Poznan University of Technology

Faculty of Machines and Transportation

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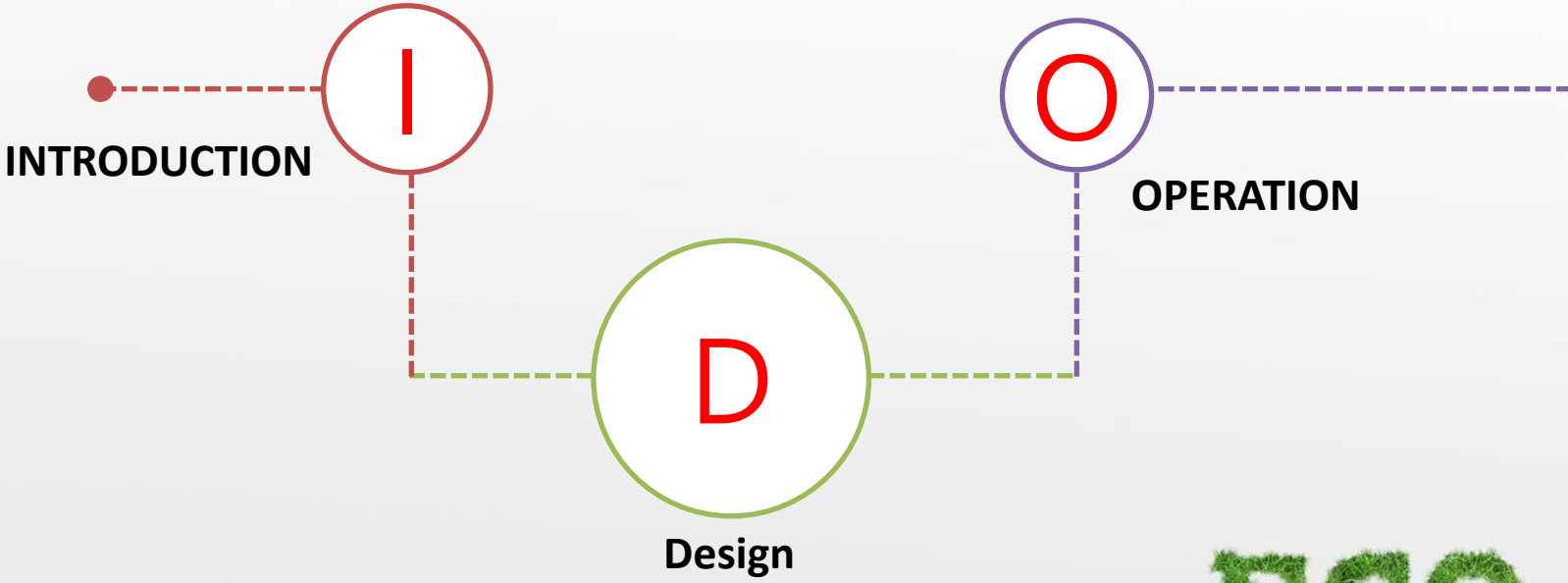
Agenda



A

Advantage

C

Conclusion

Energy Policy Goals

- Increase energy supply.
- Optimize available resources.
- Develop new technology.
- Limiting environmental impact.

Pros & Cons

- **COAL**
  - cheap and abundant
    - but source of greenhouse gases
- **HYDRO**
  - clean
    - but seasonal and no new sources
- **NATURAL GAS**
  - cleaner than coal
    - but limited supply
- **SOLAR & WIND**
  - renewable
    - but expensive, low energy density, and intermittent

Pros & Cons

NUCLEAR

- high energy density
- no air pollution
- reliable fuel supply
  - but what about safety, security, and waste?

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Desktop Turbine Runs On Carbon Dioxide Environmentally Friendly

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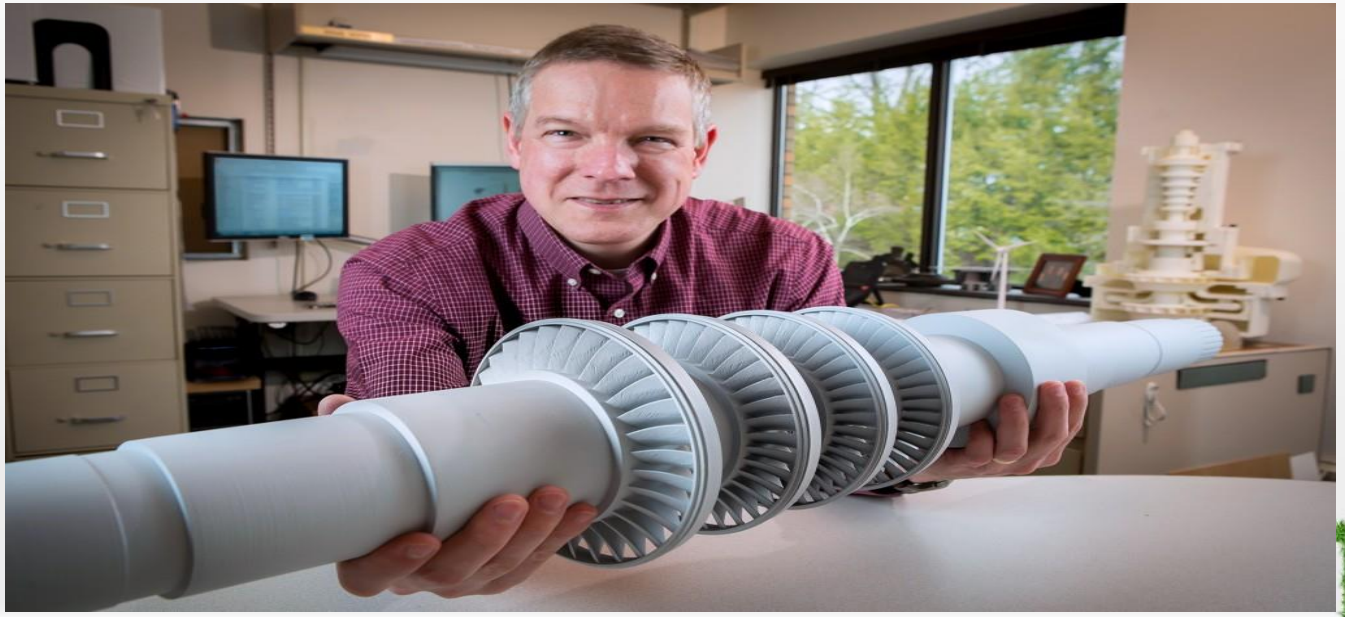
WHAT Is It?



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INTRODUCTION

- A picture may be worth 1,000 words. But this one is also worth 10 MW.
- Though small in stature, the turbine in the photos could contribute to solving some of the world's biggest energy challenges, not to mention powering an entire town.
- The turbine is driven by 'supercritical carbon dioxide', which is kept under high pressure at temperatures of 700˚C.
- Under these conditions, the carbon dioxide enters a physical state between a gas and a liquid, enabling the turbine to harness its energy for super-efficient power generation - with the turbines transferring 50 percent of the heat into electricity.

Design

- Engineers have developed a turbine which has the potential to power a small town all the while being no bigger than your office desk.
- Designed by GE Global Research, the turbine could power 10,000 homes, and could help to solve some of the world's growing energy challenges.
- But rather than steam, which is typically used to set turbines in motion, the new turbine uses carbon dioxide.
- The model was 3D-printed from plastic. The real functional version of the turbine, made from high-strength metal, would make the scientist hold up about 150 pounds (68 kg). But even that's like lifting a feather. Machines generating this kind of power typically weigh several tons.

OPERATION

01 The turbine is driven by 'supercritical carbon dioxide', which is kept under high pressure and temperatures.

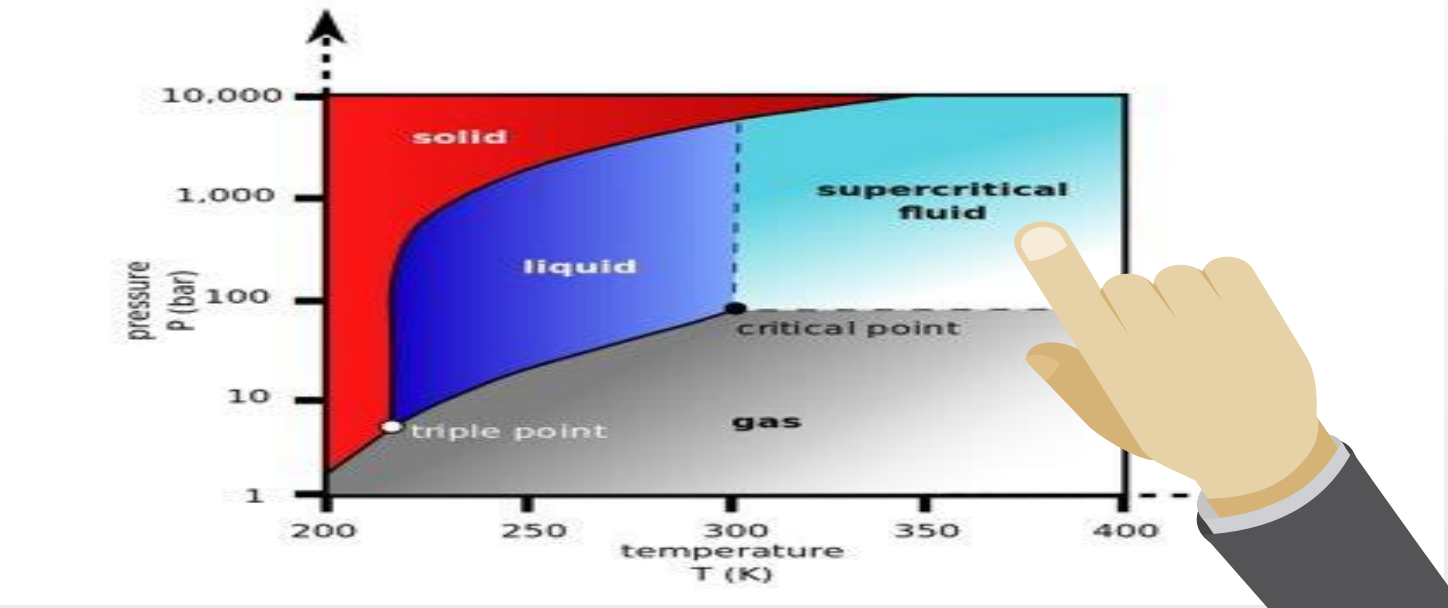
02 Carbon dioxide enters a physical state between a gas and a liquid, enabling the turbine to harness its energy for super-efficient power generation.

03 It could help energy firms take waste gas and repurpose it for efficient and cleaner energy production.

04 Waste heat from solar or nuclear stations, could be used to melt salts, which then heat carbon dioxide gas to a super-critical liquid - which may be much quicker than heating water for steam.

05 Currently, the design of the turbine would enable up to 10 MW of energy to be produced, but it could be scaled up to generate 500 MW, enough to power a city.

Supercritical Fluid



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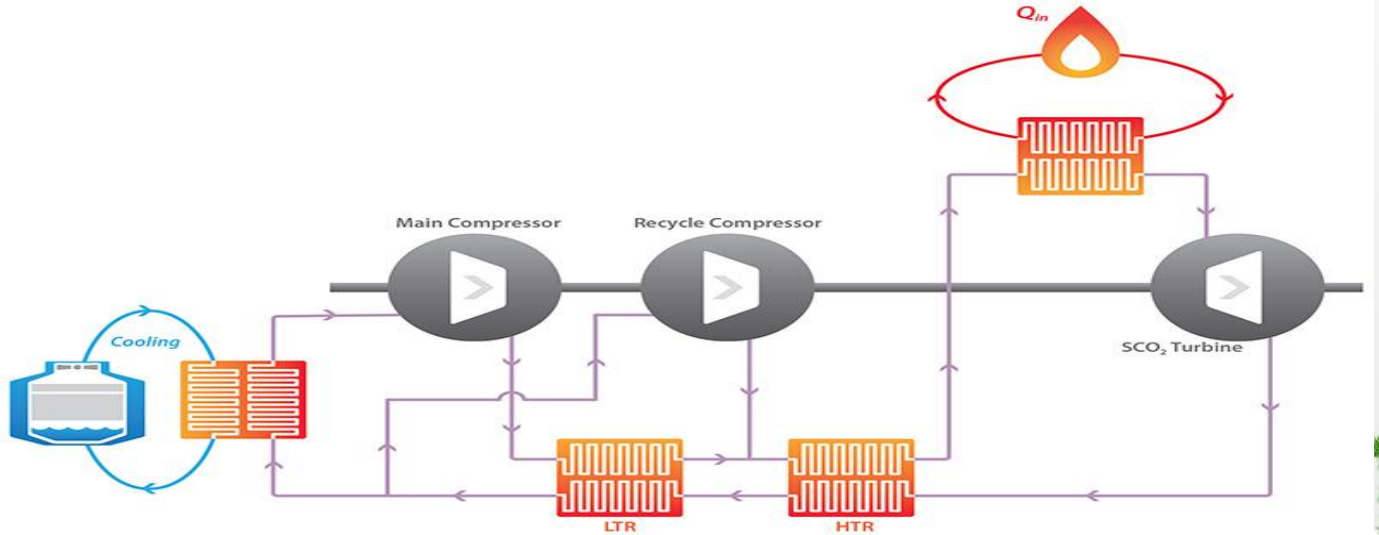
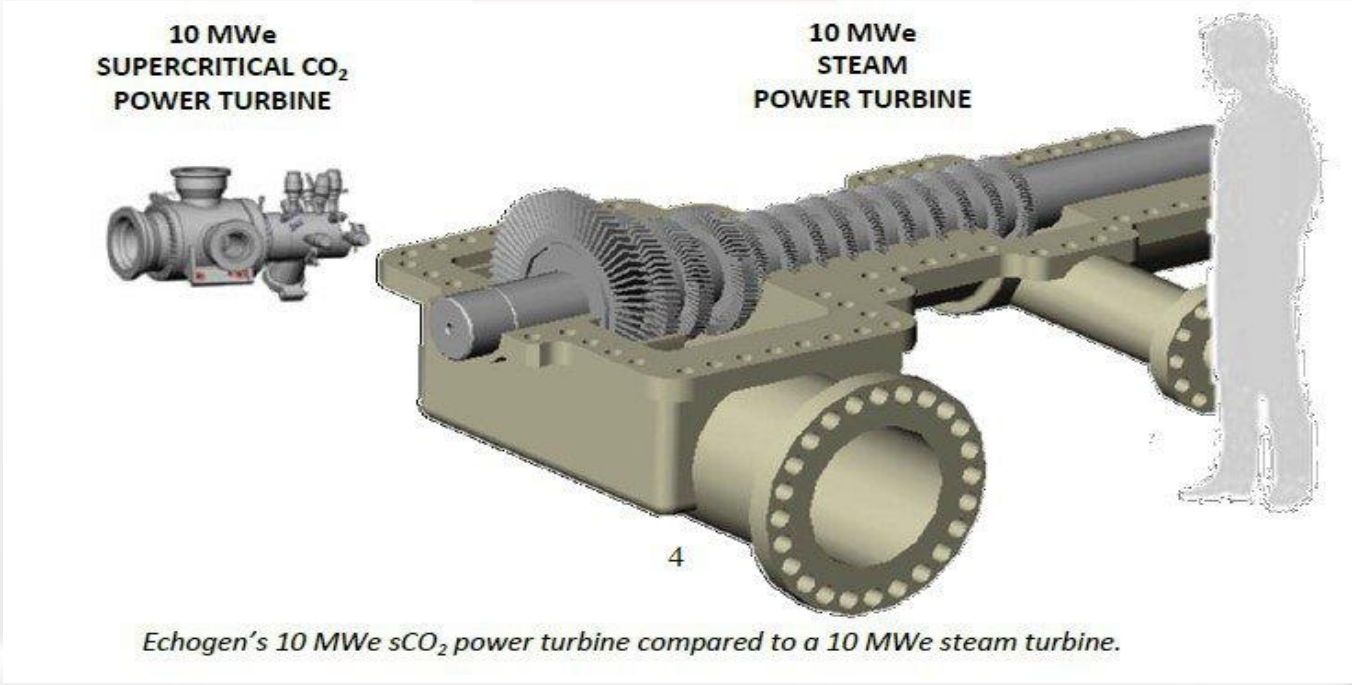
GE confirmed the power cycle is a closed loop which circulates the CO2 continuo usly around the cycle, and that there are no waste products from the system whe n used with solar energy.



Size



Echogen's 10 MWe sCO_2 power turbine compared to a 10 MWe steam turbine.

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Advantages

A. Environmental improvement and reduced product contamination because use the waste exhaus t heat from a natural gas generator.
B. Would be a major environmental benefit, because it would significantly reduce the overall CO2 emissions per kW hour of electricity produced by gas-powered plants.
C. The turbine's design would enable it to be powered up and shut down easily could make it usef ul for grid storage - an issue with renewable sources such as wind and solar.
D. Could make gas-fired power plants 25 to 50 percent more efficient because use the waste exha ust heat from a natural gas generator.
E. Cheap because you are not making the energy, you are taking the energy from the sun or the tu rbine exhaust, storing it and transferring it.
F. Highly efficient, yielding as much as 68 percent of the stored energy back to the grid. The most e fficient gas power plants yield 61 percent.
G. Increase the efficiency of centralized power plants.

Conclusion :

- Tiny turbine that fits on your desk can produce enough energy to power a small town.
- Turbine runs on carbon dioxide under high pressure and heated to 700˚C.
- This supercritical liquid state allows for super-efficient energy production.
- Prototype will produce enough power for around 10,000 homes (generate 500 megawatts).
- Could help energy firms repurpose waste gas and heat for efficient and clean energy production.
- Environmental improvement and reduced product contamination.

Thank You For Your Attention

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