Today I Learned About Cleaning Up Clean Tech

"We have to think of the full equation when we're making this transition. This is about clean water, fair trade, fair labor, people's rights on the planet, animals' rights, all of these things are part of it. We want to bring everyone with us on this journey and raise everyone up together. We need to make sure we do it right this time."

Suzanne Greene, MIT Center for Transportation and Logistics
TILclimate podcast: Today I Learned About Cleaning Up Clean Tech

SUSTAINABLE DEVELOPMENT GOALS

UN Sustainable Development Goals

In 2015, all United Nations member states adopted the 2030 Agenda for Sustainable Development. At its core are 17 Sustainable Development Goals (SDGs). According to the UN, "The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice."[1] According to the Environmental Solutions Initiative at MIT, "The SDGs demonstrate the interconnectedness of environmental concerns with all aspects of human wellbeing."[2] Clean technology development threads through many of the SDGs.

While You Listen

On the next page, you will find all 17 SDGs. While you listen to the TILclimate podcast episode, consider which of the SDGs are related to the issues discussed. Note any connections you make. (There may not be direct connections to all Goals.)

Find the podcast episode at
https://climate.mit.edu/podcasts/e9-til-about-cleaning-clean-tech

1 UN Sustainable Development Goals https://www.un.org/sustainabledevelopment/sustainable-development-goals/
2 Sustainable Development Goals https://environmentalsolutions.mit.edu/sustainable-development-goals/

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UN Sustainable Development Goals

No Poverty. Economic growth must be inclusive to provide sustainable jobs and promote equality.

Zero Hunger. The food and agriculture sector offers key solutions for development and is central for hunger and poverty eradication.

Good Health and Well-Being. Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development.

Quality Education. Obtaining a quality education is the foundation to improving people's lives and sustainable development.
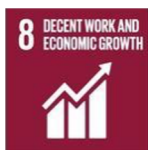
Gender Equality. Gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous and sustainable world.

Clean Water and Sanitation. Clean, accessible water for all is an essential part of the world we want to live in.

Affordable and Clean Energy. Energy is central to nearly every major challenge and opportunity.

Decent Work and Economic Growth. Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs.

Industry, Innovation, and Infrastructure. Investments in infrastructure are crucial to achieving sustainable development.

Reduced Inequalities. To reduce inequalities, policies should be universal in principle, paying attention to the needs of disadvantaged and marginalized populations.

Sustainable Cities and Communities. There needs to be a future in which cities provide opportunities for all, with access to basic services, energy, housing, transportation and more.

Responsible Consumption and Production. Doing more and better with less, decoupling economic growth from environmental degradation.
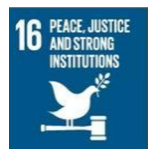
Climate Action. Climate change is a global challenge that affects everyone, everywhere.

Life Below Water. Careful management of this essential global resource is a key feature of a sustainable future.

Life On Land. Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss

Peace, Justice, and Strong Institutions. Access to justice for all, and building effective, accountable institutions at all levels.

Partnerships. Revitalize the global partnership for sustainable development.

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UN SDGs Mind Map

Mind mapping is a technique that can help you see connections between and among topics that you might not have noticed otherwise. It can also be used to take one larger topic and break it up into more manageable pieces. A simple example is provided on the next page.

- In small groups, choose 5-6 SDGs that had the largest number of connections for you as you listened to the podcast.

- On a large piece of paper, whiteboard, or digital whiteboard, write the chosen SDGs in a rough circle with plenty of space between them. Leave space at the bottom of the page for continuing questions.

- Look at the ideas you noted while listening. Draw a line between two SDGs on your mind map that are connected to that concept and write the concept on the line. You may find that some concepts go on more than one line.

- Continue to write concepts and draw lines. As new connections occur to you that were not on your original list, add them. There may be multiple connecting lines between any two SDGs.

- In the space at the bottom, write any questions that come up as you discuss your mind map and connections.

Planning for the World We Want

The purpose of the Sustainable Development Goals is to "achieve a better and more sustainable future for all." It can feel overwhelming to think about issues like climate change but thinking about the solutions that move us toward a future we want can help.

- Choose one connection or question from your mind map that you are the most excited about or interested in.

- What do you want to know more about?

- Have you heard about or imagined a solution that is related to this topic? Solutions could be behavior, design, technology, or some combination.

- Describe the solution you have heard about or imagined. What would it look like, feel like, even sound like to have this solution in use?

- Trade descriptions with someone else. How are your solutions connected? Do they solve a similar problem or use a similar tool?

Share

How would you explain the Sustainable Development Goals to someone who was not familiar with them? Choose a friend or family member – which SDG would they be the most excited about? How would you explain how it is connected to the issues you care about?

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SDG Mind Map Example
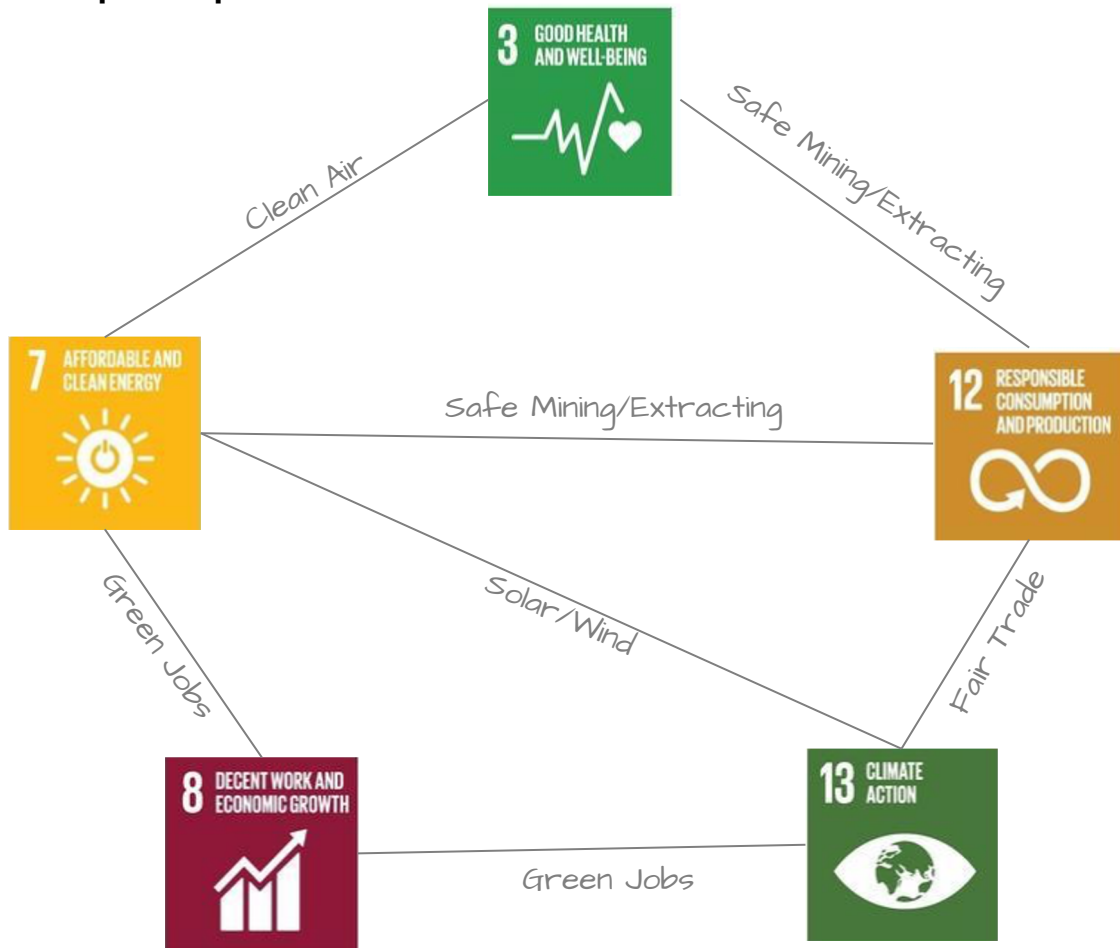
Continuing Questions

- What does safe mining look like? Where is it being done?
- Can we reuse materials from technology instead of having to mine new materials?
- What are green jobs? What kinds of green jobs are in my community?

Exciting Solutions & Shared Connections

I am very interested in the idea of green jobs for people in my community. I know that there are a lot of people who want jobs that are doing something good for the world. For example, is installing solar panels a good green job?

I am going to ask my uncle about solar panels, because he works in construction. My cousin is studying electrical engineering in college. I wonder if she knows anything about how solar panels are made and where the materials come from.

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"We look at the stuff that we see in our everyday life and then trace it back to the ingredients and where they come from, from all around the globe... We as people on the planet, we might have certain ethics that we apply to the things we want in our lives that we buy, right? ... So, in order to understand that, you need to look down the supply chain and see if all of these things agree with your ethics."

Suzanne Greene, MIT Center for Transportation and Logistics
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Supply Chain

A *supply chain* includes all the materials and activities that go into making, transporting, using, and disposing of something. For example, here is a simplified supply chain[1] for a cotton t-shirt:

India: People plant, grow, and harvest the cotton.

The cotton is shipped to China.

China: People clean the cotton, spin it into yarn, dye it, and knit it into fabric.

The fabric is shipped to Bangladesh.

Bangladesh: People cut the fabric, sew the t-shirts, and package them.

The t-shirts are shipped to the US.

US: People drive the packaged shirts to stores and unload them to sell.

Trace the path of the t-shirt on the map

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"Solar panels have a huge variety of ingredients that need to be assembled from around the world. Aluminum, indium, silicon, cadmium, iron, silver, copper, lead, tellurium, gallium, nickel, tin, germanium, selenium, and zinc. So all of these things need to be gathered, they need to be dug out of the earth."
Suzanne Greene, MIT Center for Transportation and Logistics
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What About Solar Panels?
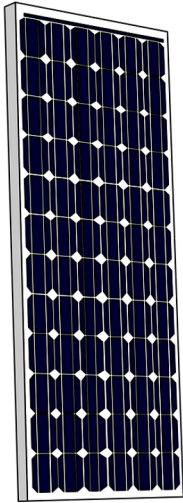
We know that adding carbon dioxide (CO_2) to the atmosphere is acting like a heat-trapping blanket, warming our Earth. This extra heat is causing dramatic changes to our climate and weather patterns. Low-carbon energy sources, such as solar, wind, hydro, and nuclear are all tools in our toolbox to generate energy without adding to the CO_2 blanket.

Photovoltaic (PV) solar panels are an important part of a low-carbon energy future. From 2011 to 2020, the amount of electricity produced by solar panels in the US grew from 1.82 to 90.89 billion kilowatt-hours – almost a 50-times increase in 10 years!

Most PV solar panels require the use of many different elements, mineral, and other materials. People mine the materials, ship them around the world, assemble them into solar panels, and then ship the solar panels to where they will be installed. It is a complex and world-wide process.

Where Does It Come From?

On the next page, you will find a list of some of the elements, minerals, and metals that can go into making a solar panel. This includes the solar cells themselves, the panels that hold them together, the wiring that connects them, and the frames that hold them in place. Each of these materials can be found in various places around the world, but none of them can all be found in the same place.

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Solar Panel Elements, Metals, and Minerals

Material	Where it is Mined
Arsenic	China, Chile, Morocco, Peru, Kazakhstan, Russia, Belgium, Mexico
Bauxite (aluminum)	Australia, China, Brazil, India, Guinea, Jamaica, Russia, Venezuela, Suriname, Kazakhstan, Guyana, Greece
Boron	United States, Turkey, Argentina, Chile, Russia, Peru, China, Bolivia, Kazakhstan
Cadmium	China, South Korea, Japan, Kazakhstan, Mexico, Canada, Russia, United States, India, Netherlands, Poland, Germany, Australia
Coal (coke for steel)	Worldwide
Copper	Chile, United States, Peru, China, Australia, Russia, Indonesia, Canada, Zambia, Poland, Mexico
Gallium	China, Germany, Kazakhstan, Ukraine
Indium	China, South Korea, Japan, Canada, Belgium, Russia, Peru, Brazil
Iron ore (steel)	China, Brazil, Australia, India, Russia, Ukraine, United States, South Africa, Iran, Canada, Sweden, Kazakhstan, Venezuela, Mexico
Molybdenum	China, United States, Chile, Peru, Mexico, Canada, Armenia, Iran, Russia, Mongolia
Lead	China, Australia, United States, Peru, Mexico, Canada, India, Bolivia, Poland, Russia, Sweden, Ireland, South Africa
Phosphate	China, United States, Morocco, Western Sahara, Russia, Tunisia, Jordan, Brazil, Syria, Israel, Egypt, South Africa, Canada.
Selenium	Japan, Belgium, Canada, Russia, Chile, Philippines, Finland, Peru, Sweden, India
Silica	United States, Italy, Germany, United Kingdom, Australia, France, Spain, Japan, Poland, Hungary, South Africa, Mexico, Austria, Iran, South Korea, Slovakia, Canada, Belgium, India, Bulgaria, Norway, Chile, Gambia, Turkey, Czech Republic
Silver	Mexico, Peru, China, Russia, Poland, Australia, Bolivia, Chile, Kazakhstan, United States
Tellurium	Australia, Belgium, Canada, China, Germany, Japan, Kazakhstan, Peru, Philippines, Russia, United States.
Titanium dioxide	Australia, South Africa, Canada, China, India, Norway, Ukraine, Vietnam, Mozambique, United States, Sierra Leone, Brazil

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"What we need to do is hold the companies that are producing these things accountable. And give them the space and the time to clean up the supply chain and make sure it fits all of our standards."
Suzanne Greene, MIT Center for Transportation and Logistics
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Cleaning Up Clean Tech Questions

1. Imagine you are a solar panel manufacturer in the US, and you would like to advertise your solar panels as being 'locally made.' How many materials can be sourced within North America (US, Canada, or Mexico)?

2. For the materials that cannot be found within North America, where is the next closest country in your possible supply chain? (Use a paper or digital map.)

3. How many countries are involved in your model solar panel materials supply chain?

4. The materials list on the previous page is only part of the full supply chain for a solar panel. What are some of the other parts of the chain? (Think about manufacture, assembly, installation, etc.)

5. Solar panels are not the only technology that is considered "clean tech." What are some other technologies you have heard about or seen that are called "clean" or "green"?

6. What do you think some of the challenges are for the supply chains of those technologies?

7. What is one solution you have heard of or you can imagine for one of these challenges?

8. What other questions do you have about supply chains, solar panels, or other low-carbon technology? How might you answer these questions?

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