

ZERO-EMISSION FOSSIL FUEL POWER PLANT

Speech text

Good morning. My name is Dmitriy Fedoriaka, I'm a fourth-year student at MIPT. We are here today to discuss a new, clean and cheap, technology of energy production from fossil fuel, proposed by American engineers. It's important topic because today humanity need clean ways of energy production, but renewable energy sources aren't able yet to satisfy all needs in energy. So, I will tell you about zero-emission fossil fuel power plant. My talk is based on the article from Science News. My presentation will take up to 8 minutes, after that I will be glad to answer your questions.

I will start with the overview of modern wide-used technology of producing energy from natural gas. **Then I am going to** new state-of-the-art technology which enables to produce energy without air pollution. **After that I'd like to** discuss advantages of that technology and tell you how it is implemented.

Let's start with the overview of world energy production. The chart on the slide shows annual electricity generation in the world by sources. 2/3 of world energy is produced from fossil fuels (i.e. coal, petroleum or natural gas). 1/5 of world energy is produced from natural gas.

Now let's see how conventional natural gas power plant works. Natural gas is burnt in air oxygen. Combustion gases at high pressure drive gas turbine which produces energy. **Then** they are directed to boiler, where they boil water and **eventually** are emitted into atmosphere. Steam from boiler drives steam turbine, which also produces energy. **Then** steam is directed to cooling tower where it is cooled and becomes water again. This cycle yields about 60% efficiency, **but** combustion gases are emitted into atmosphere, creating air pollution. **Also** a lot of energy is wasted when steam is cooled in cooling tower.

Let's move on to the next slide and see what USA startup NET Power offers instead. They offer fundamentally different technology, called the Allam cycle, designed by British engineer Rodney Allam. In this cycle the only working body is carbon dioxide, and it is not in gaseous form, but in the form of supercritical liquid – when it expands like gas but floats like liquid. In Allam cycle, natural gas is burned not in air oxygen, but in specially extracted from air pure oxygen. Combustor produces only carbon dioxide and water in form of supercritical liquid. They drive CO₂ turbine which produces energy. **Then** they are cooled, water condenses and CO₂ is stored without being emitted to the atmosphere.

That brings me to the main point which deals with the advantages of such technological process. **First of all**, it is clean because it produces no air pollution. It produces pure water and carbon dioxide, which can be used. **For example**, CO₂ can be used in enhanced oil recovery – the process when CO₂ is pumped into oil reservoirs to free more oil. **Note** that in this process CO₂ goes underground, but not into the atmosphere. **Also there is an important fact that** plant produces only carbon dioxide, it doesn't produce compounds with nitrogen or sulfur or particulate matter, like other fossil fuel power plants. This technology is as approximately much effective as conventional natural gas plant – its efficiency is 60%. Price of energy generation is 6 cents per kilowatt-hour, which is about the same cost as power from a state-of-the-art natural gas-fired plant and cheaper than most renewable energy. **And, after all**, this plant has smaller size because CO₂ turbines are much smaller than steam turbines and also it doesn't need cooling towers.

And the last point of my presentation refers to actual implementation of this technology. Engineers from NET Power managed to get investments and this year they are finishing building of prototype power plant near Houston in Texas, USA, which they started last March. This plant will produce 25 megawatt-hours of electricity. If prototype works well, in 2021 they will build full-scale power plant with power of 300 megawatt-hours, which will cost about \$300 millions.

That brings me to the end of my talk. Let me sum up what I have been talking about. **Firstly**, I described conventional natural gas cycle and new Allam cycle. **Then** I discussed the benefits of the new technology and told you about the prototype which now is being built and future plans of building a full-scale power plant.

In conclusion, people today are really concerned about environmentally friendly ways of energy production and other new clean technologies are likely to appear in the nearest future.

Thank you for your attention. Now you are welcome to ask questions.