# The future of energy in 9 short videos with Stanford University professors plus one long video

**Homework: listen to the tenth video**

BIG IDEAS FORUM
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# Note

- Global warming is discussed a lot in this presentation
- This can be a controversial subject
- Please remember everyone is entitled to their opinion.

Access to the videos shown
Can be found on that videos PP Page.

# Not much change in "energy distribution" in the last 100+ years

- Basically what Tesla developed with Westinghouse
- Except computers make decisions now
- Does not take into consideration renewable (Solar and Wind) that are variable.

Not Wireless Power Transfer

Fossil fuels are entrenched and produce green house gasses

# How do we get there?

**Steven Chu**, a Stanford professor of physics, and of molecular and cellular physiology, discusses the enormous challenge of eliminating global greenhouse gas emissions by the end of the century. (*Worldview Stanford*)

https://youtu.be/sbKEYjXX8NY

# Capturing carbon

**Sally Benson**, a Stanford professor of energy resources engineering, explains the essential role of capturing carbon and storing it underground in curbing climate change. (*Worldview Stanford*)

https://youtu.be/kn87eQL7zJ8

# Clean alternatives to gasoline:

**Thomas Jaramillo**, a Stanford associate professor of chemical engineering, explains how researchers are developing clean alternatives to gasoline and other fossil fuels. (*Worldview Stanford*)

https://youtu.be/MLGgz7_hQw8

# Innovations in electricity:

**Arun Majumdar**, a Stanford professor of mechanical engineering, explains how advances in big data and technology will lead to a modern, low-carbon electric grid. (*Worldview Stanford*)

https://www.youtube.com/watch?v=bIhIyZQw8A4

# Improved batteries and solar cells

**Yi Cui**, a Stanford professor of materials science and engineering, discusses the big technical challenges in battery and solar research, and some possible solutions from his research. (*Worldview Stanford*)

https://youtu.be/LUzpCSfnfYI

# Natural gas as a transition

**Mark Zoback**, a Stanford professor of geophysics, discusses the impact of the natural gas revolution as electricity providers transition from coal to a renewable-energy future. (*Worldview Stanford*)

https://www.youtube.com/watch?v=NTaV2cAydv4&t=51s

Financing the transition:

**Dan Reicher**, a Stanford professor of the practice of law, discusses the role of policy and finance in spurring development of clean-energy technologies. (*Worldview Stanford*)

https://youtu.be/NTaV2cAydv4

Controlling chemistry to make new fuels:

**Stacey Bent**, a Stanford professor of chemical engineering, explains strategies underway in her lab for making ethanol from molecules in the air. (*Stanford School of Engineering*)

https://youtu.be/0rMdosPDj8I

Increased efficiency

Our best source of clean energy:

Based on the book *Energy Efficiency: Building a Clean, Secure Economy* by **James Sweeney**, a Stanford professor of management science and engineering, this video explains how gains in efficiency have done more to decarbonize the U.S. economy than all of the growth in renewables, natural gas and nuclear power combined. (*POLICYed*)

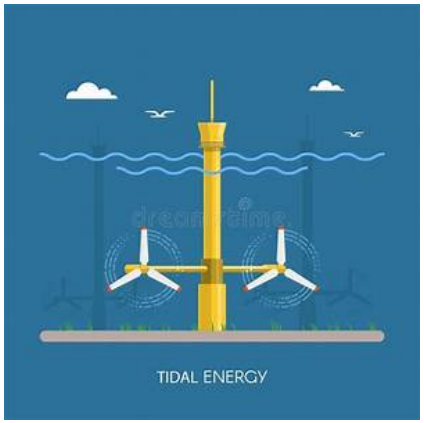
https://youtu.be/bJh53jhpKDA

# Additional Video

The Global Energy Transformation:
**Franklin M. ("Lynn") Orr**, a Stanford emeritus professor of energy resources engineering and former U.S. undersecretary for energy, explains how we're getting closer to producing energy that is clean, sustainable, dependable and economical. (*Future Talk*
https://youtu.be/NTaV2cAydv4

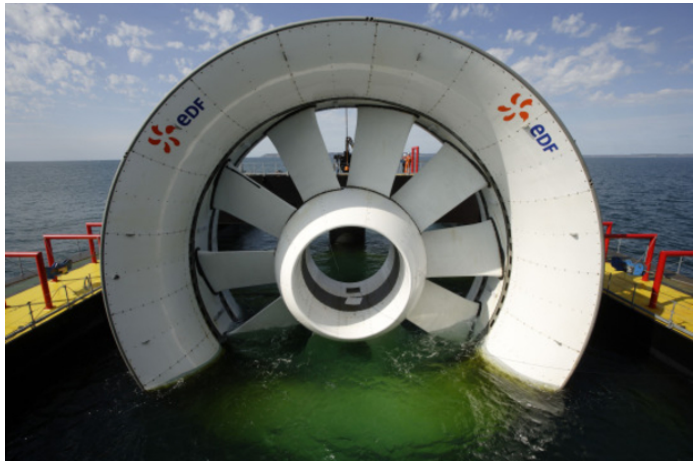
# Tidal Power Generation

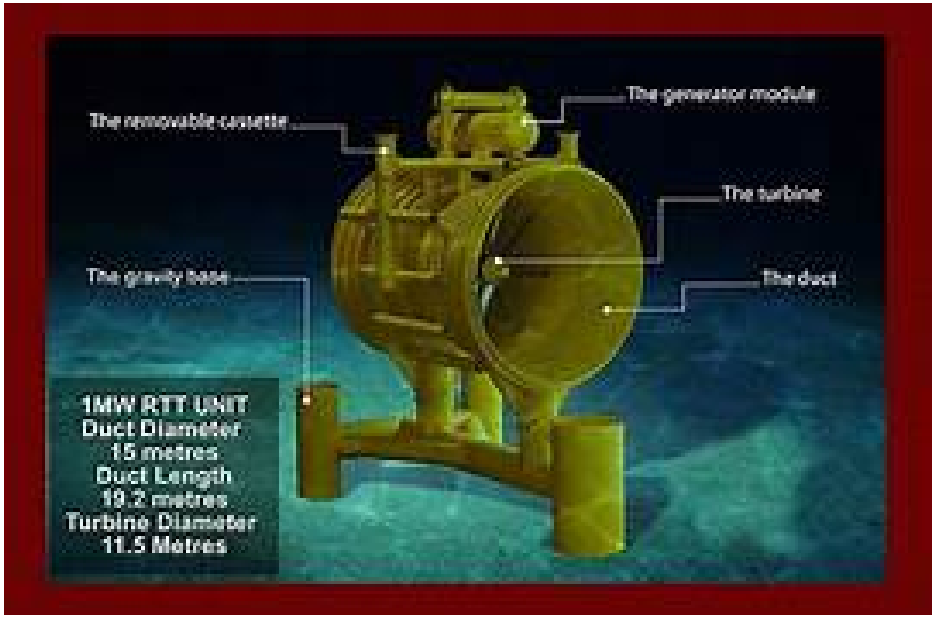
- Gets very little press
- Have the tides turn generator
- More predictable and reliable than wind or solar
  - But not always on




GE Power Conversion is testing tidal turbine electricity generators on the sea floor off the coast of the Orkney Islands in Scotland and at Ramsey Sound in Pembrokeshire, Wales. Sitting at a depth of between 50 and 70 metres, these underwater propellers are positioned precisely to capture the rush of the tides as they channel past the Scottish coast.

# Tidal Power Generation



# Further reading

**Collaboration brings energy transformation to Stanford**
Fifteen years ago, a novel industry partnership sparked an energy revolution at Stanford. Since then, research into renewable energy, batteries, carbon capture, the electric grid and natural gas have sprung up around campus. Read the companion articles to these videos.

Stanford energy experts agree that the world needs to move decisively to a low-carbon energy system. On the road to that future, barriers must be scaled; mysteries, unraveled. The prospect is remaking the world's largest economic sector—energy—to be more sustainable, secure and affordable for everyone.

Coal, oil and natural gas are burned to warm our homes, charge our devices and power our cars. These fossil fuels supply 80 percent of the world's energy use and are the primary human source of greenhouse gas emissions. Our use of energy has become enormously more efficient over the past 50 years, but the associated reduction in emissions has been overwhelmed by global economic growth. Most people agree that cutting our reliance on fossil fuels would have many benefits, but what will replace them and continue economic growth?

Wind and solar are increasingly popular sources of energy, but the sun does not always shine, nor the wind blow. Batteries to store their intermittent energy are not yet cheap and powerful enough to fill the gaps. Nuclear energy produces no greenhouse gases directly, but the current generation of reactors has other problems. Solutions like storing carbon dioxide underground or turning it into clean fuel are promising, but they also need much development. The list of possibilities goes on.

In ten short videos, Stanford researchers describe how, among these many developing options, they envision the world arriving at our green energy destiny. Nobel physicist and former U.S. Secretary of Energy Steven Chu outlines the broad challenge, "which cannot be overestimated." Other professors describe pathways to better technologies, as well as the public policies and financial mechanisms necessary for the best applications to flourish. All agree that the goal is a decarbonized energy system, and that a symphony of solutions—rather than one instrument—likely will create that future.