Script: German Energy Transition

Large wind farms - solar panels on rooftops, biogas plants. Germany is changing because of its energy transition.

But what does energy transition really mean?
Why is it so important now?
And where are the opportunities and challenges?

We need energy in all areas of life: for transportation, and as heat and electricity. Today, we get most of our energy from fossil fuels.

But there are many arguments against the use of fossil fuels. Two of the most important factors:

Since the beginning of industrialization, we burn more and more fossil fuels, releasing large amounts of carbon dioxide. This increases the greenhouse effect, which is causing the Earth to heat up quickly. We have induced man-made climate change, which dramatically changes our planet's natural processes and creates a number of problems.

Fossil fuels are finite. Especially the amount of available oil, our main energy resource, is decreasing rapidly. There is still some oil left. But the exploitation is becoming increasingly expensive, unsafe and dangerous for the environment.

Both factors are exacerbated by the rapid economic development in emerging countries. The result: accelerated climate change and increasing resource scarcity.
To curb this trend, a massive shift in energy policy is essential.
Nuclear power is no solution. The catastrophe of Fukushima has shown this once again.

Germany's energy transition involves two main changes:
First: A shift to renewable energy instead of fossil fuel.
Second: A decrease in energy use through design, technology and energy efficiency measures.

Let's take a closer look at these issues.

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Renewable energy sources: This means the extraction of energy from materials that are not finite or regenerate themselves. This can happen in large plants, but also on a small scale in private households, close to the consumer.

Wind turbines have rotors, which are moved by the power of the wind. A generator then creates electricity.

Similar to wind power, in hydroelectric power stations, kinetic energy drives a generator, which produces electricity. Wave and tidal power plants use the natural movement of the sea.

There are two major forms of solar energy: solar collectors heat a transmission medium with the sun's energy. On a small scale, this includes hot water heaters for individual households. On a large scale, concentrated solar power plants produce electricity by using mirrors to focus the sun's rays on a single spot.
Solar photovoltaic cells convert the sun's rays directly into electricity directly. These systems are often installed on rooftops, but can be seen on a smaller scale in calculators, handbags, and even watches!

Geothermal energy can also be absorbed by collectors. Just a few meters below the earth's surface, the increased temperature can be high enough to supply the heating for private households. In regions with high underground temperatures, electricity can also be generated in this way.
Biomass from animal and vegetable substances like organic waste from agriculture and households, or specially grown energy crops, can generate electricity or be converted into fuel.
The fermentation of these substances produces methane gas, which is transformed into electricity and heat in cogeneration plants.

Ethanol and biodiesel fuels can be produced with special energy crops. Solid biomass is burned in order to generate heat or electricity.

While burned, plants only release the amount of CO2 they have absorbed during their growth. Thus, the CO2 balance is neutral.

From the energy source to the consumer, energy runs through various conversion processes.

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In each of these steps energy is lost. To increase energy efficiency means to minimize these losses. Or in other words: to win as much net energy as possible from the original energy source.
Many losses can be avoided in industry and households.

In electricity production and in many industries, a great amount of heat is released as a by-product.
Heat and power cogeneration, uses this energy to heat the surrounding community .

Old appliances with a high power demand can be exchanged for more efficient ones. This decreases power consumption and lowers costs for the consumer.

Just as important as increasing efficiency is the reduction of the overall consumption. Our way of life uses too much energy. We need to conserve.

The Energy Transition is a very complex challenge. What are the difficulties?

The use of renewable energy can have negative ecological consequences. Occasionally, the interests of nature conservation conflict with the production of "green" power.
Wind and hydroelectric power plants may damage the habitats of birds and fish.
For the cultivation of energy crops, rain forests are cleared: This destroys Valuable ecosystems – and important natural carbon sinks -- and increases CO2 emissions.
Energy crops are often grown on fields that previously grew food crops. This increases world food prices.

Residents in the vicinity of many power plants can complain about unsightly buildings and noise.

Often, state funding practices have been criticized. Subsidies can hinder a complete restructuring and favor the few large energy producers.
From time to time, businesses and households cannot afford the upfront costs of buying more efficient equipment, even if they lead to long-term savings.
And sometimes it is very difficult for us to change our habits.

The reliable and constant supply of "green" electricity is a major technical challenge. Two points are particularly challenging: the structure of power grids and the storage of power.

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In Germany for example, energy production and consumption are located in different regions. The most profitable supplier of renewable electricity - wind power plants- are mostly located in the north due to the good climate conditions. Much of the country's energy-intensive industry, however, is located in the south.

Currently the power grid lacks the capability to transport enough energy from north to south. As a result, energy often has to be bought from other sources, even though enough energy is actually produced.
In addition: Renewable energy sources are heavily dependent on the weather. Their output fluctuates.
In times when power plants achieve a high performance, for example when there is a strong wind, there is a lack of sufficient storage capacity for the energy surplus. During times of lower energy production, this stored energy would be very useful.
Pump storage stations are a way to store some electrical energy.
But these storage facilities are space-intensive and dependent on location . At this time, a well-engineered storage technology that could be implemented nationwide doesn't exist.

A technical solution might be so-called smart grids. These intelligent power grids observe and link production, storage and consumption of energy in a large integrated system. Depending on the demand for energy at a certain time, they can fine-tune energy production and moderate consumption. They balance fluctuations between energy supply and demand and integrate the many new decentralized producers into the power grid. Thus, the energy supply becomes more efficient and more reliable.

We see: An energy transition is inevitable. The change to renewable energy definitely poses many challenges. But these are much smaller and easier to deal with than the consequences of continued reliance on fossil fuels.
And the energy transition also offers enormous opportunities:
The exploration and development of this new economic sector is creating many new jobs.
We also reduce our dependence on oil and gas imports, especially from unfriendly countries.
With its energy transition, Germany can play a leading role in developing new technologies and can make an important contribution to shaping a sustainable future.