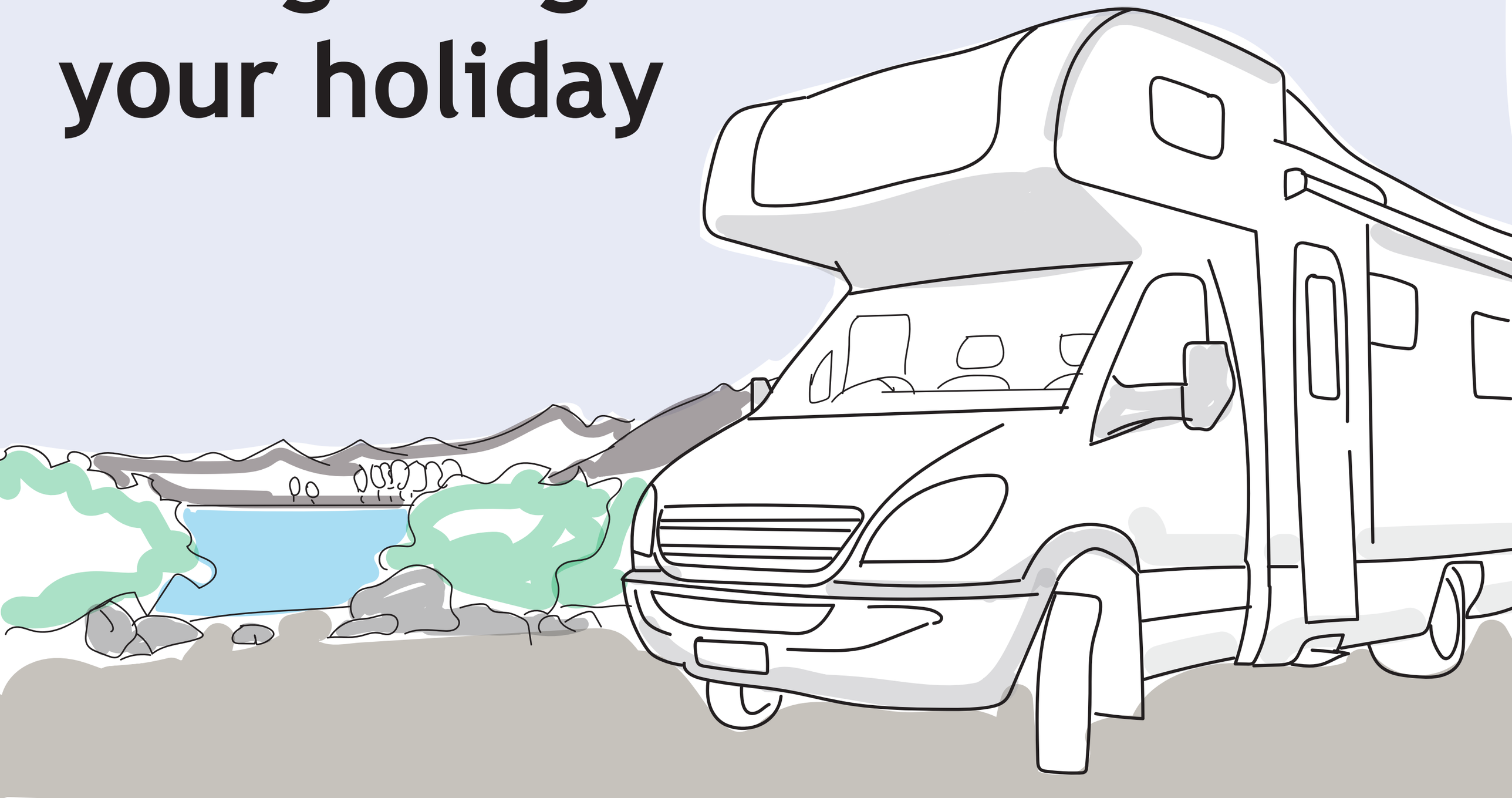
2030:

Going off-grid on your holiday



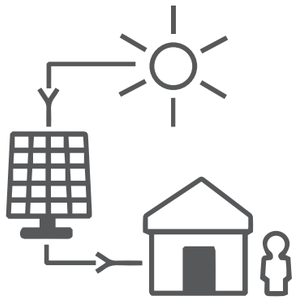
Going off-grid on your holiday

CONTEXT

In most parts of the world energy demand is growing too quickly to keep green-house-gas emissions within international targets, according to a report released by the International Energy Agency (IEA), a think-tank. Many in Africa, however, worry about the opposite problem: the acute shortage of electricity. The continent is home to almost a fifth of the world's population, but accounts for less than 4% of global electricity use. North Africa enjoys near-universal access to electricity, yet more than half of the sub-Saharan population—600m people—live in the dark (see map). This can hinder the provision of basic services. Half of secondary schools in sub-Saharan Africa do not have power; many clinics and hospitals in the region also lack access to reliable electricity.

Initiatives to use off-grid solar energy are working very well to give people (and farmers) access to electricity in many parts of sub-Saharan Africa. By 2030, 834 million people will hopefully use this off-grid solar energy system (currently, 420 million people use this system). The off-grid solar system works as in the figure you can see on the right.

Meanwhile, the number of electric cars on the road is expected to reach at least 125 million by 2030 and up to 220 million. Facilities to charge the vehicles will be widely available over Europe, but how will this work in Africa where the rise of people having access to electricity has just gone up?



CHALLENGE

Africa currently does not have many charging points for vehicles: there are some at campsights, but the more south you go, the rarer they get. More importantly: there are some gas stations providing charging options, but they are very hard to locate on Google Maps. And the ones that can be located are too far away from each other.

QUESTION

How might we create a system involving molten salt to make sure Jonas and his family can charge their electrical vehicle throughout Africa?

STORY - EXPLORING AFRICA

Jonas lives in Copenhagen, together with his wife and two kids. Jonas and his wife used to travel all around the world with just a backpack, but with kids they need a little more structure in their travel schedules. For the final part of their parental leave, they decided to explore Africa together with the kids. They will explore the nature of Africa with a campervan to make sure they always have a place to sleep: they just bought a new electrical vehicle that has all facilities needed. Jonas values to spend time in nature, especially because it gets harder and harder to find a little quiet in the city of Copenhagen. He wants to show his kids what it is like to be disconnected for a while, he actually hopes they will enjoy it and do this for a while.

The family will visit many countries with very limited access to electricity, such as Sierra Leone and Liberia. The rise of off-grid solar panels has helped the country a lot over the last ten years, but the grid's are still unreliable and leave citizens without electricity for days sometimes. Jonas will drive an electric camper throughout entire Africa, so electricity is quite essential for the family to move.

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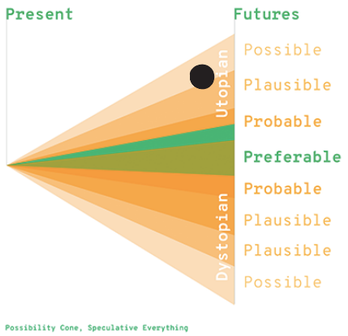


2030:

Reliable harvests for African farmers

Reliable harvests for African farmers

CONTEXT

When most people think of solar power, they think of solar panels placed on rooftops to create electricity for residential or commercial use. But there is also another critical purpose — to mine and distribute water to boost productivity.

It's especially relevant in Africa, where agriculture is the main industry for most countries there. Yet, their output is suffering because because the fields do not get the proper amount of irrigation. Through the use of solar pumps, though, they are able to double or triple their yields — economic gains that have an enormous ripple effect while improving the lifestyles of many Africans.

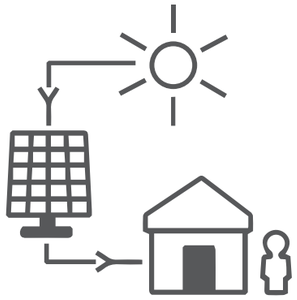
"Farmers who were growing one season per year can now grow three times per year," says Yariv Cohen, the founder and chief executive officer of Ignite Power, which is a British-American company, in an interview. "Solar pumps lead to more efficiencies, which leads to more employment and greater disposable income. Disposable income increases by 20% to 30%."

Meanwhile, the world's population is growing: the population of Denmark is expected to grow to 6.1 million people by 2030 (currently there are 5.6). This means Denmark would need about 5 per cent more food than they do today. Once African farmers have more consistent harvests, they might be able to sell it to other countries such as Denmark. It will help the African economy and feed the Danish population: a win-win situation.

STORY - SUSTAINABLE SUPPLY CHAIN

Ellen works in a large food-import company: she is the head of import from the continent of Africa. Ellen is quite proud with the way she set up the supply-chain: she has been very considerate with the farmers and how to help them with the economic growth in their country.

Moreover, all energy used on their farms is solar and therefore emission free. Ellen's goal is to make the whole supply chain sustainable, but the planes flying the bananas from Africa to Denmark do not help. It is very difficult to find the right way to do it: planes are simply the fastest but still very polluting to the environment. The current status of electrical planes is they can carry up to a hundred people for a short distance. It will take ages before that technology is developed far enough to be feasible for us, so I need to come up with another way of transporting the food.



CHALLENGE

The distance from sub-Saharan Africa to Denmark is quite long, yet fruit and vegetables cannot spend weeks being transported. Planes are used to transport the fruit and vegetables: it is fast and when the food is frozen it remains fresh. However, the flying industry is not ready to go electrical yet. The technology is still highly expensive and underdeveloped.

QUESTION

How might we use molten salt to transport the food from sub-Saharan Africa to Denmark in a sustainable way?

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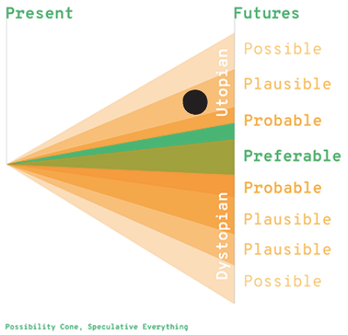
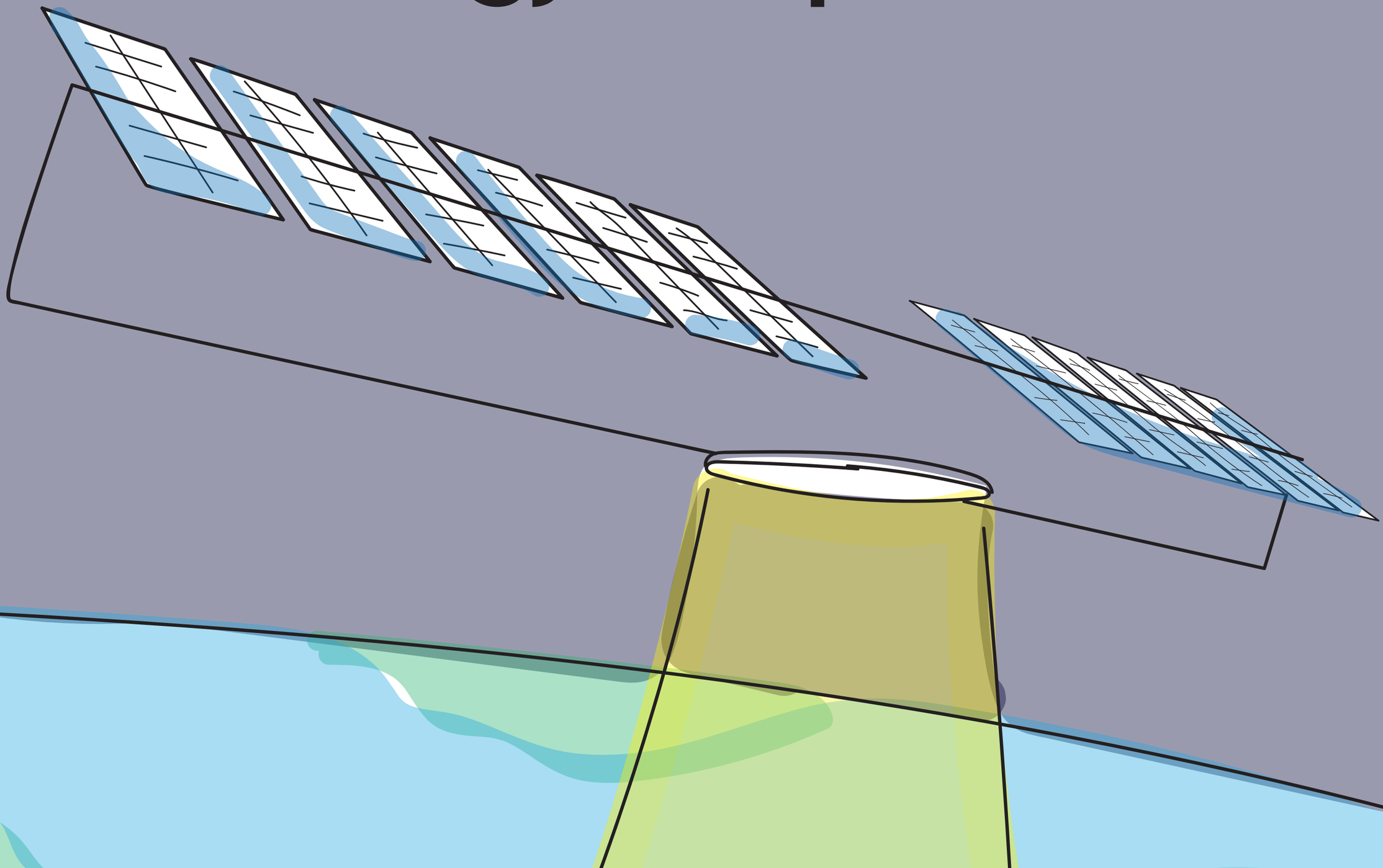


2050:

Solar Energy in Space



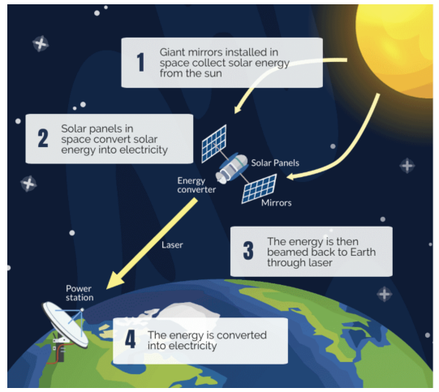
Solar Energy in Space

CONTEXT

Global energy demands are only growing, and we need to find a sustainable way to generate this energy. For some years now, researchers have been exploring if they can generate energy in space through solar panels. Since the sun always shines in space, space-based solar power is seen as a uniquely reliable source of renewable energy. In space, we don't have to deal with the day and night cycle, clouds or seasons. We will end up with eight to nine times more power available to us.

A space-based solar power technological process includes using solar panels to collect solar energy in space with reflectors or inflatable mirrors that direct solar radiation onto solar panels, and then beaming it on Earth through a microwave or laser. The energy is then received on Earth via a microwave antenna (a rectenna). Currently, research institutes such as Caltech are exploring how this 'beaming' of energy to earth could work exactly.

According to the National Space Society, space-based solar power has the potential to dwarf all the other sources of energy combined. They argue that space-based solar power can provide large quantities of energy with very little negative environmental impact. It can also solve our current energy and greenhouse gas emissions problems.



STORY - STORING SPACE ENERGY

Professor Mankins works at Caltech University and has been working on the project from the very beginning. Years have gone by before they found the right way to beam the energy from space to earth, let alone to decide where to locate the receivers on earth. The first receiver ended up in Oklahoma, where we currently deal with a huge amount of energy. Oklahoma turned out to be the most convenient place to aim the energy-beamer at, and since it is somewhat in the middle of the United States, we expected it to be a convenient place to collect the energy. It turned out to be more difficult than we expected because there is too much energy received to put in the grid immediately. So now, we are trying to look at how Europe is storing their energy and how they distribute it.

CHALLENGE

These 'receivers' on earth would take the form of giant wire nets measuring up to four miles across that could be installed across deserts or farmland or even over lakes. If technology succeeds in collecting the energy generated in space, this means we would be left with enormous amounts of energy around these receivers. Who will own these receivers and how will the energy be distributed over the world?

QUESTION

How can molten salt help to store and distribute the energy from space?

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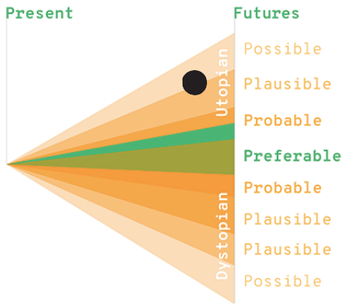
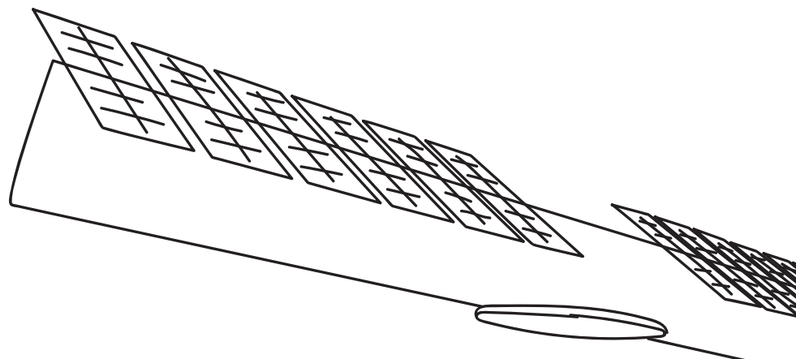
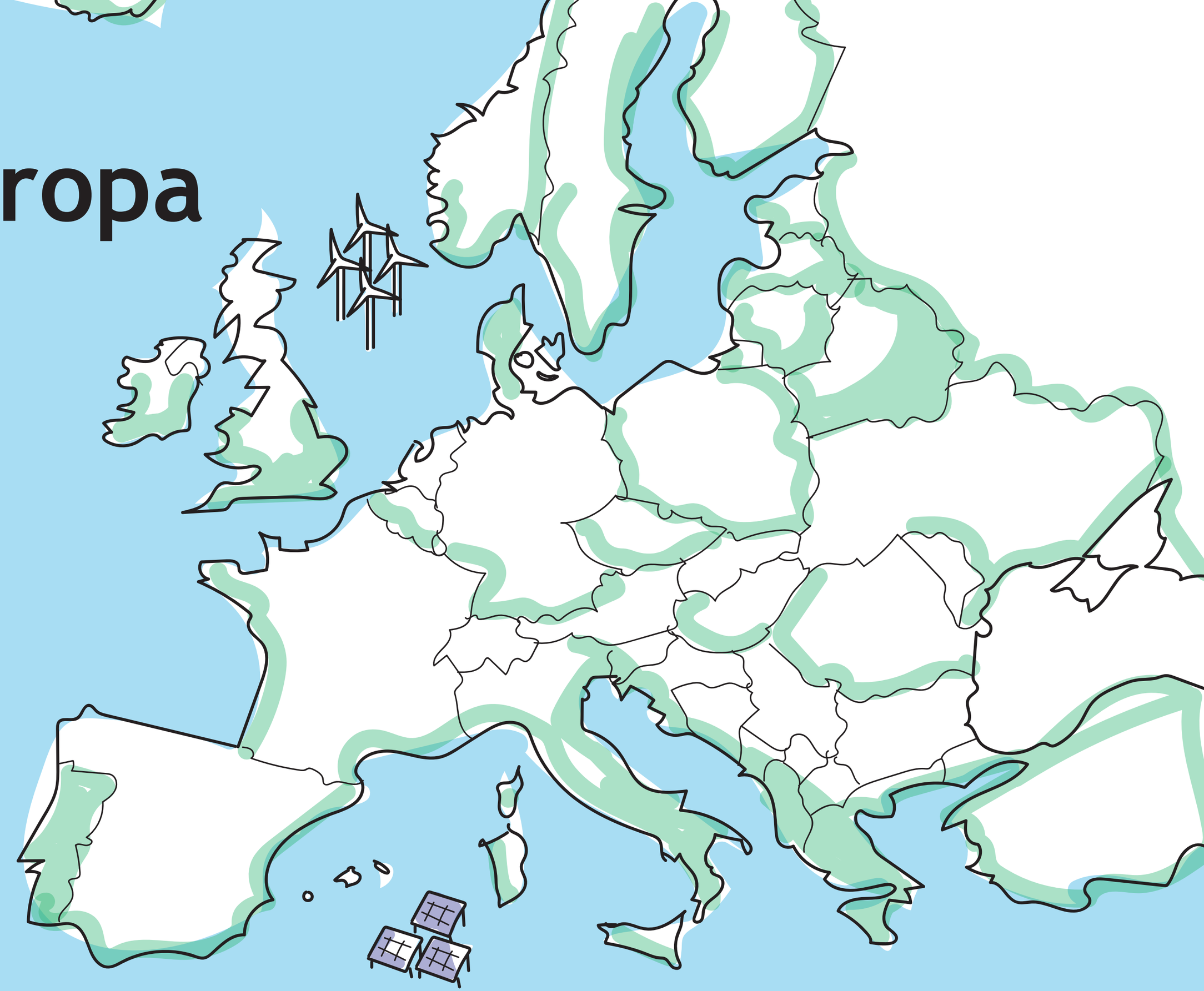




2050:

Eneropa



Eneropa

CONTEXT

The Map of Eneropa was created in 2010 looking into 2050. It was made according to the fact that renewable energy sources such as wind and sunshine are unstable and unreliable, which means they have to be supported by other forms of power. But they are also available in different quantities in different places – wind is abundant in Britain, sun in Spain – and in different seasons. The big idea was to create a power network across the continent linking all these sources, which could then compensate for each other. If it was windless in Britain but sunny in Spain, power could travel from them to us, and vice versa.

Today, The North Sea holds a large potential for offshore wind power where 180 GW could be generated by 2045. (To keep global warming below 2, the world needs 266GW storage by 2030, 924GW by 2040). According to a recent study - scientists suggest wells drilled into North Sea rocks could act as storage for renewable energy produced by offshore wind farm or even stored in deep salt caverns.

CHALLENGE

The parcs are off-shore: meaning they are not part of a particular country. Many countries want to benefit from the parcs economically speaking: especially Spain is trying to claim the solar Parc because it would be a huge boost for their economy. However, the initiative comes from a sustainability perspective, so the most important factor should remain sustainability.

QUESTION

How might we create a sustainable (politically and environmentally) system to distribute the energy from the wind parcs near the UK and the solar parcs near Spain?

STORY - STORING EUROPE'S ENERGY

The European Union has put together universities from five countries to create an energy system involving the wind parks next to the United Kingdom and the solar parc right by Spain. Their idea is to co-create not only the technological system, but also the political system. Professors and students from multiple disciplines work together to find out who should own the European Energy system and how to create a payment system around it. Political scientists and philosophers are involved together with many engineers to make sure the system in Europe will work. The research group has faced many difficulties throughout their study: the EU has given the group a huge budget, but no guidelines in what they envision the system to be itself. Every time the research group proposes some kind of system, there is at least one leader who is totally against it - usually the leader of a country that is trying to take ownership of the energy parcs.

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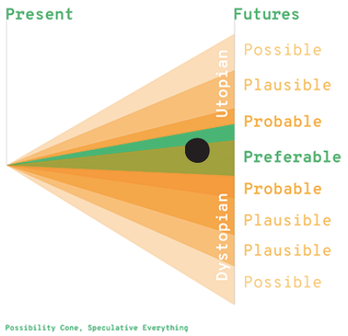

Possibility Cone, Speculative Everything