

Appendix A: Challenge Statement 1

Decarbonizing the Global Energy System

Summary

Signed at the end of 2015, the Paris Agreement is a landmark negotiation to combat climate change and accelerate and intensify the actions and investments needed for a sustainable low-carbon future. The central aim of the agreement is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century below 2°C. Students will be asked to design innovative technologies to decarbonize the global energy system and stabilize greenhouse gas concentrations at levels consistent with the goal of staying below 2°C.

Background

What is the Paris Agreement?

At the Paris Climate Conference, convened by the United Nations in December 2015, 195 countries adopted the first-ever universal, legally binding global climate deal, which is set to take effect in 2020 and signals unparalleled international ambition and cooperation to curb climate change.¹ This agreement establishes a global action plan to limit global warming to less than 2°C.² Additionally, the agreement aims to strengthen countries' abilities to address the effects of climate change. Signing countries agreed to the following:

1. Keeping the increase in global temperature well below 2°C above pre-industrial levels.
2. Limiting the increase to 1.5°C, as this would significantly reduce the risks and effects associated with climate change.
3. The need for global emissions to peak as soon as possible, recognizing that this will take longer for developing countries.
4. Achieving zero net emissions in the second half of this century.
5. Undertaking rapid reductions thereafter in accordance with the best available science.

Under the Paris Agreement several countries outlined the post-2020 climate actions they intend to take, also known as Intended Nationally Determined Contributions or INDCs.³ These climate actions largely determine whether the world achieves the long-term goals of the Paris Agreement. These outlines mark structural transformation, decoupling economic growth from greenhouse gas emissions to achieve the goals enumerated above.⁴

Climate Change and the Global Economy

One of the major arguments against strong climate action is that it would have a huge adverse

impact on the global economy, which some argue would be far worse than any future climate impacts. However, as more and more countries shift to clean energy and technologies that reduce carbon emissions, we are seeing a decoupling of economic growth from carbon emissions—meaning that countries are cutting emissions and their economies are still growing. According to the World Resources Institute, 21 countries experienced positive economic growth since 2000 while cutting carbon emissions. These countries include several in Europe, aided by stronger climate policies, and also the United States, where emissions have fallen by about 6% and the economy has grown by 29% since 2000.⁵

In 2015, according to data reported by the International Energy Agency (IEA), global energy-related carbon dioxide (CO₂) emissions, the largest source of human-made emissions, stood at 32.1 billion tons, staying essentially flat for the second year in a row.⁶ The two largest emitters, China and the United States, both showed a decline in energy-related CO₂ in 2015. China's emissions declined by 1.5% as coal use dropped, generating less than 70% of Chinese electricity according to data collected by the IEA. Over the same period, the use of low-carbon sources—mostly hydro and wind—to generate electricity jumped from 19% to 28%.⁷ In the United States, emissions declined by 2%, a change linked to the increase in use of natural gas instead of coal for electricity.⁸

Amazing progress has been made over the last few years; however, the declines in the US and China were offset by an increase in emissions in most of the developing countries in Asia and the Middle East, and a small increase in parts of Europe.⁹ It is nonetheless clear that there is a movement toward greater reliance on clean, renewable energy sources, such as wind, solar, and hydro. Technology and deployment are improving, allowing us to get more economic output for each unit of energy. But to meet the goals of the Paris Agreement, we will need more efficient ways to produce clean energy and further decarbonize our economy.

The Challenge

Design an innovative technology or system that addresses the goal of decarbonizing the global energy system and stabilizing greenhouse gas emissions at levels consistent with the goals outlined in the Paris Agreement. Solutions may include redesigning or rethinking existing technologies, or developing new technology-based solutions to increase the utilization of existing technologies or practices. This may include, but is not limited to, energy sources, grid technology, transportation, and agriculture.

Success Criteria

Solutions will be judged based on the following criteria:

- **Innovation:** Is this a breakthrough in thinking or design? Ideas that show the greatest innovation will be viewed more favorably.
- **Quality of Presentation:** Is the concept concisely and clearly explained?
- **Commercial Viability:** Does an interesting and viable market exist? Can the idea be

commercialized within two years? Is there a clear strategy for commercializing the idea?

- **Sustainability:** What is the social impact? Is the technology scalable?
- **Teamwork:** Was the experience a collaborative endeavor?

Additional Considerations

- A successful solution *should* address the goals outlined in the Paris Agreement.
- A successful solution *should not* require a significant commitment of additional resources, policy changes, or improved core infrastructure for success.
- A successful solution *should* consider existing technologies and systems.
- A successful solution *should* be designed for scale and consider a systems approach.
- A successful solution *should* be cost effective and affordable for the target consumer.
- A successful solution *can* address change in one particular country or region, and does not have to apply globally.
- Successful teams *should* complete and properly submit all deliverables on time.
- Successful teams *should* demonstrate that they worked collaboratively.
- Successful teams are *encouraged* to work with a mentor, if possible, and interact with him/her on a weekly basis.

Notes

1. More information on the Paris Agreement may be found at http://unfccc.int/paris_agreement/items/9485.php
2. Climate Action. Paris Agreement. European Commission. August 12, 2016. http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm
3. What Is an INDC? National Resources Institute. <http://www.wri.org/indc-definition>
4. Ibid.
5. The Roads to Decoupling: 21 Countries Are Reducing Carbon Emissions While Growing GDP. World Resources Institute. August 19, 2016. <http://www.wri.org/blog/2016/04/roads-decoupling-21-countries-are-reducing-carbon-emissions-while-growing-gdp>
6. Decoupling of Global Emissions and Economic Growth Confirmed. Internal Energy Agency. August 19, 2016. <https://www.iea.org/newsroomandevents/pressreleases/2016/march/decoupling-of-global-emissions-and-economic-growth-confirmed.html>
7. Ibid.
8. Ibid.
9. Ibid.