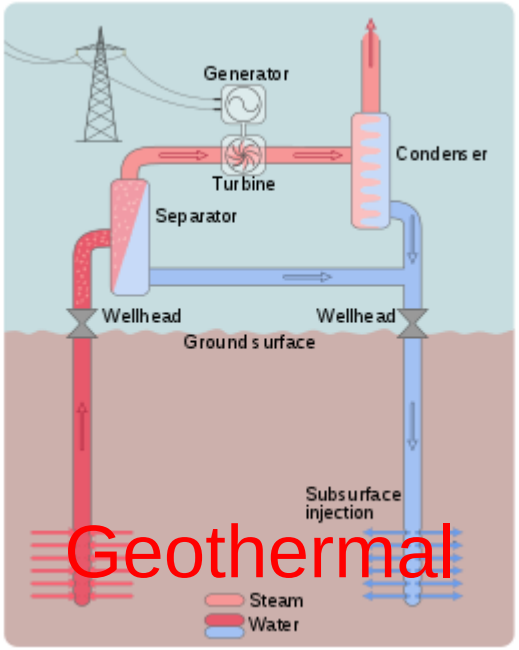
Every energy source has some environmental cost.

What is clean, renewable and sustainable energy?

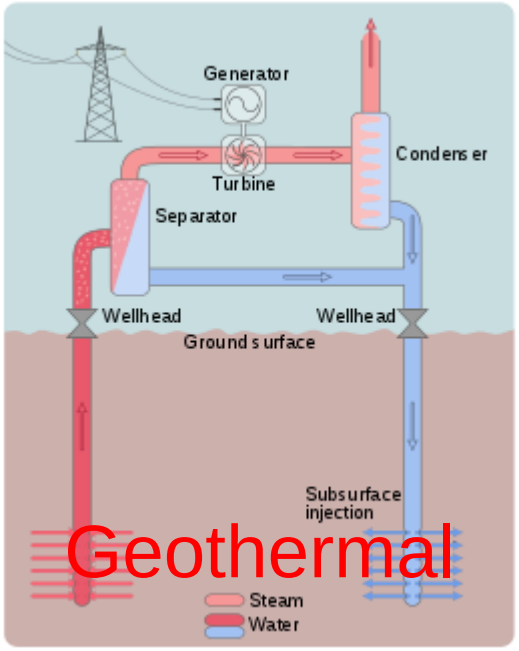
What is clean, renewable and sustainable energy?

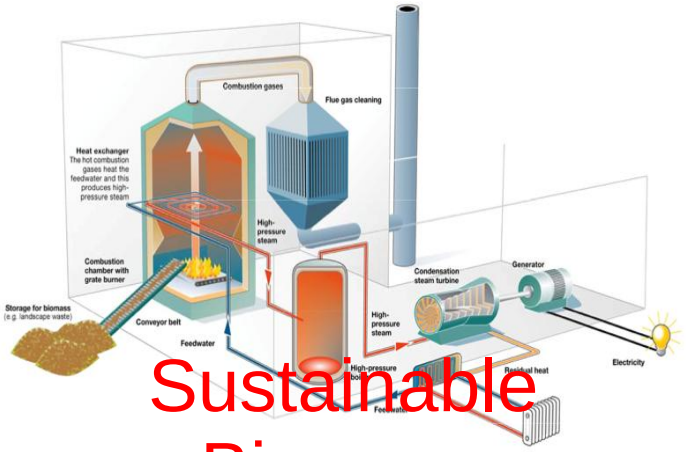
What is clean, renewable and sustainable energy?

What is clean, renewable and sustainable energy?



What is clean, renewable and sustainable energy?

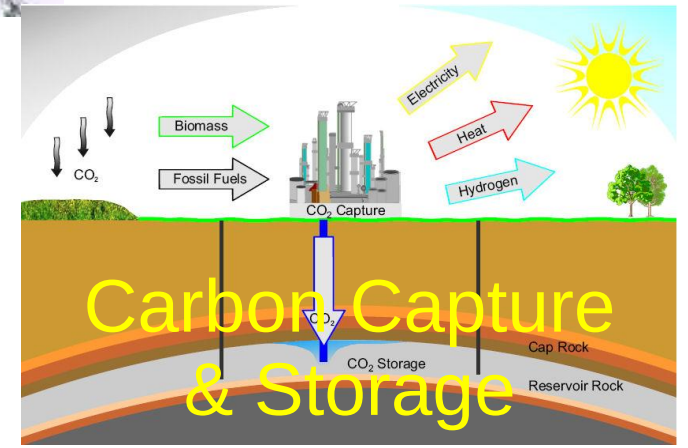




What is NOT clean, renewable & sustainable?

What is NOT clean, renewable & sustainable?

What is NOT clean, renewable & sustainable?



Is this achievable?

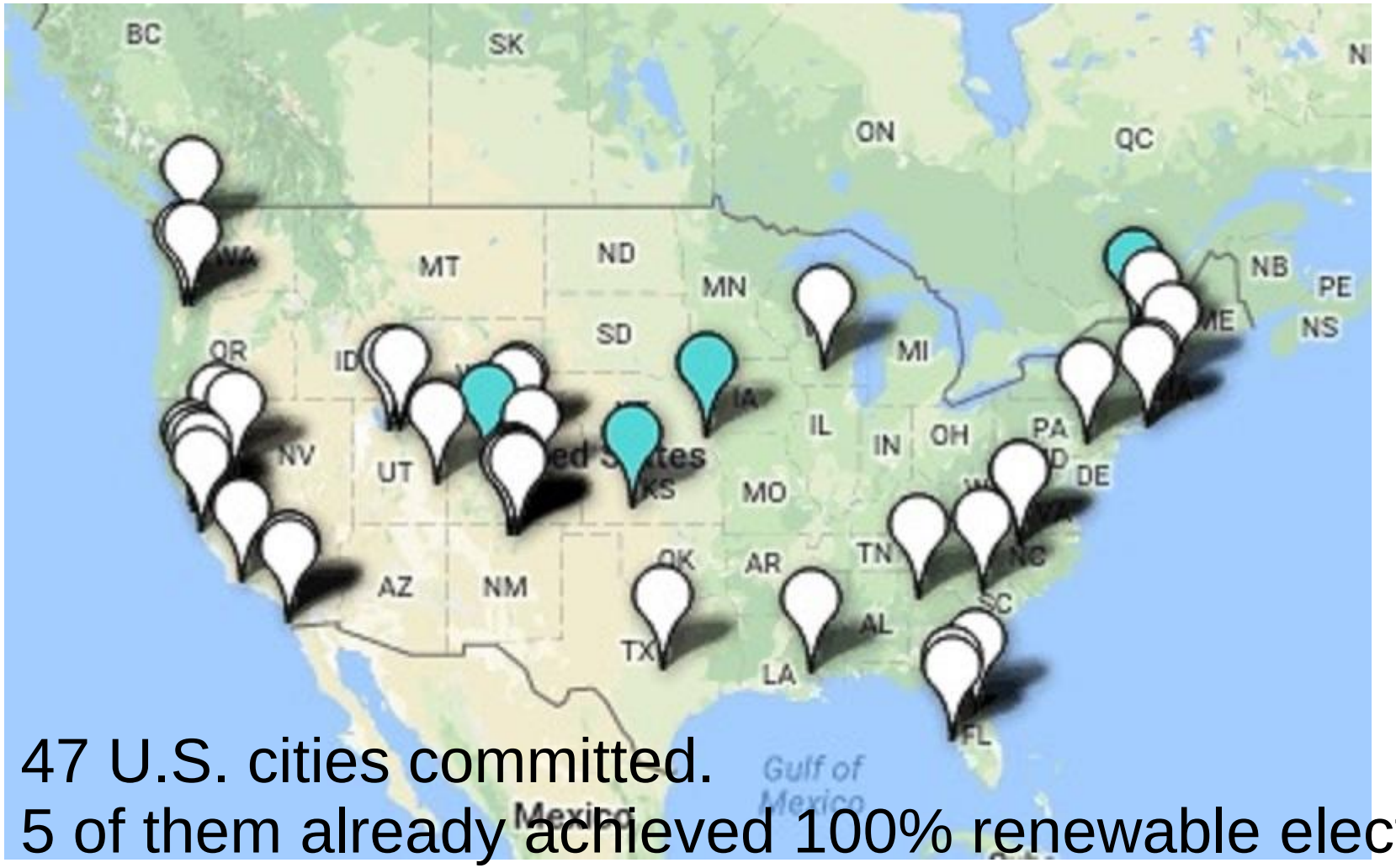
Is this achievable?

We believe so:

- It's being done right now by others.
- Technological advances over the past 10 years support feasibility of transition.
- We have 32 years to plan ahead.

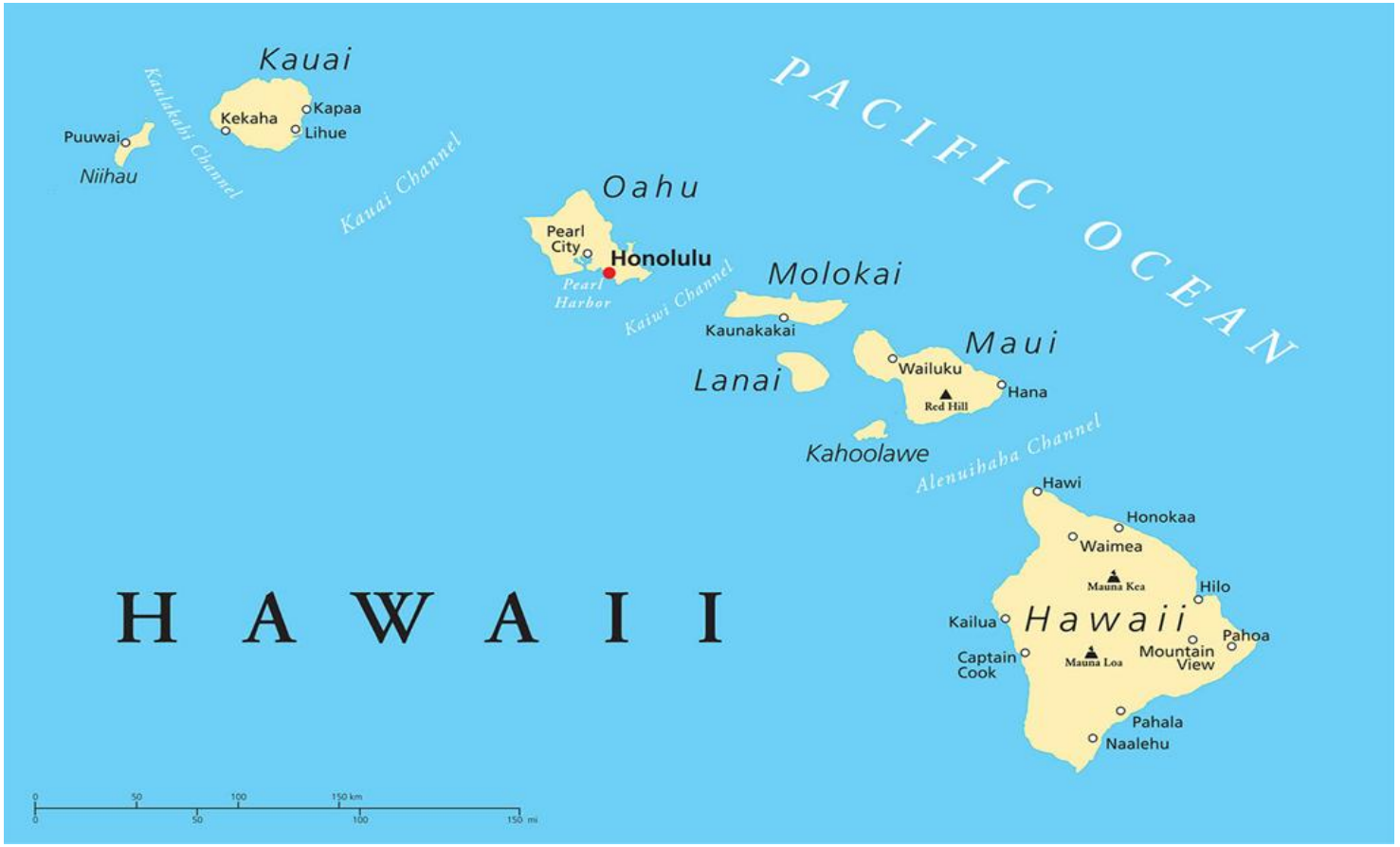
Who is doing this now?

Who is doing this now?



47 U.S. cities committed.
5 of them already achieved 100% renewable electricity.

Who is doing this now?



Hawaii is committed to reaching 100% renewable energy by 2045. They are already at 9.5%.

Who is doing this now?

Goal: 100% fossil fuel-free by 2050.
Already 57% renewable electric power

26 cities & 5 districts have
100% renewable goals.

Who is doing this now?

Who is doing this now?

Georgetown, TX
100% renewable electricity by 2018.
Heating, cooling & transportation by 2030.

Who is doing this now?

Who is doing this now?

READY FOR 100% ACTION

113 Corporations worldwide, including:

Microsoft

Goldman Sachs

Kellogg's

LEGO

Walmart

Technological Advances

Electric vehicles:

Now can travel more than 200 miles on one battery charge.

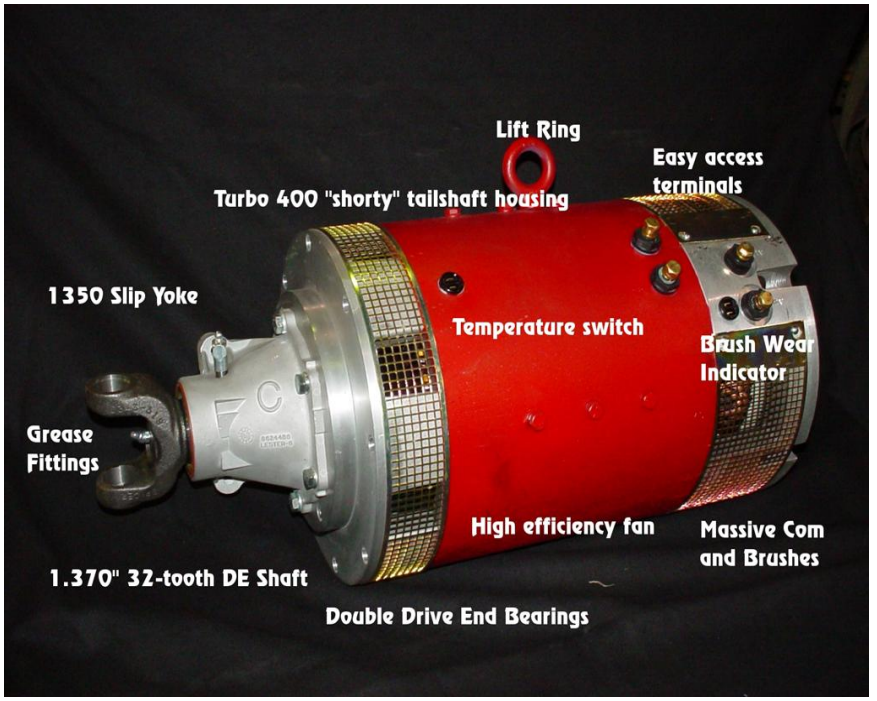
Great deal of innovation, including electric buses and even heavy duty trucks, which are already in use.

Technological Advances

READY FOR 100% ACTION

Comparing Gas Engine vs. Electric Engine:

Internal combustion engine (ICE)
2,000+ moving parts



Electric vehicle motor
18 moving parts
100x less!

Technological Advances

Internal Combustion Engine vs. Electric vehicles:

21% efficient	95% efficient
80% of gas goes up in smoke or heat.	Only 5% energy lost.

Electric vehicle is 5x more energy efficient than ICE.

Technological Advances

Electric trucks:

Chicago - 2014
1st all electric garbage truck.

2013: Dutch Emoss
19-ton truck, 200 mile range
7 other Dutch electric trucks in operation

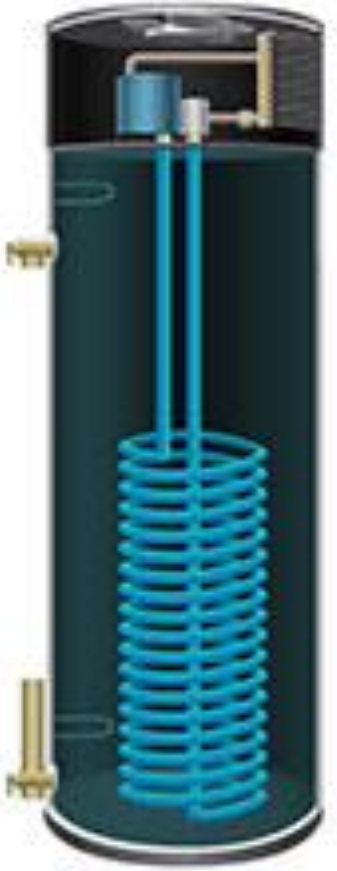
2006: Smith Newton
55-110 mile range
Sold worldwide.

2014: Swiss E-Force One
18-ton truck
Solar panels on top

Technological Advances

Heat Pumps:

Most efficient method of heating homes and water using electricity.



Technological Advances

BATTERIES & ENERGY STORAGE:

Renewable sources provide electricity intermittently.

Batteries are a key component to successfully transitioning to 100% renewable energy.

Technological Advances

BATTERIES & ENERGY STORAGE:

EXISTING:
Lead Acid
Battery

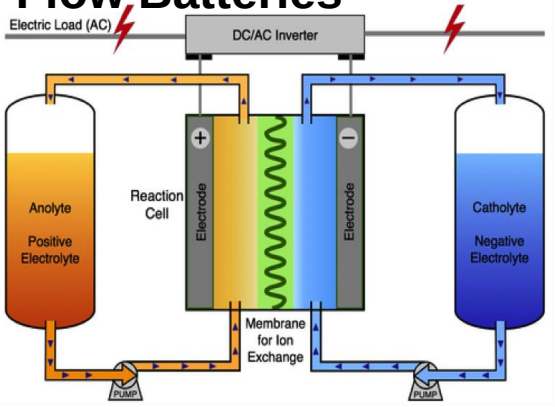
ADVANCED:

Tesla Powerwall 2

SONNEN

Lithium Ion Batteries

Flow Batteries



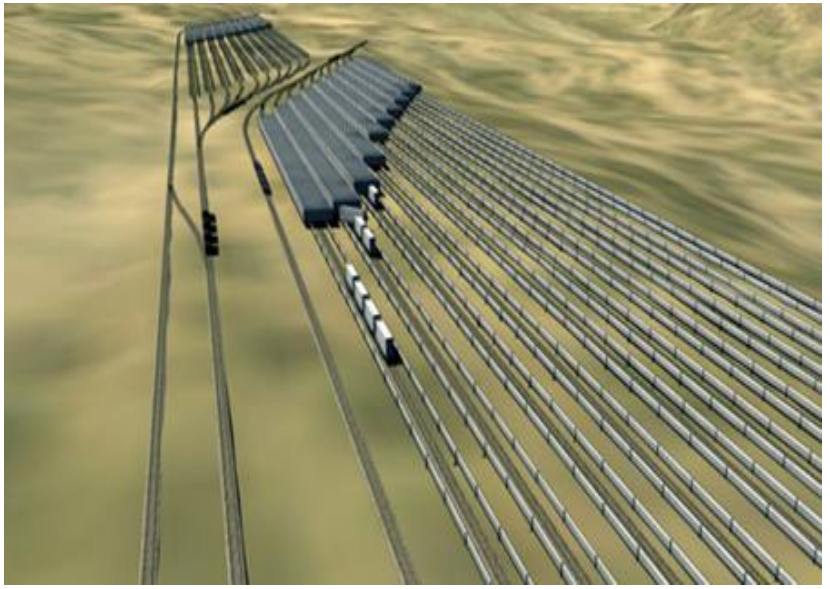
Technological Advances

READY FOR 100% ACTION

LARGE SCALE ENERGY STORAGE:

CONCENTRATED SOLAR & MOLTEN SALT

GRAVITY TRAIN



Technological Advances

READY FOR 100% ACTION

SMART GRID

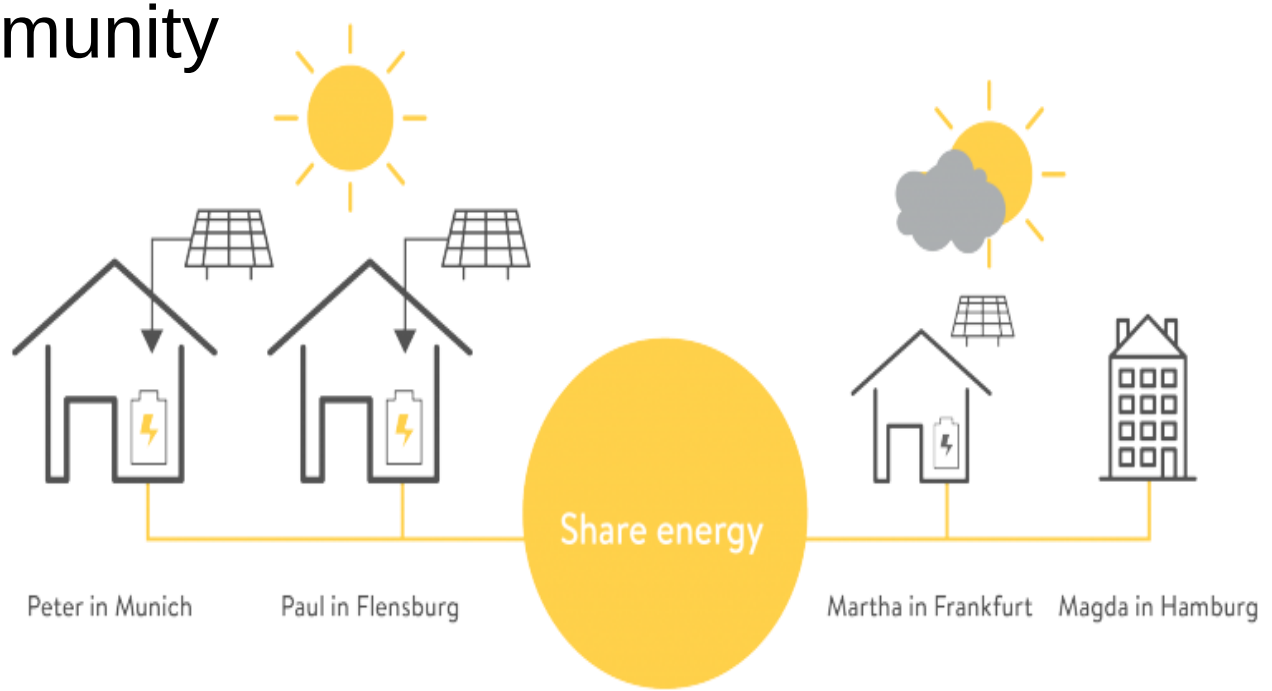
Technological Advances

BATTERIES & ENERGY STORAGE:

<u>Decentralized & virtual power plants:</u>

Green Mtn. Power Powerwall Program in Vermont

Sonnen Community



Key Components to achieving renewable energy goals

Combine renewable energy with:

Batteries

Renewable Energy is much more than just solar.

Achieving a renewable future involves:

- Reducing energy use (efficient appliances, conservation)
- *WEATHERIZING* buildings (sealing, insulating)
- Transitioning to electric vehicles
- Using electric powered heat pumps instead of oil or gas burners
- Community solar farms

Renewable Energy is much more than just solar.

Our towns could…

- create their own utility
- have energy cooperatives
- have municipal, residential, and community energy storage batteries
- install electric vehicle charging stations at stores, municipal buildings, and in homes
- think about purchasing electric school buses and heavy duty trucks

Electrify Everything

- ***Moving away from fossil fuels means electrification of everything:***
- Electric ranges
- Electric heat pumps
- Electric heat pump water heaters
- Electric cars and car chargers
- Electric lawn mowing equipment
- Electric chainsaws

Reduce Overall Energy use. Increase electrical use

By electrifying everything, there would be an increase in electrical usage.

This would need to be accommodated by additional renewable energy generation.

This is NOT a mandatory program.

It is voluntary.

The targets are non-binding.

This commitment would serve as a compass to guide future decisions in our town.

A town that has adopted the goals would make prudent fiscal choices which will increasingly be for renewable energy.

Positive Benefits will drive choices

Switching to renewable energy will become the wise choice:

- Energy efficiency & weatherization will benefit homeowners.

- Electric cars, heat pump systems, solar panels will become the most cost effective method for all energy use.

Just & Equitable Transition

- Provide support & opportunities to help make it possible for everyone to benefit.
- We all need to look ahead and be aware of how a renewable future may affect our current livelihoods.
- Jobs in fossil fuel-related industries will diminish.
- Support those who currently work in fossil fuel-related jobs by making sure they have access to clean energy jobs.

Just & Equitable Transition

The good news is that many new opportunities for innovation and employment in the renewable energy sector will be opening up.

Just & Equitable Transition

CLEAN ENERGY JOBS in 2016:

2017 U.S. Energy & Employment Report

- 350,000 jobs in solar industry, **exceeding** the **combined** # of jobs in fossil fuel electric industry, which was 200,000.
- 100,000 jobs in wind energy.
- 700,000 jobs in electric, hybrid, hydrogen fuel vehicles.
- 1.8 million jobs in energy efficiency industry.

What plan will get us to 100%?

- Each town is unique – there is no set plan that all towns can follow.
- Each town will need to review its resources & strengths, and devise a plan that will work for its unique features.

What plan will get us to 100%?

First Steps:

- ✓ Calculate all residential & municipal energy needs.
- ✓ Weatherize buildings.
- ✓ Reduce energy use.
- ✓ Explore what locations would be good for large solar & wind installations.
- ✓ Hire energy consultants to recommend best strategies to benefit the town.
- ✓ Start to install electric vehicle charging stations in as many locations as possible.

IT'S ABOUT PLANNING AHEAD

- It's important to be thinking about renewable solutions for all aspects of town programs and residential life.
- Town Committees would be guided by principles of renewable energy for all their projects:
  - Planning Board
  - Zoning Board
  - Selectboard
  - School Board

How much will this cost?

- No specific costs tied to this proposal.
- Town will need to balance energy innovation with fiscal responsibility.
- Future expenditures will be subject to the standard budgetary process that identifies costs & benefits (tangible & intangible).

How will we pay for this?

- Grants – USDA Rural Energy grants
- Loans – low interest energy loans
- PPA's – Power Purchase Agreements

EXAMPLES:

- Plainfield Elementary School Solar
- Cornish Commercial Solar Installation at Miller residence on Townhouse Rd.

How will we pay for this?

It is our hope that towns will see the wisdom of dedicating funds to invest in renewable energy projects.

Plainfield Elementary School
Deep Energy Retrofit
2009-2010
$275,000 bond

How will we pay for this?

DEEP ENERGY RETROFIT (DER)

Plainfield Elementary School – 2009-2010

Before: 21,000 gallons fuel oil per year.
215,000kwh electric usage per year.
$80,000 in energy costs per year

After: 4,500 gallons of propane annually (Gym)
160,000kwh electric usage per year (even with addition of electric heat pumps).

Extra benefits: used local workers; cleaner classroom air and quieter classrooms.

How will we pay for this?

Smart financial investments have resulted in significant financial returns

- Saving towns money
- Generating revenue through:
  - Selling of surplus renewably generated energy
  - New businesses that grow from the manufacture or distribution of new renewable energy technology.

How much solar would it take?

ROUGH ESTIMATE –
EXISTING ELECTRIC USAGE

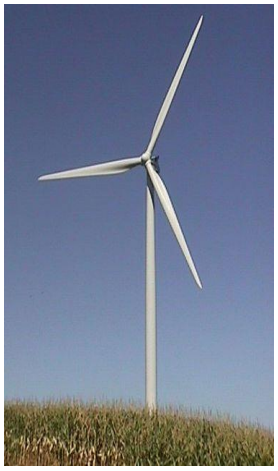
Cornish – 800 households
29 acres of solar

Plainfield – 1200 households
43 acres of solar

How much wind would it take?

ROUGH ESTIMATE – EXISTING ELECTRIC USAGE

And dependent on good wind sites.



Cornish
1 3Mw wind turbine

Plainfield
2 3Mw wind turbines

How much would it take?

LEMPSTER, NH WIND FARM:

- 12 Gamesa 2Mw turbines
- Came online Nov. 2008
- Powers approx. 10,000 homes

Beyond Renewable Electricity

- Electricity is approx. only 21% of our total energy use.
- Possible to power all current electrical needs with renewables by 2030.
- Heat & transportation consume the bulk of our energy use.
- Need to look ahead for ways to supply heat & transportation needs renewably.

Words of Realism

- Not an easy accomplishment.
- No clear path.
- As time passes, we may need to reassess certain plans.
- This may involve changes to our current level of convenient living.

What happens if we don't reach our goal?

If we reach 2050 and have only achieved an 80% renewables target, then we have achieved 80% and we continue on the path to 100% as soon as possible.

UPCOMING EVENTS

Dec. 12 – Film “Clean Disruption”

January – WEATHERIZE LAUNCH

The Plainfield & Cornish Energy Committees'
RENEWABLE ENERGY EDUCATIONAL SERIES


dis
cussion
dis
cussion