

United Nations Climate Summit

Thursday July 24





Public Information North American Young Generation in Nuclear
Fuels Engineer Duke Energy

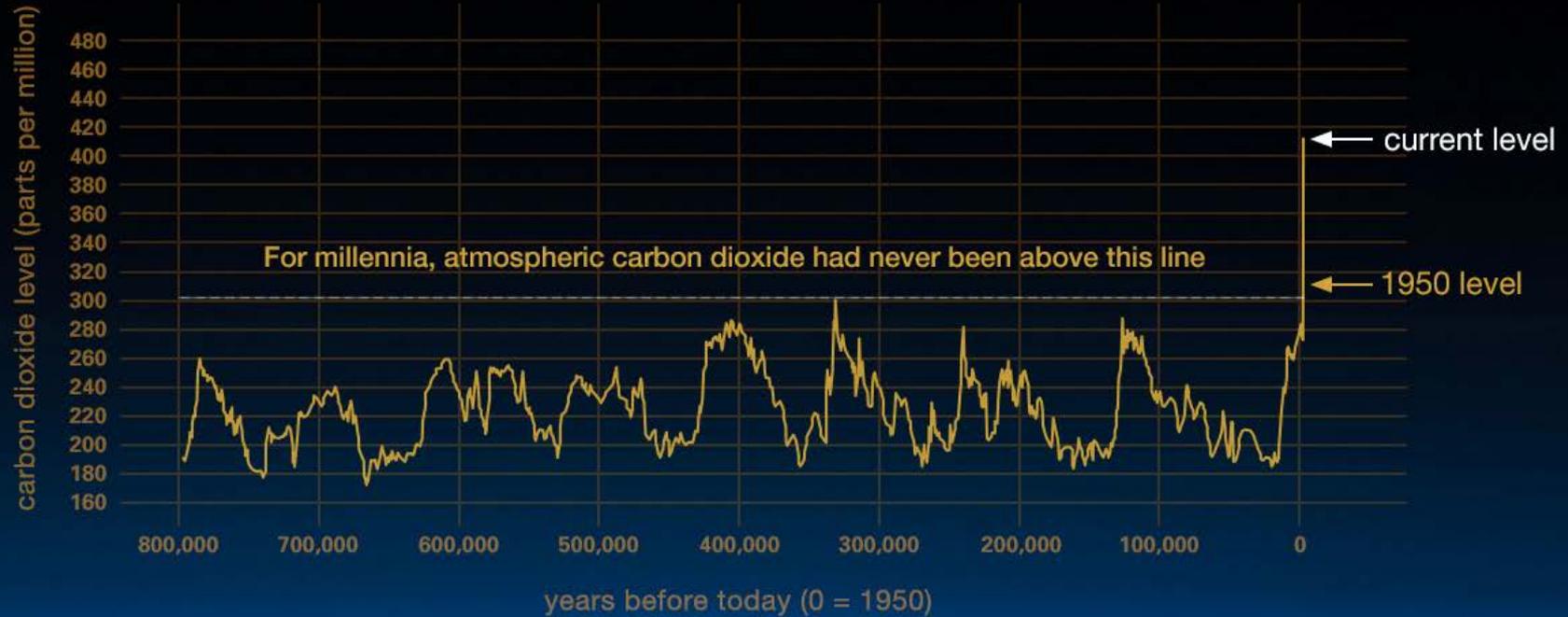
Amanda Lang



- Planet surface temperature: increased 0.9 deg C since late 1800's
- Ocean temperature: increased by 0.22 deg C since 1969
- Sea level: rose by 8 inches in the last century
- Ocean acidification: increased by 30% since beginning of the Industrial Revolution

- Let's look at surface temperature from 1880 to 2018





1.5C

of warming

VS

2C

of warming

Up to
 1.1 months

Heatwaves

Up to
 1.5 months

▼
 9%

Freshwater *availability in the Mediterranean**

▼
17% 

▲
 5%

Heavy rainfall *increase in intensity**

▲
7% 

 Wheat production down
9% ▼

Crop yields *in tropical regions**

Wheat production down
▼ 16% 

 Maize production down
3% ▼

Maize production down
▼ 6% 

 Soy production up
6% ▲

Soy production up
▲ 7% 

 Rice production up
6% ▲

Rice production up
▲ 6% 

▲
 40cm

Sea level rise *by 2100 relative to 2000*

▲
50cm 

 90%
of reefs at risk

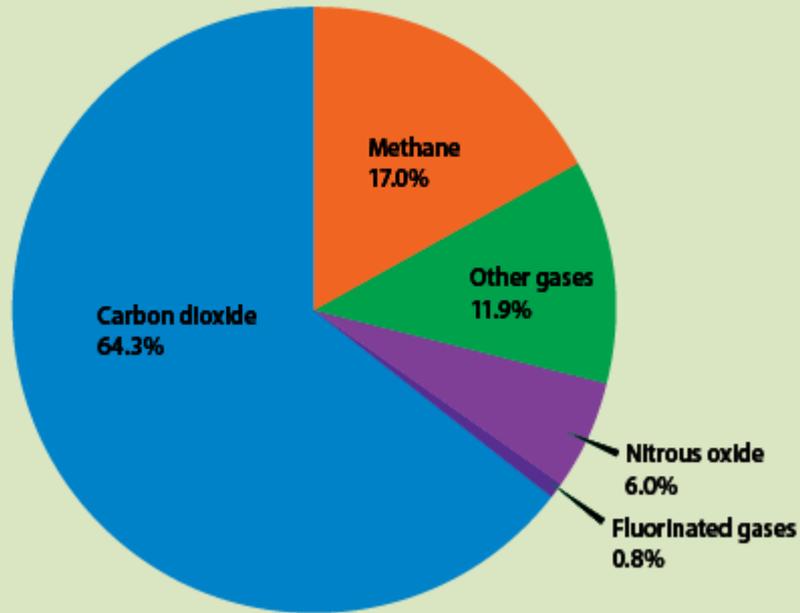
Coral bleaching *from 2050 onwards*

98% 
of reefs at risk

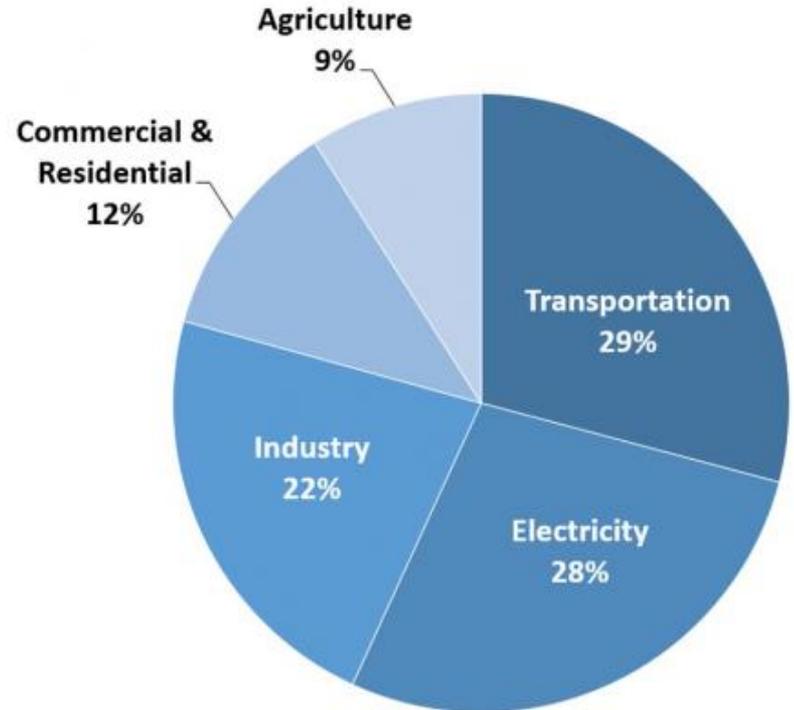
What are greenhouse gases and where do they come from?

- EPA 2014 data

Major Greenhouse Gases from People's Activities



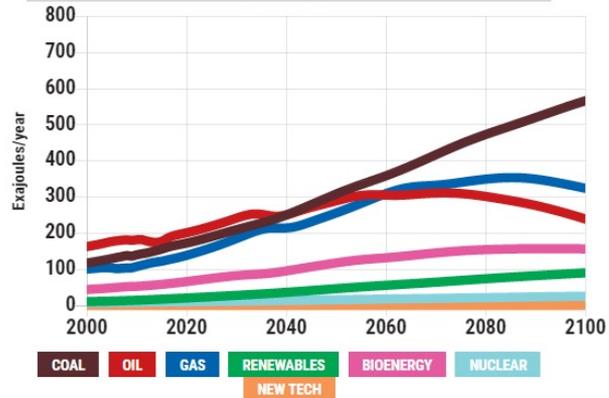
Total U.S. Greenhouse Gas Emissions by Economic Sector in 2017



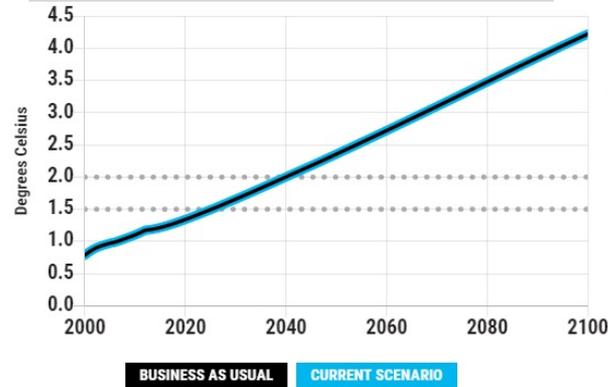
Note: End Time **2:45 pm**

Background on En-ROADS Dynamics

▸ Sources of Primary Energy 



▸ Temperature Change 



+4.2°C

Temperature Increase by 2100

Energy Supply

- Coal: status quo
- Oil: status quo
- Natural Gas: status quo
- Bioenergy: status quo
- Renewables: status quo
- Nuclear: status quo
- New Technology: status quo
- Carbon Price: status quo

Transport

- Energy Efficiency: status quo
- Electrification: status quo

Buildings and Industry

- Energy Efficiency: status quo
- Electrification: status quo

Growth

- Population: status quo
- Economic Growth: status quo

Land and Industry Emissions

- Deforestation: status quo
- Methane & Other: status quo

Carbon Removal

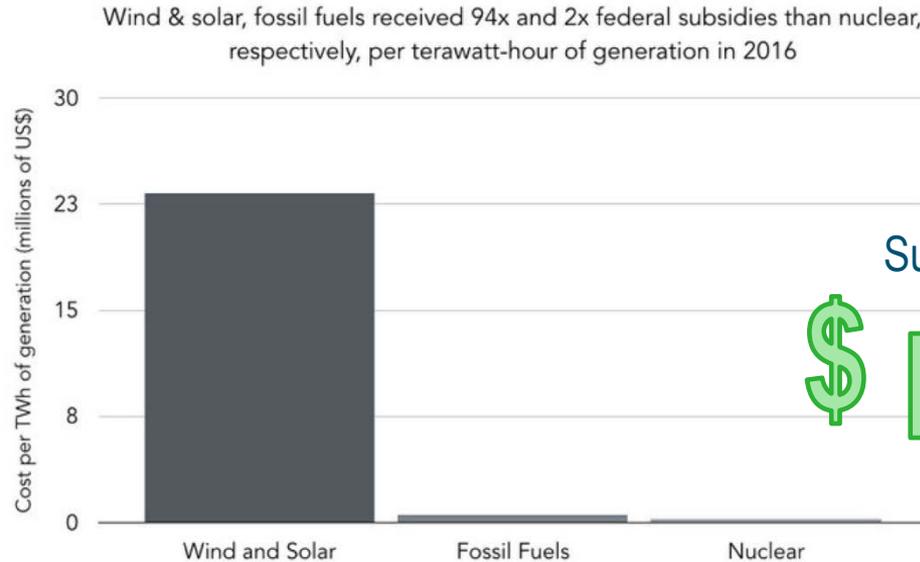
- Afforestation: status quo
- Technological: status quo



Sustainability Initiative

Subsidies (or Taxes) on Energy Supply

- Coal
- Oil
- Gas
- Bioenergy
- Renewables
- Nuclear



Subsidies in En-ROADS:
\$ per kWh

Sources and notes: 2016 wind, solar, oil, gas, coal, and nuclear generation data from U.S. Energy Information Agency.

Total costs of energy-related tax preferences in 2016 adapted from "Testimony on federal support for developing, producing, and using fuels and energy technologies: Hearing before the Subcommittee on Energy Committee on Energy and Commerce", U.S. House of Representatives, 115th Cong. (2017) (Terry Dinan, Congressional Budget Office). Available: <https://www.cbo.gov/system/files/115th-congress-2017-2018/reports/52521-energytestimony.pdf>

Non-biofuel renewable subsidies, totaling \$6.6 billion, are associated almost exclusively with wind and solar electricity. Fossil fuel subsidies, totaling \$4.6 billion, have been apportioned based on applicability of specific subsidies and the proportion of oil, gas, and coal used for electricity. Available: <https://www.cbo.gov/system/files/115th-congress-2017-2018/reports/52521-energytestimony.pdf>

- New!
- Cheap!
- Clean!

FUSION THORIUM

CLOSED FUEL CYCLE

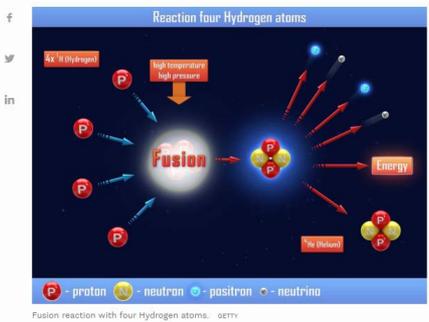
SMRs MICRO REACTORS

FAST REACTORS PEBBLE BED

How to get NEW TECHNOLOGY

- Invest in research and development
- Public/private partnerships

49,975 views | Jun 10, 2019, 07:30am
Google Ran A Secret Experiment To Search For Cold Fusion. Did They Find It?



Fusion reaction with four Hydrogen atoms. cerry

- In En-ROADS:
 - Breakthrough occurs in 2022
 - Price could be approximately equal to coal or half the price of coal.

50,383 views | May 31, 2019, 05:48pm
ThorCon Advanced Nuclear Reactor -- More Than Worth Its Weight In Salt



Each ThorCon power plant is based on one or more hulls, each containing two 250 MWe power modules, a 600 MW super-critical turbogenerator, gas insulated switchgear (GIS), a decay heat pond, and auxiliaries. THORCON

It's been 30 years since America built a really new nuclear power plant



How to Jump-Start a Micro Nuclear Industry in the US

Small and micro reactors could revitalize America's nuclear sector—with support from a new paper from The Breakthrough Institute, the R Street Institute and Clean Energy

JULIA PYPER | SEPTEMBER 27, 2018



Supporters say micro reactors target niche applications, allowing the technology to compete in the near term.

Photo Credit: Third Way



- Coal, Gas, Oil
- Cost will likely be passed on to customers, so policy must be designed to minimize the impacts on the poorest.
- Intent: market effect on energy consumption

Efficient

- Vehicles, shipping, air travel, transportation systems.
- Think: hybrids, public transport, cycling/walking.
- Think more: higher density neighborhoods, reducing flying, telecommuting, buying local, higher parking prices.

Electric

- New cars, trucks, buses, trains, ships
- Think: EV charging stations, battery investments.
- Think more: EV sales targets.

Efficient

- Well-insulated homes, reduce the amount of energy factories use
- Think: people buy energy efficient tech (lighting, motors, appliances, servers, HVAC), conserve energy
- Think more: tax breaks for incentivizing energy efficient products

Electric

- Use more or less electricity in buildings/appliances/machines
- Alternative to more electrification is using fuels like oil and gas
- Think: replace gas furnaces with electric heating systems
- Think more: research electric motors – could wind/solar replace oil and gas-fired industrial facilities?



POPULATION GROWTH

Assume higher or lower population growth. Population is a key driver of increased greenhouse gases; however, this is also tied heavily to consumption habits. Women's education and access to family planning could accelerate shifts to smaller families worldwide.

Examples

- Different assumptions for future fertility rates and demographics.
- Greater empowerment of women and girls, resulting in lower fertility rates.
- Increased education on and access to reproductive health services.

Energy access is about providing modern energy services to everyone around the world. These services are defined as household access to electricity and clean cooking facilities (e.g. fuels and stoves that do not cause air pollution in houses). - International Energy Agency



**17% of the
global
population
lacks access to
electricity**

**1.2 billion people
don't have
access to
electricity**

- At what GDP per capita would you be comfortable living?

172	<input type="checkbox"/>	Haiti	1,864
173	<input type="checkbox"/>	Togo	1,746
174	<input type="checkbox"/>	Eritrea	1,657
175	<input type="checkbox"/>	Comoros	1,632
176	<input type="checkbox"/>	Madagascar	1,630
177	<input type="checkbox"/>	Sierra Leone	1,620
178	<input type="checkbox"/>	South Sudan	1,502
179	<input type="checkbox"/>	Liberia	1,418
180	<input type="checkbox"/>	Mozambique	1,291
181	<input type="checkbox"/>	Niger	1,217
182	<input type="checkbox"/>	Malawi	1,199
183	<input type="checkbox"/>	Congo, Democratic Republic of the	767
184	<input type="checkbox"/>	Burundi	732
185	<input type="checkbox"/>	Central African Republic	712
—	<input type="checkbox"/>	Syria	n/a
—	<input type="checkbox"/>	Venezuela	n/a

International Monetary Fund (2018)^[4]

Rank ↕	Country/Territory ↕	Int\$ ↕
1	Qatar	130,475
—	Macau	116,808
2	Luxembourg	106,705
3	Singapore	100,345
4	Brunei	79,530
5	Ireland	78,785
6	Norway	74,356
7	United Arab Emirates	69,382
8	Kuwait	67,000
9	Switzerland	64,649
—	Hong Kong	64,216
10	United States	62,606
11	San Marino	60,313
12	Netherlands	56,383
13	Saudi Arabia	55,944
14	Iceland	55,917
—	Taiwan	53,023
15	Sweden	52,984

- In En-ROADS: Population*GDP per capita = Total Global GDP (Gross World Product)

- Deforestation
 - REDUCE: Public support and campaigns to support land preservation.
 - INCREASE: Government subsidies for expanding farms into unused forest

- Methane & Other
 - REDUCTION: Decreased meat consumption.
 - REDUCTION: Modified agricultural practices such as increasing digestion of manure and decreasing fertilizer use.
 - REDUCTION: Decreased leakage from oil and gas industries (natural gas is largely methane)
 - INCREASE: Larger landfills due to many disposable products

- Afforestation (planting trees)
 - Government policies, incentives, and funding to identify available land, plant trees, and manage forests
 - Business, land owner, and public support for large scale tree planting

- Technological (Carbon Dioxide Removal - CDR)
 - Advancements in various CDR technologies through research and development and government policies.
 - Support from businesses, land owners, and general public to implement such technologies.

Climate Summit Simulation

Role Play

- Introduce yourselves:
 - Where you work
 - Why you are in energy industry

Welcome

United Nations Climate Summit

2 minute speech by group lead; 1 action your group will take

Round 1

3 actions your group will take

Round 2

Reflect | How do we feel?

Discussion

Plan a “UN Summit” for an outreach event!

Concluding Remarks

