

My Notes on HBO Vice: The Future of Energy

<http://www.hbo.com/vice/episodes/04/45-the-future-of-energy/index.html>

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Vice on HBO, a weekly documentary TV-series created and hosted by Shane Smith of **Vice** magazine

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Introduction : "At the UN Climate Change Conference in Paris, world leaders agreed that climate change is an urgent threat -- cementing green energy production as a new frontier of innovation. VICE takes an in-depth look at the future of how we make and use energy, and how we can meet growing demand as we cut carbon emissions."

At the UN Climate Change Conference, in Paris in Nov 2015 world leaders reached an agreement to move away from fossil fuels to clean energy.

interview with **Taylor Wilson**, Nuclear Physicist

at 14, he built a nuclear reactor in his garage while attending the University of Nevada

Power is energy over time.

He makes his own "yellow cake" from raw Uranium ore.

"If human beings are going to sustain our civilization long into the future, we have to cut our addiction to fossil fuels." This is done with a combination of technologies: renewable, grid storage & nuclear power.

interview with **Dr. Steven Chu**,

former Secretary of Energy & Nobel Prize winner

Now, U.S. electricity is mostly generated from Coal, 34% (decreasing) & Natural Gas, 33% (increasing). We still have to wean ourselves off fossil fuels for climate change reasons. U.S. is blessed with amazing renewable resources, in 2-3 decades from now we could easily be 50% renewable.

Wind is about 5% of Energy & Hydro is 6% in U.S.

We will still need backup power.

interview with **Elon Musk**,

Inventor & CEO & Cofounder of SolarCity (leading manufacturer of solar power & Tesla Motors, makes the most popular car in America (0 to 60 in 3.2 sec.)

"The end game is to have a sustainable energy future"

Tesla has cutting edge battery technology – Tesla PowerWall designed to work very well with Solar, you can go completely off-grid. Has potential to replace power plants.

He has open-sourced all his patents.

Solar power has made steady advances 5-10 % a year over the past decade.
The cost of solar power is now \$4.29 / watt.

interview with **Peter Rive,**

CTO & Co-founder of SolarCity

In 16 states, you can produce solar power at a rate that is lower than you can buy power from the Utilities companies.

interview with **Claus Poulsen,**

head of one of the largest wind farms in the world (111 wind turbines, 400 mgW)

Denmark has 14 offshore Wind Farms, powering over 40% of the country. On a windy day, all the country's electricity is generated by wind.

Almost 20 % of our electricity is generated by nuclear, the largest single source of carbon-free electricity today. Most nuclear reactors were built in the 60's & 70's.

There are 2 types of nuclear: fission & fusion.

Chu : Fission is splitting atoms apart. The downside is radioactive waste & can be hard to control (Fukushima Nuclear meltdown in 2011 Tsunami in Japan)

Wilson : The way to handle increasing nuclear waste is to design a reactor (molten-salt) that will make electricity from this waste.

In U.S., alone, there is 67,000 metric tons of spent nuclear fuel from power plants & 3 billion metric tons of Uranium waste.

The 2nd type of nuclear power is fusion (the sun has used for billions of years). Energy is produced from a high speed collision of atoms combining.

The fuel is limitless & produces no carbon or toxic waste, no chance of meltdown.

interview with **Dr. Mark Herrmann,**

director of National Ignition Facility, world's largest laser facility

We still are not able to output more energy than input, but hopes are of generating unlimited, emissions-free electricity

interview with **Bernard Bigo,**

Director General of ITER

ITER - a massive nuclear fusion experiment, 7 countries are working together for this goal in southern France using magnetic fields instead of laser. It will be ready in 10 yrs.

interview with **Dr. Steven Cowley,**

Head of Culham Centre for Fusion Energy in Great Britain

JET is an experimental facility that uses hot plasma fuel for fusion. It is actually outputting more energy than input.

“Fusion is the perfect way to make energy. It is definitely the energy source of the future.”

footage of Pres. Obama : “The world is firmly committed to a low-carbon future, and that has the potential to unleash an investment and innovation in clean energy at a scale we have never seen before.”

Musk : “Eventually we are going to move to sustainable energy ... Between now & then, how much carbon are we going to put in the environment?”

Shane Smith : “Humanity already has the technology to make clean & virtually limitless energy. ... What we have to do now is keep pushing our politicians and our energy providers, as well as using our purchasing power, to make sure we speed up the adoption of renewable ... before it's too late.”