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An EU energy scenario compatible with the Paris Agreement

Media Briefing

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Climate hopes rise as European civil society organisations map out the first-ever NGO-led energy scenario based 100% on renewable energy and looking at reducing carbon emissions by at least 65% by 2030. The analysis corroborates existing evidence, showing that Europe can achieve climate neutrality by 2040 and lead the rest of the world in the energy transition.

A 100% renewable energy scenario is within our reach, according to a new analysis led by Climate Action Network (CAN) Europe and the European Environmental Bureau (EEB) in cooperation with industry representatives and researchers.

The scenario is the first-ever to be developed by a coalition of civil society organisations and was produced as part of the PAC project. It has therefore been dubbed the PAC Scenario. It shows that Europe can reach climate neutrality by 2040 – 10 years earlier than envisaged by EU leaders. To achieve this goal, the NGOs call on policy-makers to shift investments towards clean solutions and to start planning a gradual phase out of fossil fuels from our energy system.

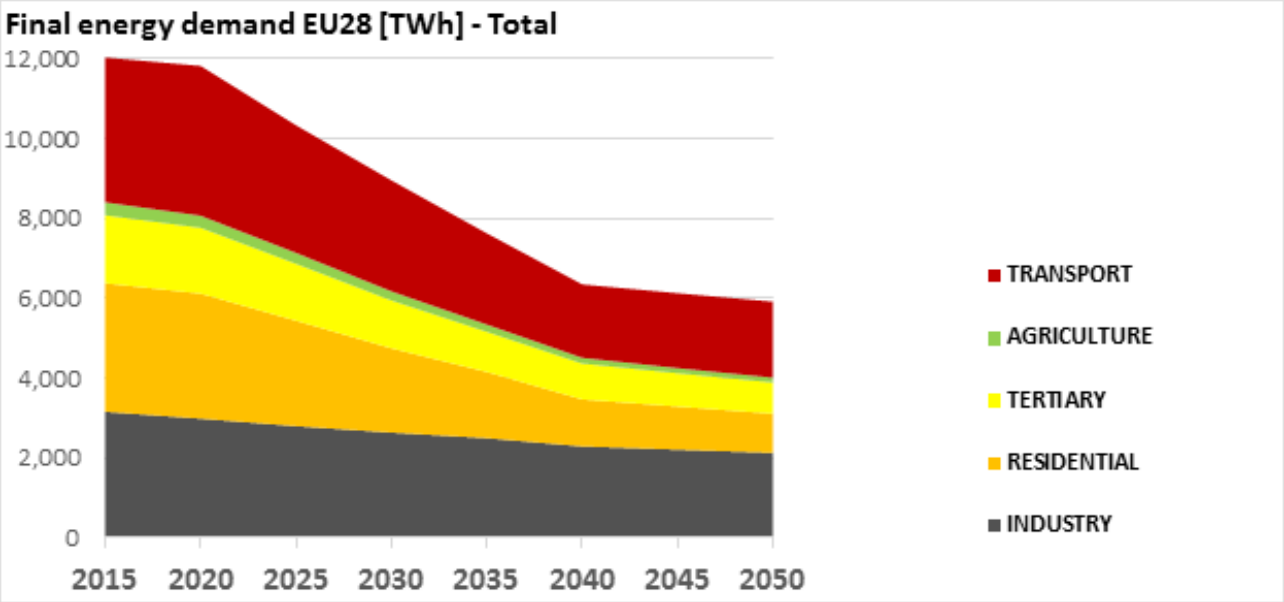
The study also shows that boosting renewable energy and energy efficiency now is key for a 65% reduction in greenhouse gas emissions by 2030. The EU's current target for 2030 is set at at least 40%, but policy-makers are expected to come up with a new target by the end of this year.

From declining demand for coal and gas to the increasing uptake of renewables and energy efficiency, we set out a truly sustainable and coherent vision for Europe's energy system of the future.

Key findings of the PAC Scenario

A. How much energy will Europe need in the coming decades?

Final energy demand can be cut in half according to the PAC scenario results. This is mainly due to deep renovation in the buildings sector, increased efficiency of vehicles in transport, modernisation of industrial production processes, mobilisation of energy efficiency gains in appliances and a reduction in demand for materials through the application of circular economy principles: reducing, reusing and recycling. These conclusions are based on existing studies and an exchange with science, stakeholders and modellers that looks into energy savings potentials in the five sectors: industry, residential, tertiary, agriculture and transport.



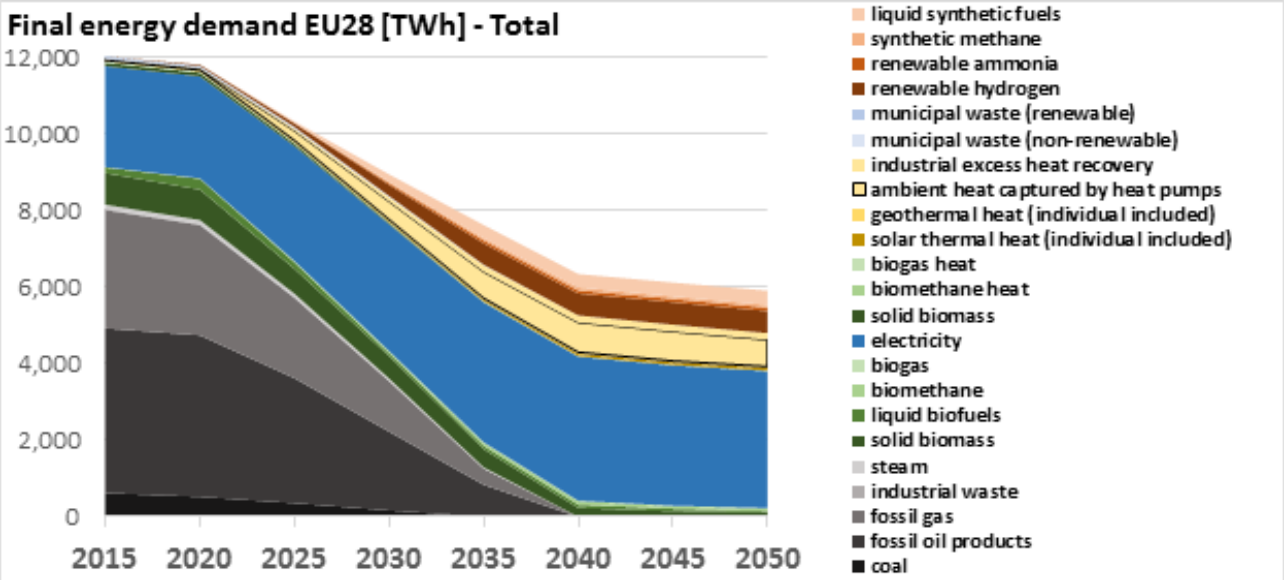
B. Which type of energy?

EU Member States need to multiply their solar and wind electricity generation capacities and put energy efficiency first, in particular with a deep renovation wave in the buildings sector. We have to reduce our dependence on fossil fuels and consider a complete phase out of

coal - the most polluting energy carrier - by 2030, fossil gas by 2035 and fossil oil products by 2040.[1]

The PAC scenario does not expect any lifetime extension of nuclear power. On the contrary, increasing costs of maintenance, of the fuel chain and decommissioning rather tend to incentivise earlier retirements. By 2040, we should phase out nuclear power too.

Renewable electricity generation more than triples during the decade from 2020 to 2030. This leads to renewables covering 50% of gross final energy consumption in 2030 and 100% in 2040. Such an increase of renewable energy is one of the key elements for cutting greenhouse gas emissions by 65% by 2030. By 2040 we should have 100% renewables.



How much **electricity** will we consume by 2040?

Despite important improvements of efficiency of electric appliances, electricity demand doubles between 2015 and 2040 in the PAC scenario. The ramping up of the electric vehicles fleet as well as the replacement of inefficient individual fossil gas boilers with electric

[1] Recent analysis as well as the European-wide wholesale electricity market modelling run with PAC scenario numbers by Öko-Institut clearly prove the decline of former "king coal". With rising renewable energy capacities and a carbon price of €84 per ton of carbon in 2030, coal power plants will only provide very limited reserve capacities during a few days per year in Poland and Germany. They inject marginal 7 TWh of electricity into the grid in 2030. Many lignite and hard coal capacities were already uneconomic before the COVID-19 crisis. The increase of solar and wind electricity generation scrunches full load hours.

heat pumps increase the renewable electricity demand. The most important driver however will be electrolysers that produce renewable hydrogen with additional renewable electricity (30% of final electricity demand in 2040).
The PAC scenario shows that many industrial processes can be electrified. Once implemented, this modernisation allows for a supply of cheap, renewable electricity to industry. Only a few processes that cannot be electrified and that need an energy carrier with a high energy density, e.g. for steel production, will switch to renewable hydrogen or synthetic methane.

What does the scenario foresee for **transport**, especially aviation?

Fossil oil will be phased out by 2040 in the transport sector by electrifying vehicles such as passenger cars, busses, vans and parts of long-distance freight. Only parts of heavy freight will adopt renewable hydrogen used in fuel cells. Long-distance shipping needs to use renewable ammonia which is derived from renewable hydrogen but easier to store.

In aviation, no new aircraft designs are expected before 2040, meaning that liquid synthetic fuels, also based on renewable hydrogen, will have to be scaled up soon. Liquid biofuels will largely be phased out and shifted to agricultural direct use. They remain a niche product in aviation until 2040. It is possible that some first electric aircraft are introduced beyond 2040, however the effect of this on the transport sector's energy mix would be negligible.

What does the scenario foresee for the use of **hydrogen**?

Only renewable hydrogen that is produced through electrolysis with renewable electricity brings about a climate benefit. The PAC scenario shows that the EU has sufficient renewable energy potentials to produce the additional electricity needed to run the electrolysers. As producing renewable hydrogen and other non-fossil gases and fuels such as synthetic methane and liquid synthetic fuels is linked with high losses, the direct use of renewable electricity is the preferred option. Only in those sectors where an energy carrier with high energy density is needed do we foresee the introduction of renewable hydrogen, e.g. in the steel industry, in shipping, aviation and partly in long-distance heavy freight.

For efficiency reasons, neither renewable hydrogen nor synthetic methane are introduced for heating in buildings. Introducing hydrogen from fossil gas in combination with CCS technologies is neither considered a realistic option nor a contribution to emissions reduction.

C. How to limit temperature rise to 1.5°C? Immediate and ambitious steps.

The PAC scenario's overarching aim is to illustrate a robust pathway that ensures the EU limits temperature rise to no more than 1.5°C, as endorsed in the Paris Agreement. To do

so, the emissions curve must be flattened now2. The deployment of energy savings and renewable energy potentials ensures a quick reduction of greenhouse gas emissions. In view of the EU climate and energy targets for the year 2030, the PAC scenario shows that the current level of ambition can be raised substantially:

- The current EU target of reducing greenhouse gas emissions by at least 40% compared to 1990 can be updated to at least 65% emission reductions.
- The current EU energy efficiency target of 32.5% can also be outperformed. The PAC scenario leads to at least 45% energy savings as compared to PRIMES 2007 projections for both primary and final energy.
- The current EU renewable energy target of 32% share of renewable energy sources in gross final energy consumption can be increased to at least a 50% renewable energy share.

We have now a window of opportunity offered by the recovery packages to shift investments into the right direction and away from fossil fuels. What's more, by simply removing man-made (not physical or natural), barriers to further renewables deployment and energy savings measures, we can ensure a more resilient future for all of us.

D. What **technologies** do we need to see this scenario become reality?

The PAC scenario is viable with today's technologies. No brand-new technologies have to be introduced into markets, except from liquid synthetic fuels in aviation. The PAC scenario is very conservative because it only builds on those technologies and processes that have already proven as mature and ready for scale-up.

The PAC scenario assumes no carbon capture and storage/usage (CCS/CCU) technology is introduced. Given the strong increase of renewable energy sources in the energy mix and the reduction of fossil fuel demand, sufficient greenhouse gas emission reductions can be realised without CCS. It is not necessary to introduce CCS technology for reaching the 65% emission reduction target.

E. What is the role for **individual citizens** in contributing to its implementation?

The PAC scenario describes an energy future where citizens will become key drivers of the transition. Households easily can harvest the benefits of renewable energy technologies, in particular solar PV panels and batteries. They turn into self-generators that do not only cut

[2] What is the pace of emission reductions needed? The recent UNEP Emissions Gap Report states that annual reductions of 7.6% between now and 2030 are required to keep the 1.5°C temperature target attainable.

their own energy bill but contribute to security of supply and stable grids in a more decentralised energy system. The deep renovation of buildings will strongly reduce the energy demand of households. Provided the regulatory framework is well adjusted, energy efficiency measures can become the pillar of Europe's fight against energy poverty.

EUROPEAN INFRASTRUCTURE PLANNING

What are the next big moments in terms of energy infrastructure planning in Europe?

Over the course of this summer, the two main bodies for European energy infrastructure, the European Network of Transmission System Operators for Electricity (ENTSO-E) and for gas (ENTSOG) will define the key assumptions for the scenarios that are at the core of the next Ten Year Network Development Plan (TYNDP), the masterplan of European energy infrastructure planning. It is high time to align the TYNDP scenarios to the Paris Agreement. When it comes to the next round of selecting Projects of Common Interest (PCIs), based on the TYNDP, the European Commission needs to make sure that the Paris Agreement alignment has been observed.

How will this scenario influence the energy infrastructure planning?

Current European energy infrastructure planning still includes scenarios that foresee relatively high shares of fossil fuels until the year 2050. This obviously puts reaching our climate targets at risk. All modelled scenarios should be Paris Agreement compatible and ideally have broad societal support behind them. For this reason, CAN Europe and the EEB will suggest that the PAC scenario be integrated as a scenario for the next Ten Year Network Development Plan (TYNDP), the masterplan of European energy infrastructure planning.

How far apart are the findings of the PAC scenario compared with the official scenarios of the EU?

In contrast to the scenarios published by the European Commission in its own Long-term strategic vision (EU LTS)[3] at the end of 2018, the PAC scenario provides a much faster, but more stable way to limit temperature rise to 1.5°C. While the Commission's scenarios bet on technologies such as CCS of which the economic feasibility and climate benefit are not

[3] https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf

yet proven, the PAC scenario reaches net-zero emissions in 2040 with mature solutions that are mostly already introduced into markets.

The same applies to the TYNDP scenarios[4], all of which still assume a high fossil gas consumption. The official TYNDP scenarios as well as the EU Long-Term Strategy also assume that the installation of new nuclear power plants will increase strongly with up to five new reactors built per year, a number which the nuclear industry has not been able to reach over the entire course of the last decade. On the contrary, the PAC scenario assumes we can phase out nuclear power in the EU by 2040.

COSTS

How much does the implementation of the PAC scenario cost?

Making the PAC scenario come true is Europe's best insurance for saving the climate, nature and health. It prevents the unpayable costs of the climate crisis and is a bold investment plan which would enable the EU's energy sector to become the motor of economic recovery after the COVID-19 crisis. We expect the costs for building and running a 100% renewable energy system to be below a business as usual scenario, because renewable technologies are cheaper and render expensive fossil fuels superfluous.

In macroeconomic terms, first estimations show that the energy system costs of the PAC scenario would reach at least 600 billion per year in 2050. This includes the investment costs, operation and maintenance of power plants (mainly solar PV panels and wind turbines), as well as storage technologies (e.g. batteries and electrolysers) and electricity grids. This does not, however, include investments in vehicles and in energy efficiency in industry. Thus, the system costs of the PAC scenario would probably be in the range of comparable 100% renewable energy scenarios for Europe, e.g. the Energy Watch Group scenario published in 2018, whose assumptions were partly taken over and adapted.

The German Institute for Economic Research recently published a study that assesses the costs of a scenario for 65% emissions reductions by 2030 and has parameters that are very similar to the PAC scenario[5]. System costs increase with respect to the business as usual scenario by €200 billion, but emission reductions are worth more than €10 trillion in terms of avoided environmental and climate damage by 2050. Investments into renewable energy

[4] https://www.entsos-tyndp2020-scenarios.eu/

[5] DIW Berlin: Make European Green Deal Real, June 2020; https://www.diw.de/documents/publikationen/73/diw_01.c.791736.de/diwkompakt_2020-153.pdf

and storage technologies amount to €3,000 billion, but are financed largely through savings in fossil fuel imports, equal to €2,000 billion.

The European Commission's own scenarios bring about much higher annual total energy system costs because they stick to relatively high shares of fossil fuels until 2050 (PRIMES reference scenario 2016: €2,400 billion in 2050, Long-term strategic vision 2018: €2,200 billion to 2,800 billion in 2050). In contrast with the PAC scenario, the European Commission's scenarios are not at all aligned to the Paris Agreement's 1.5°C target.

A more detailed macro-economic cost analysis of the PAC scenario will be developed in the second half of 2020.

Who will pay for this?

As is today already the case, all European energy consumers will pay our future energy system directly, through their energy bills and indirectly, through taxes and levies. It is indispensable to make the right investments today to speed up Europe's transition towards 100% renewables. Economists show us that doing nothing and preserving the current system is much more expensive. The cost of inaction largely exceeds the costs of building a more efficient, renewable system (see European Commission's PESETA model 2014: almost €200 billion additional climate damage if no action is undertaken to stop temperature rise by 3.5°C; European Environmental Agency 2020: €175 billion welfare loss per year with 3°C temperature rise). A more detailed macro-economic cost analysis of the PAC scenario will be developed in the second half of 2020.

PAC project background

What is the PAC project?

The transformation of the energy system has an impact on all areas of human life. In addition to personal energy consumption and mobility, natural resources, landscape, flora and fauna are also affected. The goal of the PAC Project is to provide a platform for a deeper exchange of civil society, industry and academia experts to think about an energy system for the future and the consequences of choices and preferences. Thanks to intense debates, all sides could gain many new insights and expand their knowledge.

One of the ambitions of the PAC Project was to deliver a storyline developed by a broad coalition of civil society organisations as a contribution to the discussion about a desirable future energy system. The PAC Project has over delivered here: Climate Action Network (CAN) Europe and the European Environmental Bureau, together with their extensive member networks have developed an entire quantified scenario. Around 150 different

stakeholders were involved in the scenario building process, be it through participation in workshops or through bilateral exchanges.

Furthermore, a series of Modellers' Exchange workshops organised by the Renewables Grid Initiative served as a platform for exchange among energy system modellers to discuss modeling challenges they face and possible solutions.

Who is involved in this project?

The PAC consortium consists of Climate Action Network (CAN) Europe (+170 NGO members across Europe), the European Environmental Bureau (EEB) (160 NGO members across Europe), the Renewables Grid Initiative (RGI) (12 NGOs and 10 Transmission System Operator Members) and REN21 (80 members with an international focus from civil society, academia and research, governments, industry and intergovernmental organisations). The PAC scenario has been constructed by CAN Europe and the EEB, drawing on the expertise of their broad, civil society-based network of members.

Climate Action Network (CAN) Europe is Europe's leading NGO coalition fighting dangerous climate change. With over 170 member organisations active in 38 European countries, representing over 1,500 NGOs and more than 47 million citizens, CAN Europe promotes sustainable climate, energy and development policies throughout Europe. www.caneurope.org

The European Environmental Bureau (EEB) is the largest network of environmental citizens' organisations in Europe. It currently consists of around 160 member organisations in more than 30 countries, including a growing number of European networks, and representing some 30 million individual members and supporters. www.eeb.org