



## THE LIMITS TO RENEWABLE ENERGY

Fossil fuels still account for about 80 per cent of global energy use. By replacing fossil energy sources with renewable energy, we can significantly reduce global greenhouse gas emissions. But what would a world with a 100 per cent renewable energy mix look like? What are the limits to the wider use of renewable energy?

The UN Intergovernmental Panel on Climate Change (IPCC) has confirmed that global average temperatures are rising<sup>1</sup>. An IPCC report has concluded that the effects of a 1°C increase in global average temperature are already apparent; but also that the most severe effects of global warming can be avoided if action is taken now. Any increase above 1.5°C increases the risks associated with long-lasting or irreversible changes.

**“CLIMATE CHANGE RESEARCH SUGGESTS THAT TIME IS RUNNING OUT TO MAKE THE NECESSARY CHANGES IN CONSUMPTION AND SUPPLY TO MINIMISE THE EFFECTS OF A WARMING WORLD”**



Today we have several options to utilise energy generated from renewable sources such as wind, water, sun, geothermal, wave-tide and biomass/biofuels.

### WHAT DOES THE FUTURE LOOK LIKE?

While some countries have a very high share of renewable energy in their heating, transport and electricity supply, others still rely heavily on coal, oil and gas.

**“TRADITIONAL ENERGY SOLUTIONS HAVE FOCUSED ON ELECTRICITY, HEATING AND TRANSPORT AS SEPARATE SECTORS, WITH LIMITED INTERACTIONS BETWEEN THEM”**

Renewable energy is often associated with electricity only. However, heat and transport together are much more energy intensive than the electricity sector.

Almost all of Norway's renewable energy (98 per cent) is generated from hydroelectric power plants, with less than 1 per cent coming from wind energy<sup>2</sup>. Sweden is at the forefront of renewable energy usage in its transport sector. In fact, 30 per cent of the total energy used for transport is renewable energy, mostly biofuels. Sweden had set a goal for 50 per cent renewable energy in its total energy consumption (heat, transport, power) for 2020. In 2016, the country had already met its goal of 54 per cent renewable energy in total energy consumption.

Overall, the target for the share of renewable energy in total energy consumption for 2020 in European countries is on track – but what next? Not all countries have set targets for 2030, 2050 or beyond.

1) The Intergovernmental Panel on Climate Change (IPCC)  
2) Government.no

## SUCCESSFUL APPROACHES

We already have the technologies, the proven business cases and the infrastructure to support wider integration of renewables into energy systems.

For example, Costa Rica has run exclusively on renewable electricity for more than 300 days; and for a whole year, renewables accounted for almost 100 per cent of the country's electricity needs.

Costa Rica, Norway and Sweden have an important similarity in terms of their electricity sectors. All three countries have excellent water resources which are ideal for generating electricity from hydroelectric power stations at low cost.

Denmark and Scotland, which are world leaders in wind energy per capita – in 2016 they produced over 50 per cent of their gross electricity consumption from renewables.<sup>3,4</sup>

**“THE LIMITS TO RENEWABLES ARE NOT TECHNICAL, FINANCIAL OR REGULATORY – THEY ARE THE ONES WE SET FOR OURSELVES AND FOR EACH OTHER”**

Some countries have already committed to 100 per cent renewables in electricity production but few have issued draft or final targets for total energy consumption.

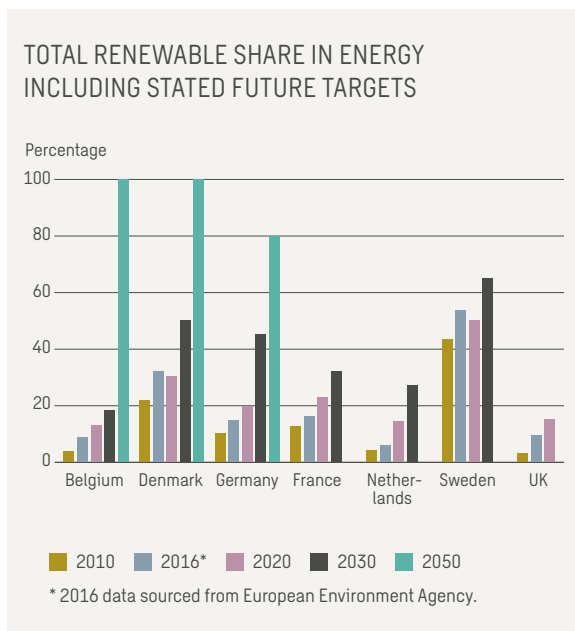
**“TO MEET FUTURE DEMANDS, WE NEED TO USE RENEWABLE ENERGY IN A SMART WAY AND CREATE MORE INTERACTIONS BETWEEN SECTORS AND SYSTEMS”**

Countries could certainly produce the equivalent of their electricity consumption using wind and solar energy, but this electricity could not always be utilised. Digitalisation, energy storage and demand response are the keys to helping future energy systems maintain balance as we move from an energy system that lacks unified thinking about our generation of electricity, heating and transport.

There are large, and immediate, economic co-benefits from reducing greenhouse gas emissions, by far the largest of which is the mitigation of air pollution which is now a major challenge for cities worldwide. The economic costs of not taking action to avert climate change would greatly exceed investments in mitigation opportunities. Switching to renewable energy sources would result in significant reductions in global emissions.

Renewable energy is available – in one form or another – in every country in the world. What is holding us back?

Read more about the obstacles and the successful strategies to integrate renewable energy in the Urban Insight Report [\*The Limits to Renewable Energy\*](#).



3) Danish Energy Agency

4) The Scottish Government