

Discussion Guide: *Energy Switch* Season 1

Based on the popular, national PBS Talk Show *Energy Switch*

Facilitation Notes

Energy Switch brings together two renowned experts from government, NGOs, academia, and industry, with differing perspectives on important energy and climate topics.

These lively discussions are moderated by renowned energy scientist and communicator Dr. Scott Tinker. The show is produced and directed by Emmy-winning documentary filmmaker Harry Lynch, creator of the celebrated PBS series *Great Performances: Now Hear This* and *Stories of the Mind*.

Energy Switch Season 1 features 12 episodes (26 minutes each) that are available on [PBS](#) and the Switch Energy Alliance [website](#).

Lunch and Learn

In advance:

- Select, watch, and assign an episode to discuss.
- Familiarize yourself with Dr. Tinker's episode summary and select questions for group discussion.
- Consider distributing Participant Discussion Questions ahead of time. Note: The Participant Discussion Questions do not include episode summaries. We encourage participants to watch the episode before relying on the summary notes. Summaries are included in the slide deck.
- Print episode discussion questions to have available during the discussion.
- Test AV options for slide deck.

Day of:

- Prep (approx. 10 mins)
 - Connect and test AV if available. Queue slidedeck to display Dr. Tinker's Episode Summary.
 - Distribute copies of discussion questions.
 - Arrange seating to encourage groups of 3-4 people.
- Meeting
 - Suggested Welcome and Introduction (approx 5 mins):

"Welcome and thank you for coming. Please find a seat so we can get started.

We're excited for our discussion about [topic] and the Energy Switch episode [episode title]. This topic is important to us at [name of organization] because we

*[reasons]. We will spend about [time] minutes on each question, so please be concise in your responses. Our goal is to follow the Energy Switch model of robust **and** respectful discussion, so, as a reminder, please make sure [list healthy discussion framework, examples: everyone gets a chance to participate, opposing ideas are heard and respected, follow-up questions to seek clarification, etc.]."*

- Read summary slide(s) aloud (optional).
- Display and/or read the first question.
- Progress through questions.
- Closing (approx. 5 mins):
 - Wrap up lingering discussions.
 - Make any necessary announcements.

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Facilitation Notes

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Episode 1: How Should We Respond To Climate Change?

Dr. Steven Koonin & Dr. Michael Greenstone

[Transcript](#)

Dr. Tinker Summary:

Climate modeling is not precise, but shows that human activity is increasing global temperatures with varying impacts. IPCC reports suggest heat waves and heavy rain events are increasing, but they're less conclusive on storms and wildfires. Calculating the societal cost of carbon emissions is also very difficult, but offers a way to evaluate the price of different CO₂ reduction strategies against the value of their expected benefits. Ideally, we could find solutions that provide affordable energy while reducing environmental impacts. In the end, we'll need to compare the cost of mitigation against adaptation and their likely benefits. How much we choose to spend will be influenced by other global priorities.

1. Some countries have introduced a price on carbon to attempt to reduce emissions: should the US follow suit? What are the arguments for and arguments against? What would be the most important positive and negative effects?
2. Globally, there are more than 2 billion people without access to clean cooking. They cook indoors with wood, biomass, and dung, which causes millions of premature deaths each year from the smoke and soot. Is this an either/or proposition: providing clean cooking to people in low-income countries or focusing on cutting GHG emissions in high-emitting middle and high-income countries? If both are important, how should we balance investment and priorities accordingly?
3. Do you see climate changes in the US and globally that you believe are related to the warming effects of GHG emissions? Or are these part of longer term trends that are largely in the window of natural variability?
Optional activity for participants to complete ahead of group discussion: Pick one major climate impact such as drought, forest fires, hurricanes, sea level rise, etc., and search for a graph of the data through time for that specific climate impact. Has the trend accelerated or decelerated through time, as the result of climate change?
4. Some people, especially students and youth in developed economies, are very worried about climate change. How do you think we should best communicate about climate change risk? Compare climate change risk to other risks like global poverty, global war, global food, etc.

Episode 2: What's the Future of Natural Gas?

Dr. Naomi Boness & Rachel Fakhry

[Transcript](#)

Dr. Tinker Summary

Natural gas consumption for power generation, heating, and industrial uses is growing in every global region except western Europe, and will likely continue. But that trend may depend on international trade and government policy, as it does in Europe. As oil and gas grows in other regions, this growth could come with challenges: CO₂ emissions from combustion and direct leakage of methane, which is a greenhouse gas. The IEA found that 50% of methane leak reduction could be cost neutral. The cost of the gas saved covers the work done. Good reason to make progress on reducing leaks so that the lower carbon potential of natural gas could come with the smallest environmental costs.

1. Naomi Boness sees natural gas as a very economical way to enable (make reliable) the deployment of more renewables (solar and wind) and to keep energy prices affordable. Do you agree or disagree? Explain your position.
2. Rachel Fakhry cautions against the notion that natural gas is needed long term to integrate renewables: 'If we keep building pipelines [and] turbines today, we're stuck with the gas for a long time.' In terms of the energy transition, how do you define "long time"? How might Fakhry define "long time"? Can an all renewables future ever be reliable? Affordable? Why or why not?
3. Can wind power substitute for everything that natural gas does?
4. Would you be more uncomfortable living next to a shale gas field, a gas-fired power plant, or a major wind farm?
5. How should India solve its power needs for 1.4 billion people in your view?

Episodes 3 & 4: Will Solar & Wind Power Our Future?

Parts 1 & 2

Leia Guccione & Robert Bryce

Transcripts: [Episode 3](#) & [Episode 4](#)

Dr. Tinker Summary:

Solar and wind are intermittent. They don't produce electricity when there's no sun or wind so they need redundant backup from dispatchable sources like natural gas. But even those aren't always dependable in extreme weather. Robert says solar and wind destabilize the grid and make electricity more expensive. Leia says that to make a largely renewable system reliable, we need some combination of a smart interconnected grid, diverse resources, and modernized operating practices. Those aren't easy or cheap, require social coordination and buy in, and our initial experiences with them have been less than ideal. Battery solutions have been focused on the transportation sector. Grid scale batteries have challenges of competing chemistries, scale, safety, and environmental (mining and disposal) impact. Both guests agreed, we have not focused enough on resilience in the system.

Studies suggest that getting to 80% carbon-free electricity in the U.S. by 2030 would require 1,000 gigawatts of new wind and solar capacity per year at a cost of \$3 trillion over business as usual. That's three to five times the current deployment rate, but there are 800 gigawatts of proposed projects in the U.S. pipeline, and China is deploying fast. Still, there will be conflicts over land use. And we will tap the best wind resources first, with quality locations degrading over time. Rural communities are rejecting wind and solar projects because they harm property values and viewsheds. The noise and strobe effect from wind turbines affect sleep and hearing, and the blades kill birds and bats. Developers are working to smooth these issues. Even so, building new transmission lines for these projects will be extremely difficult. This may be a limiting factor, along with the environmental impacts of mining the required rare earth elements and metals now controlled by China, and disposing of the turbine blades when they wear out. All energy at scale faces challenges.

1. Do you agree with Leia Guccione's belief that a well-planned grid system with high penetrations of renewables and modernized operations can be run reliably? Is it reliable in Germany and Australia? Why or why not?
2. Robert Bryce suggests that the federal tax incentives for solar and wind in the US are much greater than those given to nuclear and that this has distorted the wholesale market. In your opinion, what role should the government play in the energy transition?
3. Leia Guccione points out that "in some ways [redundancy] is a feature, not a bug." How can redundancy be a feature? How can it also be a bug?

4. Regarding optimal conditions for wind and solar energy battery storage, Bryce says it's like Goldilocks, "everything has to be just right" and that "the higher the energy density in the battery, the greater the volatility or the reactivity." Is battery storage a viable solution for intermittency? What are a few of the challenges?
5. Why are some communities against building wind farms, solar farms, and new grids in their community?
6. Is there really any 100% 'renewable energy'?
7. Have you lived next to renewable energy production of any kind and what was your experience?

Episode 5: Could Hydrogen Be Our Energy Future?

Dr. Steven Hamburg & Dr. Julio Friedmann

[Transcript](#)

Dr. Tinker Summary

We talked about different ways to make hydrogen; 99% of it today is called “gray,” produced from methane natural gas, but that also produces carbon emissions. Blue is the same process, just capturing the carbon. Green uses solar or wind and water for the hydrogen source. And pink uses nuclear to split hydrogen from water. To realize hydrogen's full CO₂ reduction potential, we'd have to grow blue, pink, and green as much as a thousand times. And shrink gray to near zero. We also talked about hydrogen's potential uses for heat in industry, as feedstock in chemistry, and as fuel in heavy transport. To begin, we could build hubs in existing industrial areas. And we need to get started to see what works and what may not.

1. What is hydrogen used for? In your opinion, is hydrogen our energy future? Explain your position.
2. Are the processes for delivering hydrogen as a fuel source today viable? If you have concerns, what do you see as the most concerning issue with using hydrogen as a fuel source? What is the challenge with storing hydrogen?
3. What is a fuel cell, and why is it considered a climate-friendly alternative?
4. Drs. Hamburg and Friedman discuss some of the ways that increasing hydrogen usage can be encouraged as we look towards 2050 - what are some of the “carrots and sticks” that are discussed among the participants? What are some of the potential roadblocks to increasing hydrogen usage?
5. Why are oil and gas companies interested in hydrogen?
6. Do you agree with Dr. Friedman's statement that “[t]he big challenge is that we have to be as ambitious and as urgent as we can possibly be”? Explain your position. How could government, industry, and academia be more ambitious *and* urgent regarding hydrogen?

Episode 6: Investing in our Energy Future

Dr. Kenneth B. Medlock & Deborah Byers

[Transcript](#)

Dr. Tinker Summary

Our experts think divesting in fossil fuels isn't likely because capital will follow a return. Instead, we should encourage investment that could reduce their CO₂ emissions. Subsidies work to attract investors so that these and other new technologies can be deployed. The developing world desperately needs energy. One refrigerator uses more energy per year than one citizen in many African countries. As access to electricity grows, there's a tight link to growth and prosperity in developing nations. To encourage investment there, we need to lower risk such as through loan guarantees. To increase sustainability, we should promote development. To encourage resilience everywhere, we should invest in a diverse energy portfolio.

1. Dr. Tinker states that “most energy decisions are based not just on price, but whether they can create a return for investors”. How do the guests say that this will impact future investment in fossil fuels and other energy sources?
2. Dr. Ken Medlock says that you have to “go region by region and identify where the resources are and how you can capture them to deliver lower carbon assets”. Why?
3. What are some of the ways that the guests suggest to de-risk investment in order to facilitate energy investment in the developing world?
4. Dr. Tinker mentions the film “*Switch On*”, in which he showed what it looks like when you don't have much or any energy. What are some of the issues related to energy poverty that the guests mention?
5. Why is the discussion on energy not just a binary one (good vs. bad, clean vs. dirty)?

Episode 7: New Geopolitics of Energy

Secretary Ernie Moniz & Dr. Dan Yergin

[Transcript](#)

Dr. Tinker Summary

Rising US shale oil production has changed geopolitics, reducing our dependence on and changing our political dialogue with the Middle East. Meanwhile, rising energy consumption, particularly in Asia, will see global oil demand grow into the 2030's. After that, carbon reduction policies may slow demand. Emerging and developing areas like Africa and India desperately need energy for their growing populations. They'll focus mostly on expanding grid electricity from coal, gas, and hydro, and modern cooking fuels that produce less particulate air pollution. There and around the world, emerging technologies may disrupt energy markets. We need to keep an open mind to new technologies and new ideas and to different energy mixes geopolitically.

1. What are some of the challenges for the oil and gas sector that are highlighted in this episode?
2. Give an example of the disparity in the impact of energy access between “rich countries” and emerging and developing nations.
3. What are some of the roadblocks to financial investment in energy access in developing countries?
4. Both guests seem to agree that a diverse energy mix is required, now and into the future. What are some of the energy sources that they mention? Which energy sources are dependent on future (undeveloped) technologies?

Episodes 8 & 9: Is It Time For More Nuclear Power?

Parts 1 & 2

Dr. Arjun Makhijani & Michael Shellenberger

Transcript: [Episode 8](#) & [Episode 9](#)

Dr. Tinker Summary:

Nuclear energy and nuclear weapons are indeed different technologies. But fear by some that one might lead to the other may block nuclear power development in some countries. Nuclear waste is indeed minute in volume (although high in impact) compared to the scale of energy it produces, but there are large scale mining concerns. I found the studies Michael mentioned, showing nuclear, solar, and wind have the fewest numbers of deaths per megawatt hour. And similarly, low amounts of greenhouse gas emissions. I also found the study showing solar and wind require 1000% of the mined material of nuclear per megawatt generated.

My guests agreed the costs to run a nuclear plant are low but couldn't converge on the cost to build a new one, and they disagreed on what makes them expensive. Is it building in safety precautions, or an anti-nuclear movement that encourages fear and overregulation? I suspect it's some of both. Neither guest liked the concept of new nuclear technology. Michael wants to stick to the same reactor design we've successfully built. He also felt that nuclear is the only no-carbon electricity solution available today at scale. Arjun thinks we simply can't build nuclear fast enough to meet climate goals. However, China is building solar, wind, and nuclear at scale and doing it fast. It's hard for me to see us reaching global carbon goals without nuclear.

1. Michael Shellenberger states that the real risk with nuclear accidents is that we overreact to them. What public opinions about nuclear were prevalent in your youth? Would you be more comfortable with a nuclear plant within five miles of your home, or a solar farm? Why or why not?
2. Compare nuclear and its radiation to solar and wind waste, land use, and intermittency. Which energy source or technology comes out on top in your equation and why?
3. Arjun Makhijani believes that “there's no way in which you can actually imagine a nuclear future that lives in the real world in which you can build up the supply chains, workforces and so on.” Do you agree that costs and build times today in the US make nuclear an unrealistic solution tomorrow? Explain. Why can China build nuclear reactors so quickly?

Episode 10: How Can We Make Energy More Sustainable?

Dr. Bridget Scanlon & Sean O'Donnell

[Transcript](#)

Dr. Tinker Summary:

All energies have environmental impacts and all involve trade-offs. Coal, oil, and gas still provide over 80% of global energy. To reduce their CO₂ emissions, we'll have to capture and store their carbon. There's also reducing methane releases from natural gas flaring and leaks; reducing water use in the oil and gas industry and at water-cooled power plants; considering the land use, mining impacts, and disposal of wind and solar; increasing efficiency and energy, but also in buildings and cities. All these things cost money, so we'll need price signals and incentives to motivate energy producers, investors, and consumers to make environmental sustainability economically viable.

1. When considering how to lower global CO₂ emissions, Sean O'Donnell questions where the price signals will come from to motivate a reduction in the 40% emissions that come from buildings. Would you support significant carbon taxes and credits, R&D incentives and other price signals that would prioritize reducing the carbon footprint of urban areas? Why or why not?
2. Bridget Scanlon discusses the trade off between carbon emissions, efficiency, and water use. Of those three priorities (carbon emissions, efficiency, water use), which one do you believe is the global priority? Which one do you believe is the federal priority in the US? Which, if any, is a priority in your home?
3. Agree or disagree and then explain your position: Energy will become more sustainable when the focus shifts to data instead of rhetoric.
4. What timeframe do you hold when considering sustainability? A year? A decade? A century?
5. As a consumer, what is more important to you, cost or sustainability? If sustainability, is there a point at which cost becomes more important?
6. The World Bank reports that globally, 733 million people are without any access to electricity and 2.4 billion people cook using fuels that are detrimental to their health. Sean O'Donnell says that for those people without reliable access to electricity, "It's not an energy transition for them. It's an energy addition for them."

How can we balance equity, economy, and environment so that emerging nations have increased access to low-emissions electricity?

Episode 11: Policies to Reduce CO₂ Emissions

Sasha Mackler & Dr. William Pizer

[Transcript](#)

Dr. Tinker Summary:

We talked about a carbon tax to put a price on CO₂ emissions and cap and trade, which sets a limit, not a price. But both of these are unpopular and politically difficult. Some countries have adopted one or the other. The US most likely won't anytime soon. Instead, we could broaden subsidies and incentives at the federal level to include all energies that can reduce CO₂ emissions. And we could try to adopt low carbon performance standards. While these costs are less transparent to the consumer, we still bear them. So we need them to be equitable and we need bipartisan support for these policies, or they won't happen.

1. As an alternative to a carbon tax, two flexible policies are presented:
 - a. A low-carbon portfolio standard could require certain amounts of renewable and low-carbon energy to come into the system.
 - b. A carbon performance standard would give sectors the low-carbon standard and encourage flexibility, creativity, and competition without mandating a price.Which standard do you think would be most successful at the federal level? Why? Which would have a chance to actually reduce carbon into, or take carbon from the atmosphere?
2. Subsidies to incentivize low-carbon consumer technologies, like residential solar panels or electric vehicles, are paid for by federal tax payers. Looking at extreme ends of the spectrum, should someone who has to rely on public transportation help pay for others to own one or several \$70,000 electric vehicles? Why or why not?
3. Sasha Mackler believes that bipartisan agreement is needed to get the energy transition started in meaningful ways. In an increasingly polarized political and cultural landscape, are you open to working towards bipartisan policy? If so, what is one meaningful step you could take or strategy you could enact to increase bipartisan agreement?

Episode 12: Does the US Need A Thriving Oil And Gas Industry?

Dr. David Victor & Matthew Gallagher

[Transcript](#)

Dr. Tinker's Summary: Affordable and abundant oil and gas has been an economic multiplier in the US helping to support and bring back the oil and gas industry. It's difficult to calculate how much employment the industry provides, since it's interconnected with so many other industries. Studies we found range from over a million to over 10 million well-paying jobs. It would be very hard to transition this many workers to other industries and they may not want to change careers anyway. We can be sure there would be pushback. The industry could potentially transition to lower carbon energy services, but we'd still need petroleum chemical feed stocks for plastics and many other materials.

Investors are nervous about volatility in the industry, but lack of investment will weaken supply and drive up prices. Advocates see a future for many decades to come, but political and voter decisions on carbon policy will partly determine that. Looking towards industry transitions, what diversified skills and knowledge would help you better adjust to future careers?

1. David Victor recognizes the political pushback that comes with industries transitioning to new technologies and stresses the need to build workers and industries of the future. Looking towards industry transitions, what diversified skills and knowledge would help you better adjust to future careers?
2. In your opinion, can a workforce be retrained quickly enough to meet the market demands of booming industries?
3. David Victor describes “a vibrant industry” as one that applies existing industry skills to emerging technologies. How do you define a vibrant industry?
4. Both guests agree that we need an energy “everything bagel” that prioritizes low emissions impacts and innovation, but according to David Victor, the path forward is uncertain: “Industry leaders right now just don't know what that future looks like. And so you see a lot of experimentation and no clear direction.” Agree or disagree and then explain your position.