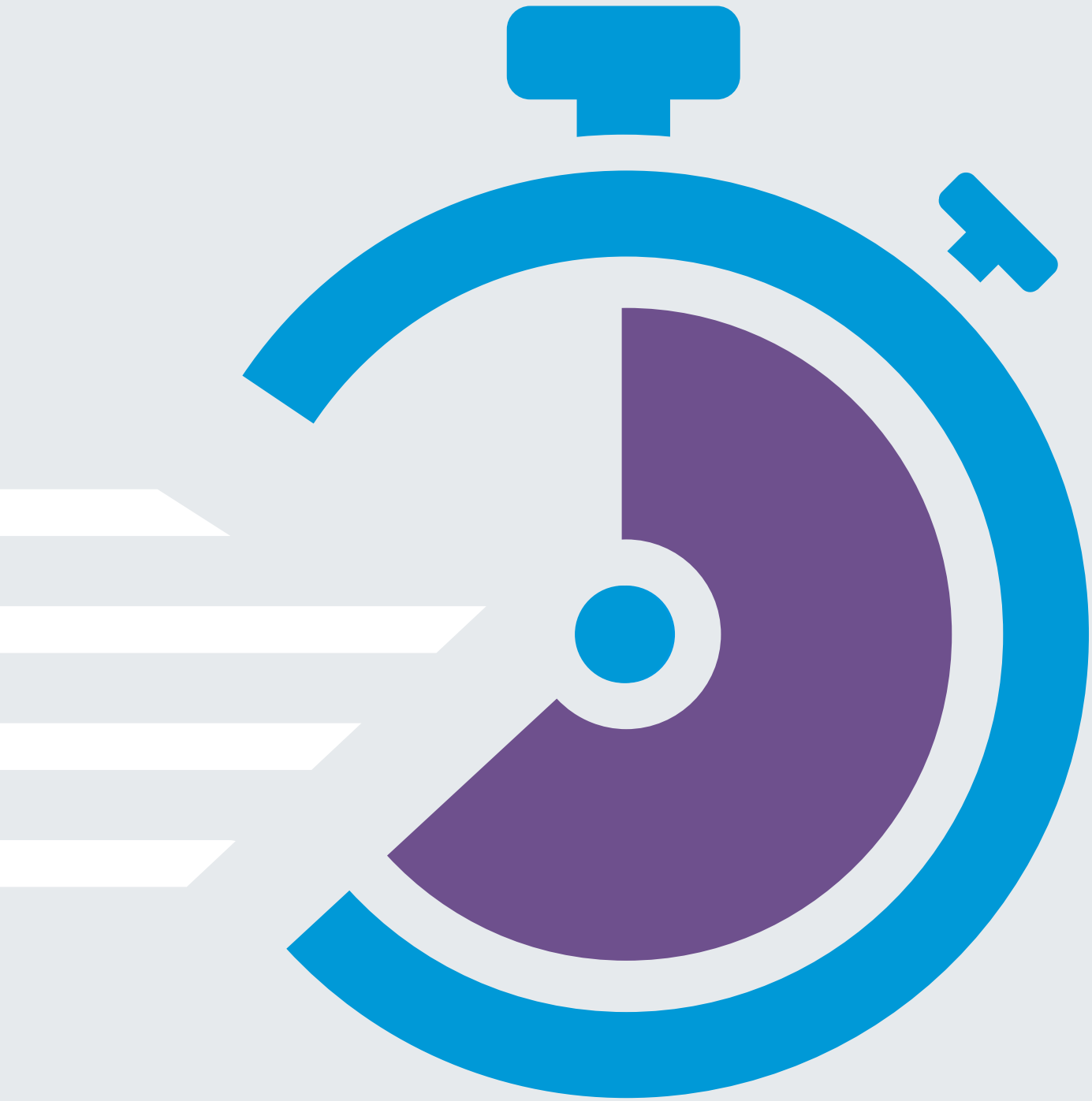
Need for speed

How offshore wind and renewable power-to-X can help solve Europe's energy crisis



Ørsted

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Mads Nipper
CEO, Ørsted

Europe is facing a new energy crisis

Europe has, for a long time, recognised the existential crisis posed by climate change and has worked to address and mitigate that global climate crisis while building a world leading value chain for renewable energy, generating millions of jobs.

Now, Europe has awoken to the reality of another energy-related crisis. Russia's unwarranted invasion of Ukraine is deplorable, and Moscow's propensity to use energy for geopolitical leverage only underscores how dependence on imported fossil fuels can neither deliver the security of supply Europe needs nor help address climate change.

The solutions to the objectives of reducing our energy dependence and mitigating climate change are the same: replace fossil fuels with renewables, directly and indirectly electrify energy use – and use energy as efficiently as possible. We were already doing this. But the new energy crisis shows the need for even greater speed. Both to secure Europe's energy supply and to help keep the global temperature increase below 1.5 °C by 2100.

Doing so will mean a radically new approach to deploying renewable energy, changing how we plan, permit, incentivise, invest in, build, connect, integrate, and utilise renewables. But at the same time, the buildout must be nested in broad societal acceptance and done with environmental and social sustainability in mind – without compromising the need for speed. Policymakers, industry, and civil society must work together to solve this conundrum. With this paper, we want to share our thoughts about what can be done to accelerate this buildout.

One part of the solution, we believe, will be to continue to mitigate the impacts on local society and natural habitats of new energy infrastructure as much as possible – while also accepting that some impacts must be compensated and offset. Another part will be to design tenders and regulatory frameworks to harness the innovative power of the industry to manage these impacts. This enables industry to compete to create societal value on several new bottom lines: environmental, social sustainability and energy system value, beyond just infrastructure.

This is not least the case for the two technologies that must grow the fastest and are the focus of this paper: offshore wind and power-to-X solutions. Together, they are at an inflection point, ready to form a potent nexus in deep decarbonisation. But to these technologies to fully play their part in Europe's decarbonisation, Europe must resist the temptation to 'race for the bottom' on cost alone and instead enable long-term investments into a sustainable industry.

At Ørsted, we are the first to admit that the way ahead will be filled with dilemmas and difficult decisions. As was our own transmission away from fossil fuel production. We acknowledge that the solutions we propose here take time and that some stop-gap measures may be required in the immediate term.

But even though Europe may be forced to increase e.g. LNG imports in the short term, fossil solutions must only be the very last resort. Europe has a strong hand to play and should first and foremost concentrate on the no-regret opportunity to accelerate renewable energy to deliver long-term energy security for Europe while transforming Europe to a climate-neutral continent.

Mads Nipper
CEO, Ørsted

Executive summary: Accelerating offshore wind and power-to-X can contribute decisively to European independence, but it requires a new approach

Europe is facing an energy and climate crisis. In the second half of 2021, European natural gas prices, and consequently power prices, increased 4-5 times above historic levels. This year, the Russian invasion of Ukraine has sparked geopolitical uncertainty not seen on the continent for decades. The current crisis means that diversification and energy independence is a pertinent challenge. It underlines the acute need to **speed up the green and just transition** in Europe.

Although diversifying European fossil supply, e.g. expanding the role of liquified natural gas (LNG), can be a necessary stop-gap solution to quickly bolster the strategic supply of natural gas, over-reliance on investments in new fossil fuel production or infrastructure will only shift Europe's liability to other external suppliers. At the same time Europe's lock-in to a fossil value chain will deepen and additional geopolitical crises will emerge, as the global climate continues to warm. More of the same is not the way forward for Europe.

Renewable energy must be the cornerstone of any solution to Europe's current two energy crises, and buildout of renewable energy can be significantly accelerated to deliver this. Offshore wind and renewable power-to-X alone hold the potential to displace energy equivalent to about two thirds of current Russian gas imports by 2035.

Europe's current climate targets calls for today's buildout rate of 3-4 GW offshore wind per year, to be doubled to 8 GW per year by 2030, and a further increase to 20 GW per year from 2036. Considering the pressing need to reduce dependence on imported fossil fuels, and the overwhelming evidence of climate tipping points approaching, this ramp-up should be expedited over the next 6-8 years, to reach 20GW per year from 2030 onwards, according to Ørsted analysis.

The necessary contribution of offshore wind to a European phase out of fossil fuels by 2050 was first outlined by the European Commission in 2019 and underscored by the 300 GW target set out in the EU Renewable Offshore Strategy in 2020. Since then, several European governments have increased offshore wind ambitions radically, but the annual buildout rate has stalled, and the supply chain is under significant pressure from inflation on the one hand and unclear build out timelines and lack of coherence between policy ambitions and concrete project allocation on the other.

Delivering 20GW per year will require a whole new approach to offshore wind and power-to-X development and delivery. From today's incremental buildout focusing on cost reductions, Europe must move to a sustainable accelerated buildout, focusing on societal value and scale. This can be delivered with the 'four A's', namely;

Accelerate deployment by front-loading current buildout plans, clearing the pathway for hybrid projects that link clusters of offshore wind with multiple markets or power-to-X clusters, streamlining and shortening permitting procedures and working with industry to ramp up the supply chain and delivering necessary supporting infrastructure, be it offshore grids or hydrogen pipelines.

Allocate the space, by tendering multiple sites at the same time and designating larger gross-areas for open-door greenfield projects, to allow market competition in identifying the right integrated solutions for society.

Activate the industry to meet the broader societal objectives revolving around the green transformation, including matching large offtakers' demand for renewable power, renewable hydrogen and e-fuels with supply, and mitigating and offsetting potential negative environmental or social sustainability impacts of new infrastructure.

Appoint a role for renewable hydrogen and power-to-X, finalising and fast-tracking ongoing regulatory work to provide market certainty, designing a strong framework to ensure a further supply push and stronger demand pull across hard-to-electrify and highly polluting sectors, and investing into European hydrogen infrastructure.

	From **Old cost out-approach**		To **New societal value-approach**
Accelerate deployment	Careful but slow permitting procedures with changes for each tender	→	Expedite processing of currently identified sites and simplify permitting procedures
	Incremental supply chain investments only when contracts are signed	→	Tender as much as possible as soon as possible, to provide clarity for industry and incentivise large scale supply chain investment
	Radially connected wind farms the default option. Hybrid projects connected to more markets, 'exception to the rule'	→	Multi-connected offshore wind and other alternative connection options normalised. Market regulation ensuring incentives are properly aligned
	Supply chain investment driven by markets alone	→	European supply chain for offshore wind and power-to-X given societal priority, e.g. with public lending facilities for new investments
Allocate the space	Dispersed approach to externalities of offshore wind or infrastructure projects	→	Holistic 'net-positive' approach to local impacts, e.g. on biodiversity
	Single or few sites per tendering round	→	Increased speed by tendering multiple sites simultaneously
	Sites screened and designated by governments	→	Identify new gross go-to areas for renewable energy and power-to-X on top of current spatial planning
Activate the industry	Buildout speed defined by tenders	→	'Open door' greenfield projects to complement government tenders
	Narrow focus in auction criteria, e.g. price-only	→	Activate industry to deliver on societal policy objectives rather than narrowly defined criteria.
	Investigations done by governments and TSOs ahead of tenders	→	Give as much responsibility as possible to developers
Appoint a clear role for hydrogen and e-fuels	No incentives or framework to promote power-to-X together with large scale RES	→	Deliver framework for large-scale integrated RES/hydrogen projects (landing zones)
	No clear regulatory framework for renewable hydrogen and e-fuels	→	Finalise ongoing processes, e.g. REDII delegated acts and the Fit-for-55 package
	Limited transnational support schemes for hydrogen	→	Front-load the pay-out from the EU Innovation Fund and super-charge funding mechanisms for renewable power-to-X to deliver rapid scale and reduce cost
	No clear framework for incentivising large-scale hydrogen and e-fuels uptake	→	Support demand side pull for hydrogen and e-fuels from hard to electrify, highly polluting sectors through e.g. quotas
	Isolated and small-scale hydrogen projects	→	Enable physical delivery through regional hydrogen backbones

Overcoming European energy import dependence

Europe is deeply dependent on imported fossil fuels for energy, especially on oil and natural gas. Although only one third of Europe's coal consumption is sourced abroad, and 84% of natural gas and 97 % of petroleum products are imported to the EU.

In and of itself, the import dependence constitutes a drain on European economies, while also keeping them highly susceptible to global price fluctuations and geopolitical risks. But whereas coal and oil are traded globally and can be imported from many sources, natural gas is a far more regionalised commodity, with Russia being the single largest exporter of natural gas to Europe. Russia's invasion of Ukraine, and the ongoing risk that Moscow links natural gas delivery to geostrategic leverage underscores the fact that the long-standing European dependence on Russian energy must be ended as soon as possible – and not replaced with dependence on other states for hydrocarbons, whose supply might also be disrupted.

Europe cannot cut our ties to fossil energy overnight. In the short term, governments and market actors must seek to minimise its their offtake of hydrocarbons, while diversifying suppliers and implementing energy conserving measures. The 2022 REPowerEU communication, shows a short-term path forward for the EU to reduce Russian gas imports by approx. two thirds already in 2022.

Short-term efforts risk locking in fossil dependence
Part of the EU proposal is to accelerate existing efforts in line with long term decarbonisation efforts, including ramping up renewable energy production, increasing energy efficiency and electrifying end uses of energy. However, most of the reduction is delivered by a diversification of energy supplies – especially in the form of increasing in European imports of LNG, estimated to constitute half of the short-term reduction, or 50 billion cubic metres (bcm) of natural gas.

It is understandable that boosting LNG imports may need to be part of emergency efforts to shore up European energy supply and avert an impending crisis. But investing in new fossil fuel infrastructure comes at a significant cost, still takes years to implement – and only deepens European economies' lock-in to fossil energy, running counter to the long-term objectives of creating a strong, green, and self-reliant European economy and avoiding future geopolitical tragedies as the impacts of climate change continue to mount.

Efforts to diversify and increase energy independence should focus on the no-regret solutions that are aligned with the long-term decarbonisation targets; first and foremost acceleration of the renewable energy buildout and energy efficiency. Europe should only rely on fossil fuel infrastructure investments and re-investments once all other measures have been fully explored.

What about onshore wind and solar energy?

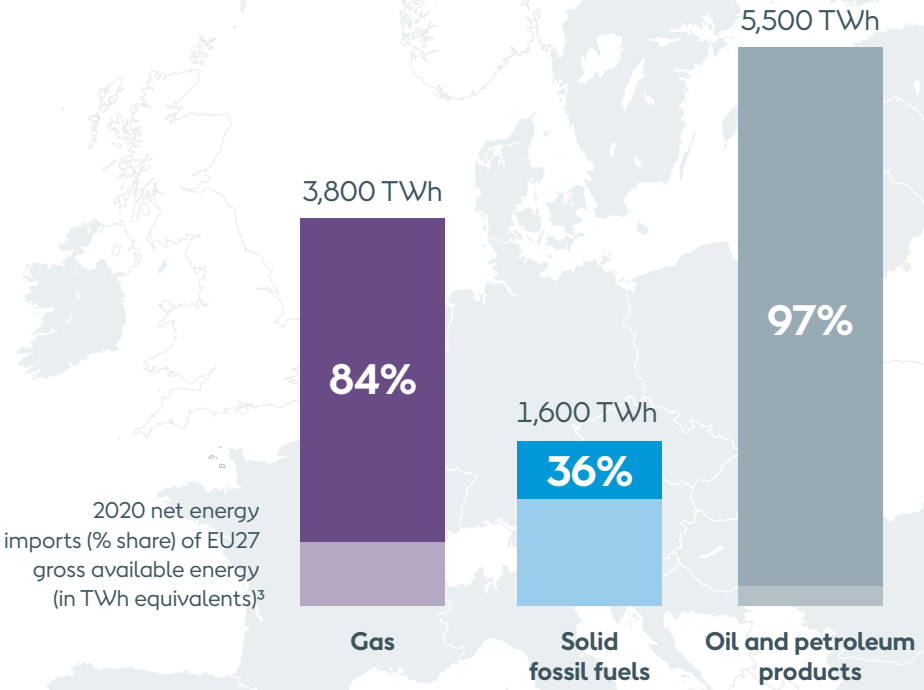
Offshore wind and renewable power-to-X are the focus of this paper. Together, they are the two sectors with the steepest growth trajectories, by a factor of around 15-20 and a factor of more than 100 towards 2050, respectively[1], for Europe to become climate neutral.

However, a lot of the principles and solutions proposed here can be applied on land. To reach its 2050 targets, Europe must increase onshore wind and solar PV capacity by factors of approx. 3 and 7, respectively[2]. Just as with offshore wind and power-to-X, this will require an updated approach to allocate space and activate the industry to mitigate and overcome local impacts and to ensure a sustainable transformation of Europe's power system.

1. EU Commission 1.5TECH Scenario, Wind Europe statistics
2. 1.5TECH Scenario, IRENA Renewable capacity statistics 2021

EU energy dependency

In 2020



Top 5 origins of imports

(% of EU27 primary energy imports 2020)

Natural Gas

Russia	38%
Norway	18%
Algeria	7%
Qatar	4%
United States	4%

Solid fossil fuels

Russia	46%
United States	14%
Australia	12%
Colombia	5%
Canada	2%

Oil and petroleum products

Russia	23%
United States	7%
Norway	6%
Saudi Arabia	6%
United Kingdom	5%

Source: Eurostat.

3. The energy dependency rate shows the proportion of energy that EU27 imports. It is defined as net energy imports divided by gross available energy that represents the quantity of energy necessary to satisfy all the energy demands.

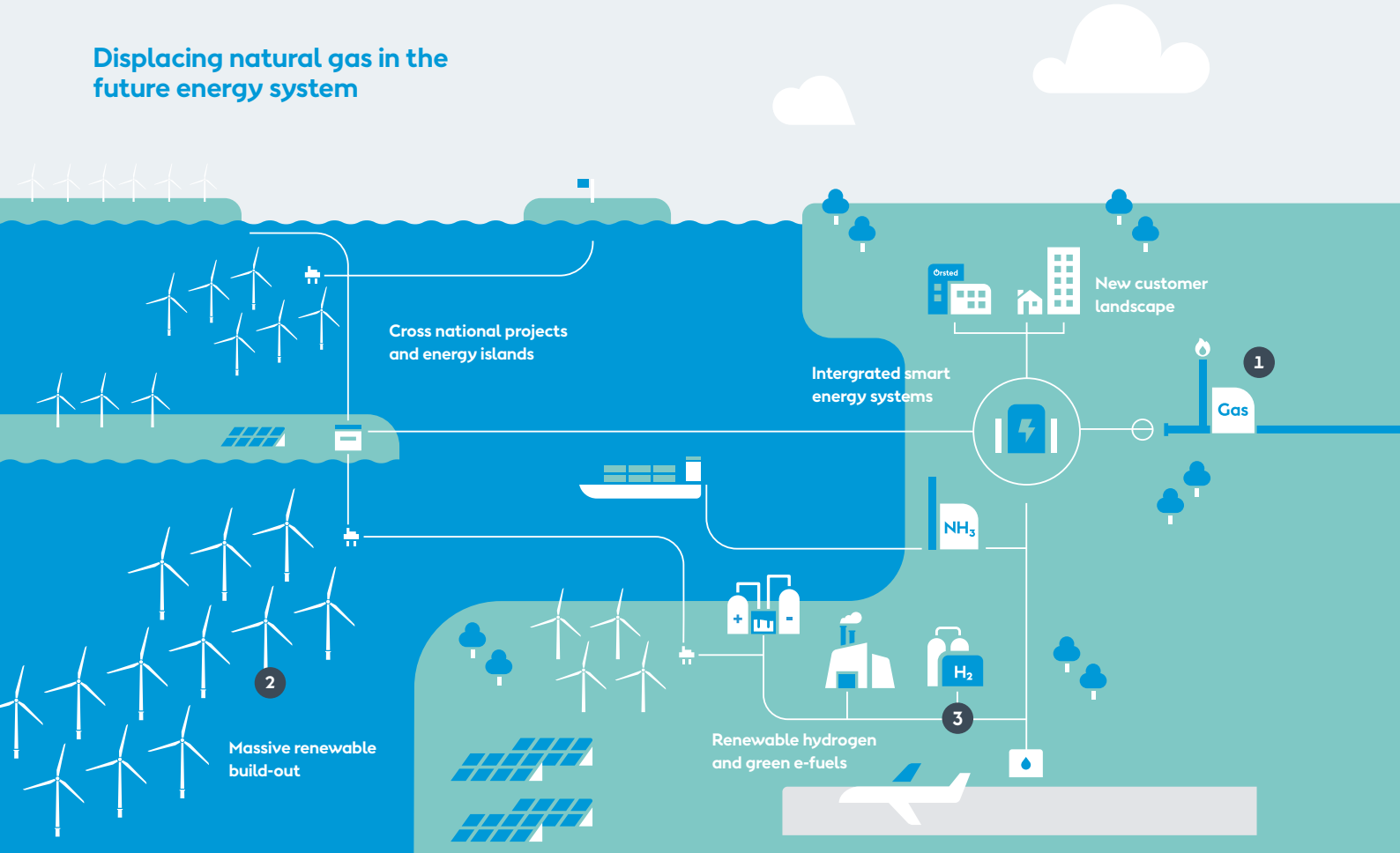
The way to climate neutrality leads to fossil independence

Europe is fortunate to have the tools it needs at its disposal to get there: renewable resources and a world-leading position within renewable energy technologies. This includes onshore and offshore wind, digital, integration, and storage solutions. And a new European supply chain for power-to-X is emerging, indicating that hydrogen and e-fuels applications can also become future European industrial strongpoints.

Frontloading offshore wind pipeline can unlock 30 GW additional capacity by 2030

Offshore wind energy will play a crucial part in freeing Europe from its fossil fuel dependencies. Collectively, Europe has an offshore wind energy target of at least 100 GW offshore wind installed by 2030, and studies point to 450 GW of offshore wind being needed by 2050 for Europe to become climate-neutral.

Displacing natural gas in the future energy system



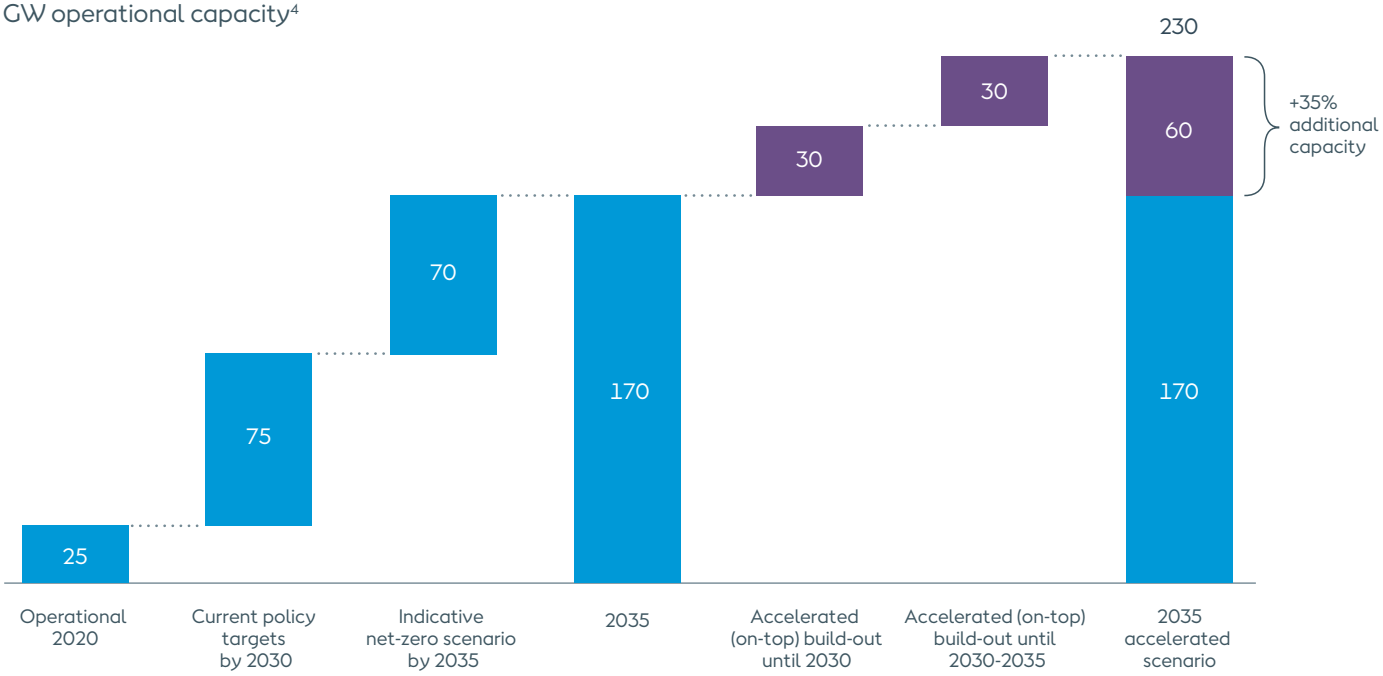
1. Prior to the current energy crisis, Europe imported 155 bcm natural gas from Russia per year

2. 1 GW of offshore wind produces the equivalent energy of app. 0.5bcm natural gas pear year

3. Currently, Europe uses approx. 10 Mt hydrogen per year – the production of which requires approx. 54 bcm natural gas

How much can we accelerate offshore wind buildout by 2035

GW operational capacity[4]



Given the scale of the necessary buildout, offshore wind cannot be the sole answer to alleviate the supply shortage today – though, arguably, no panacea exists given the timelines and trade-offs of new investments into fossil fuel infrastructure such as LNG import terminals. The gap can be partially bridged through LNG imports, biomethane production, and energy saving measures. In the medium term, however, offshore wind can help to fulfil Europe's decarbonisation and energy security agendas – and if policymakers deliver the right policy decisions, the industry can deliver an even larger impact by 2030 and beyond.

In a survey of nine key European markets and analysis of European supply chains, Ørsted has found that up to 30 GW of additional capacity can realistically be in place by 2030, and 60 GW by 2035, on top of current buildout targets. Together, this additional buildout can displace natural gas equal to 10 % of current imports from Russia by 2030, and 20 % by 2035 – or displace a similar amount of natural gas from other sources.

When coupled with electrolysis, for which there is currently an announced project pipeline of approx. 75GW in Europe by 2030, offshore wind generation can also displace natural gas and other fossil fuels and feedstock – all while improving grid resiliency and stability. Renewable power for hydrogen electrolysis will of course not have to be delivered exclusively from offshore wind – but the high load factor of offshore wind and its immense resource potential close to European industrial demand centres makes offshore wind and hydrogen a powerful green nexus.

While technically possible, such an acceleration is far from certain. Even with current buildout projections, significant efforts are needed to streamline siting and permitting, expand grid infrastructure, make anticipatory investments in transmission lines, and scale up supply chains. If deployment rates for offshore wind are set to increase five-fold, Europe needs a new and updated approach to planning, permitting, and deploying offshore wind, transmission grid, and renewable hydrogen buildout.

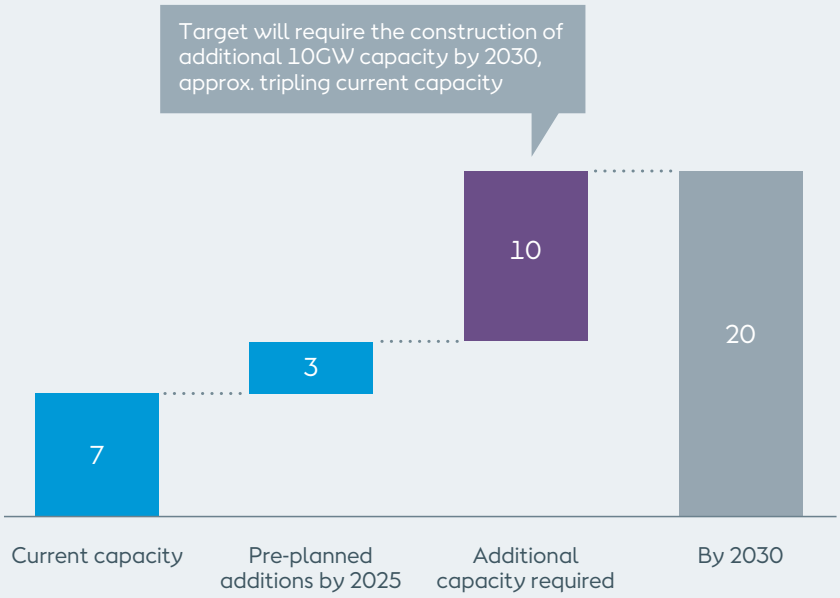
4. Current European 2030-targets of 60 GW (EU27) and 40 GW for UK. Projected buildout from 2030-2035 of 70 GW based on Ørsted analysis of nine European markets and Wind Europe 'Our Energy - Our future' (2019).

Scaling European supply chains to 20GW offshore wind per year

From 2018 through 2021, the average annual installation of offshore wind capacity was 3GW. Through the combination of firm capacity in the pipeline and planned additions, the industry is expected to be able to deliver around 10 GW per year in 2025 in line with near-term policy targets. Under the right conditions, a full-force scale-up of domestic supply chains could enable Europe to annually deploy 20 GW offshore wind from 2030. Such an installation rate would in any case be needed to reach the European long-term decarbonisation targets for 2050 – only, it would not materialise before around 2036.

Potential ramp up of EU offshore wind supply chain capacity

GW of annual OEM capacity today vs 2030 in EU[5]



Ramping up will require investments. Indicatively, scaling supply chains to 20 GW capacity per year by 2030 would entail additional investments of approx. EUR 7-10bn in the offshore wind supply chains, with wind turbine original equipment manufacturers (OEM) making up a significant proportion of this, but also including foundations, vessels, substations, and cables, according to Ørsted analysis. Private capital is ready to deliver these investments, if the framework of supporting policy conditions is right.

Since 2012, costs of offshore wind have diminished in Europe, making it a competitive renewable energy technology at scale. Gradually, this has been followed by increasing competition and financial tension within the industry, with new market entrants and thinning margins. At the same time, policy focus in some European markets has shifted towards offshore wind as a revenue generator. Overall, these are positive developments. They have lowered costs of offshore wind and have demonstrated its economic value offering to society.

However, today's strong focus on costs, in combination with growing competition, increasing fiscal pressure, and a highly inflationary environment for commodities creates uncertainty for OEMs and investors. This is compounded by lack of clear visibility for industry participants, as firm offshore wind project pipelines is limited and beset by uncertainty.

This background is not necessarily compatible with stimulating the fresh wave of major capital investment required to rapidly scale up supply chains. To quickly scale up offshore wind supply chains' ability to deploy, policymakers and industry will have to find a sustainable balance between short-term value creation and long-term investment into expanding the industry and enabling innovation and risk-taking.

5. Ørsted analysis

Accelerate deployment

Around the Northern Seas, European governments have embraced their offshore wind resources as a means to reduce import dependence and deploy renewable energy generation at scale. Together, governments have set cumulative intermediate targets of 100 GW offshore wind by 2030. For the most part, sites have been allocated and regulatory and permitting processes initiated. However, far from all this capacity has been tendered to developers, and even less has been subjected to a final investment decision.

Expedite currently planned tenders to create clarity for industry

Accelerating these proposed but unplanned sites and projects will significantly increase clarity for developers and the supply chain, helping to unlock much needed investments. As developers win tenders and FID projects, it will create certainty for supply chain companies as order books can be filled years in advance. Together with steady and coordinated buildout scheduling, the industry as a whole will be able to plan its ramping up to 20 GW per year from 2030 onwards.

Simplify and shorten permitting procedures

Due diligence and proper permitting, including environmental impact assessments and public hearings, are essential to any large-scale infrastructure project. In fact, permitting procedures can often take as long as – or longer than – the installation. Hence there are large potential gains in terms of buildout speed if they can be streamlined.

To this end, permitting processes should be as simple and transparent as possible with clearly defined responsibilities between governmental agencies, ideally setting up a single, central point of contact for renewable energy developers (a 'one-stop-shop'). Policymakers and authorities should always seek to provide flexibility, give clear guidance on unavoidable trade-offs, and avoid permitting becoming a bottleneck. This also applies to related types of infrastructure, e.g. transmission grids and harbour expansions.

Facilitate European supply chain scaling

On top of fast-tracking processing of currently planned buildout and acceleration of plans for offshore wind, governments and the industry each hold several concrete levers that can help overcome supply chain constraints and incremental by-project investments, including:

Levers for governments

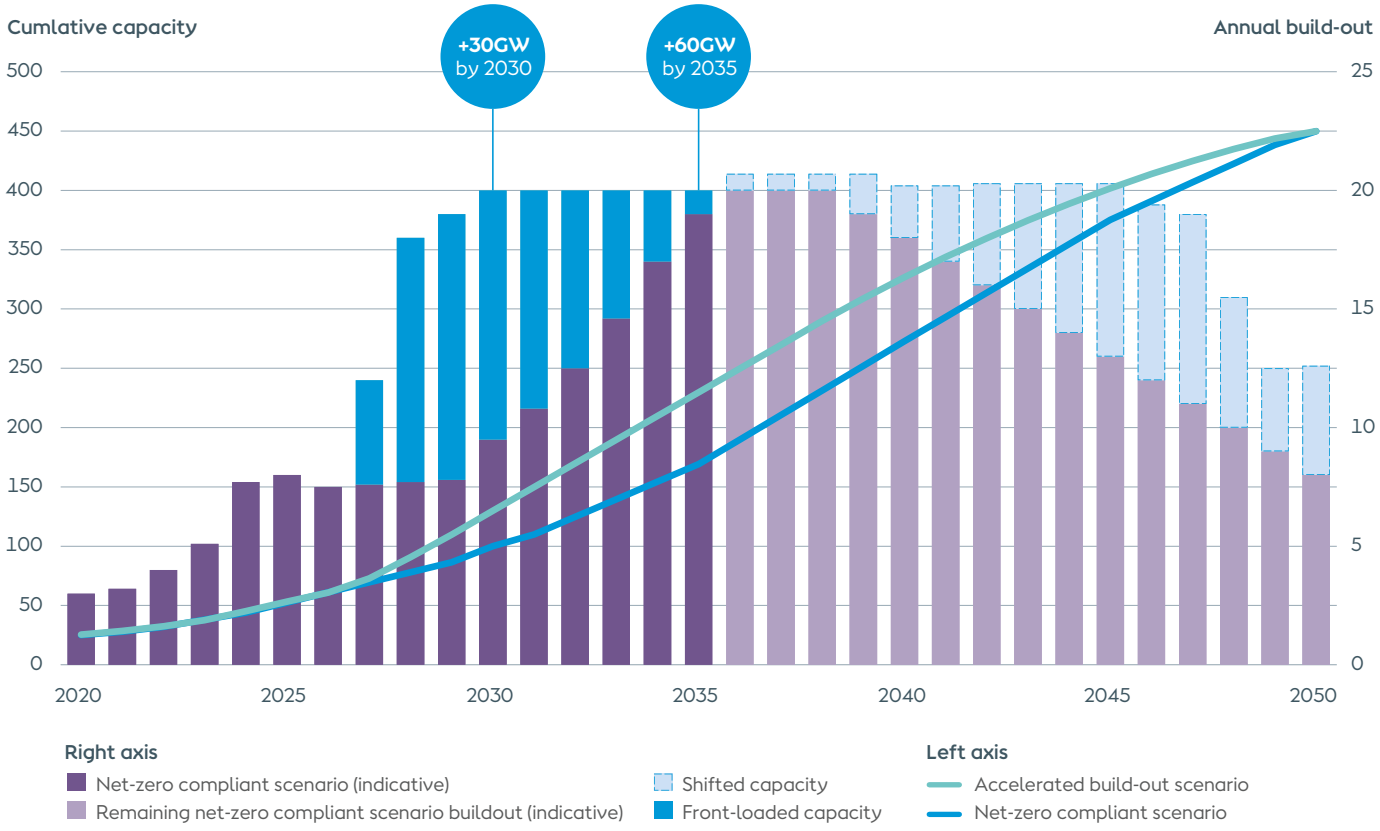
- Ensure steady and coordinated buildout scheduling, including a substantial and predictable flow of projects from developers to OEMs.
- Prioritise mega projects such as energy islands and hubs, enabling bulk component orders with cost efficiencies for supply chain.
- Facilitate giga-scale factories and streamline permissions for larger factories and facilities, allowing supply chain participants to benefit from economies of scale.
- Moderation of local content requirements. By not setting detailed requirements at component level, many inefficiencies can be avoided without necessarily reducing local economic benefits.
- Provide of low-cost financing to OEMs, boosting business cases by reducing cost of capital, e.g. by strengthening multilateral financial institutions' ability to further support the necessary investments in supply chains via loans, equity, and guarantees.

Levers for the industry

- Standardise design specifications for projects and components, to unlock further supply chain efficiencies.
- Establish of framework agreements including scale commitments, reducing uncertainty around OEMs' pipelines by providing visibility on order volumes and bearing additional sharing risk.
- Ensure flexible project design, allowing the opportunity to change project design to benefit from supply chain efficiencies – for instance, using HVAC instead of HVCD in marginal cases.

Accelerated offshore potential build-out towards 2050

GW operational capacity



By front-loading 60GW European offshore wind buildout before 2035, Europe can displace energy consumption equal to approx. 25% of current imports of natural gas from Russia.

Allocate the space

Northern Europe holds some of the best areas in the world for offshore wind. Winds are strong and predictable and the ocean floor on the continental shelf is relatively shallow. A 2018 study by Wind Europe identified a feasible potential for offshore wind in Europe exceeding 600 GW – far more than could be needed in any predictable future.

Yet, finding the space for accelerated offshore wind deployment has proven difficult, as many users compete for the space – and as large areas over and under the sea's surface are protected habitats of birds and marine wildlife. Taken together, offshore wind and transmission infrastructure have often been relegated to being 'last in line' and confined to areas where it was deemed it had no significant impact. For a while, this has been enough. But if the scale necessary to sever Europe's external energy ties and accelerate the green transformation is to be delivered, a new approach is also needed here.

Identify space for a second wave of offshore wind
As processing of currently identified sites and projects is fast-tracked, policymakers and regulators must seek to identify further and even larger areas which can be designated for an immediate 'second wave' of offshore wind tenders to be developed by 2030, to provide the necessary long-term clarity for the industry and enable planning of the necessary transmission and hydrogen infrastructure well in advance.

Establish 'go-to' areas for offshore wind
Ideally, larger gross areas can be designated with only relatively light screening beforehand, where developers on their own initiative can bid on lease areas which will be allocated on a 'use or lose' basis. Thus, the developers themselves will take the risk of relevant site conditions and impacts. This way, multiple approaches to harnessing Europe's offshore wind potential can be delivered in parallel, allowing the market to decide which is the optimal. Societies gain the upside of faster and more flexible buildout, with risk of cost or project overruns transferred to the developer. However, developers should be compensated with fixed (or no) lease costs for sites, since they are taking not only the development risk but also power market risks for such 'open door' greenfield projects on merchant terms.

Prioritise offshore wind and infrastructure
As 'go to' areas are established and offshore wind projects and infrastructure expedited, societies must also be ready to acknowledge the importance of large-scale energy transition. New renewable energy projects should not be developed at any cost or accepting any impact. But the current threshold at which environmental or social impacts are deemed prohibitive must be reconsidered in light of the acute need to diversify Europe's energy supply and phase out fossil fuels. Increasingly, critical infrastructure buildouts, e.g. for onshore transmission, should be given overriding priority within clear frameworks minimising impacts and compensating and offsetting impacts that can't be avoided.

Northern Europe has vast offshore wind resources available.

With strong winds and relatively shallow waters, the Northern Seas of Europe hold enormous potential for offshore wind. According to a 2018-study, the technical potential for bottom-fixed offshore wind alone by 2030 exceeds 600GW.

Total:
600+GW
in Northern Europe alone

Activate the industry

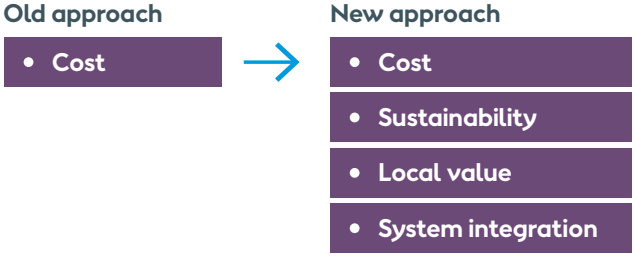
Offshore wind energy has undergone a remarkable journey in less than 30 years, to become a cost-efficient, scalable and powerful source of renewable energy – a milestone of great importance. But while cost is a key concern – now that the cost is competitive and transparent, further aggressive reductions cannot be the only target. Now the innovative force of the industry must be activated to overcome the challenges ahead, as offshore wind scales and establishes new links to other sectors, including renewable hydrogen and power-to-X.

Tenders to incentivise societal value creation
The industry must develop new and more efficient ways to integrate large-scale volumes of variable energy into the systems while limiting costly grid reinforcements. And it must identify new ways of avoiding and mitigating sustainability impacts or offsetting impacts that are unavoidable. In other words, provide broader societal value, beyond the energy system itself.

Governments can incentivise these efforts by incorporating supplementary evaluation criteria for broader value creation in tenders. Where tenders focus too narrowly on cost, deployment can be delayed, e.g. due to entrenched local opposition, or it can become more expensive, e.g. as developers optimising for cost of energy overlook or ignore optimisation of the broader systems or societal value of a project.

This race to cut costs risks blunting the industry's ability to effectively deliver on European policy objectives of energy independence and climate action. And it exerts further pressure on the European supply chain and its ability to invest in ramping up capacity, which is pressed in face of rising inflation and rising commodity prices.

Societal value creation



A two-tracked approach to building out offshore wind and renewable power-to-X
As a complement to a wider-scope evaluation in public tenders, a parallel and market-driven approach for offshore wind deployment should also be explored. Where the government-driven tender pipeline will support a minimum required deployment to achieve general electrification, this market-driven approach will allow developers to link merchant offshore wind projects directly to large-scale consumption onshore, including for future renewable power-to-X production, and thus work around potential onshore grid bottlenecks.

With a pipeline of industry-driven developments outside centralised tender schemes, developers, OEMs and supply chain companies can also form a firmer outlook for upcoming projects, further facilitating supply chain investments.

Greenfield projects should to be facilitated through national Maritime Spatial Planning (MSP) that predesignate sufficient sites in 'greenfield development zones' reserved for greenfield applications. Mechanisms for allocating rights to seabed for greenfield projects should effectively address and mitigate country-specific concerns regarding system integration costs, secured offtake, sustainability, and biodiversity impacts, etc. These concerns may vary across country-specific circumstances.

Daily turbine installation rates from today to 2030

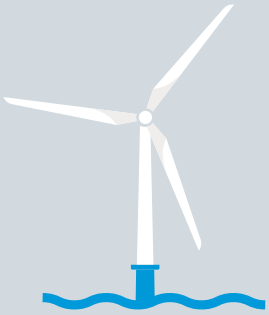
Approx.

2010

One 4 MW turbine
per 3-4 days

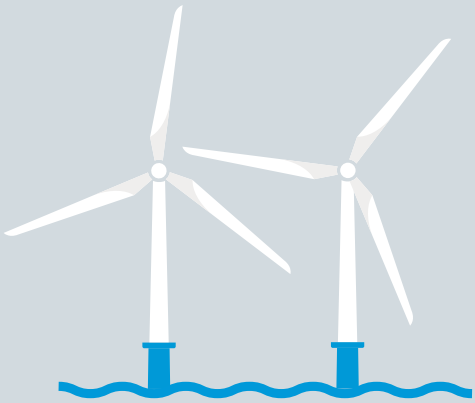
2020

One 8 MW turbine
per day



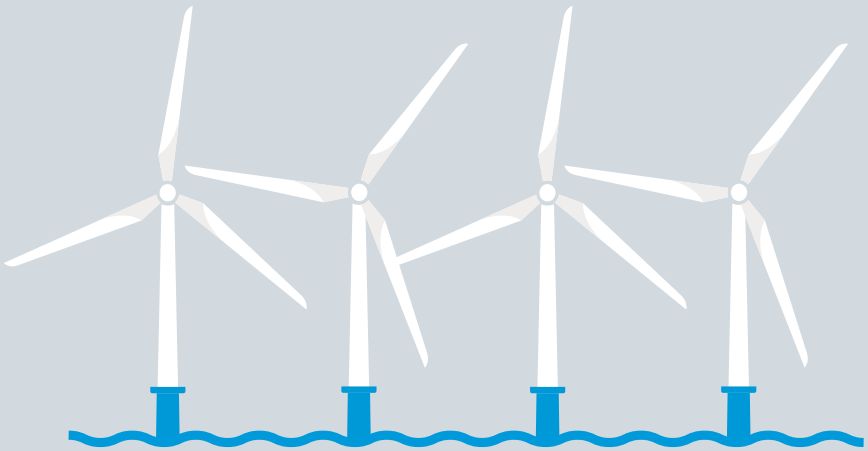
2025

Two 11 MW turbines
per day



2030

Four 14 MW turbines
per day



Appoint a clear role for renewable hydrogen and e-fuels

The decarbonisation of hard-to-electrify sectors like industry, aviation, shipping and heavy transportation, using renewable hydrogen or e-fuels, will be one of the most significant material shifts of the green transformation. It will enable society to phase out oil-based fuels from shipping, aviation, and heavy land transport and replace fossil feedstocks in chemical industry and heavy industries. And, while doing so, it will add a further layer of resiliency to the European energy system to supplement the variable output from wind and solar generation.

Today, European industries produce approx. 10Mt pure hydrogen per year[6], to produce ammonia for fertilisers, in refining and for other chemical applications. Today, it is almost exclusively derived from steam methane reforming of natural gas (SMR) of natural gas, requiring about 54bcm of natural gas per year – or about 35% of the gas what currently imported from Russia by Europe. This use case alone could justify the necessary policy decisions.

However, for Europe to reach its policy objectives, the role for renewable hydrogen and e-fuels must grow significantly beyond the replacement of current fossil hydrogen consumption, to act as an energy carrier and enable production of e-fuels for heavy transportation and hard-to-electrify sectors. Increasing European renewable generation capacity is the overarching prerequisite to do so. Beyond that, European policymakers can help kick-start the development by a series of policy levers.

Finalise ongoing regulatory processes and front-load funding

While European governments have set ambitious targets to expand hydrogen electrolyser capacity, and a significant pipeline of projects have been announced, only very little capacity has been subjected to final investment decision (FID). The European regulatory framework for hydrogen is still not in place to sufficiently incentivise scaling up and driving down costs of renewable hydrogen.

To close the gap, EU and member states must seek to quickly finalise current ongoing regulatory and administrative processes, including finalising and implementing the necessary delegated acts of the Renewable Energy Directive II (RED II)[7]. Those should establish credible electricity supply criteria for renewable hydrogen production that simultaneously allow for the ramp-up of the sector and set up a transparent methodology to assess greenhouse gas emission savings from renewable fuels of non-biological origin (RFNBO). Similarly, the European Commission should deliver on its RePowerEU commitment, namely to speed up the on-going IPCEI processes for hydrogen projects as a matter of priority with the aim to enable the assessment to be completed by summer. EU policymakers could also prioritise front-leading payouts from the EU Innovation Fund (instead of EUR 1-1.5bn per year, make the next round e.g. EUR 5bn) to super-charge the first wave of green hydrogen growth.

Enable a simultaneous supply-side push and a demand-side pull

Producing hydrogen using renewable energy is a well-known technology. But it still has a long way to go to scale up, increase systems efficiency – including establishing synergies with other sectors and value streams – and bring down costs. All while competing in an incumbent market with existing production of hydrogen for chemical industries and refining. To help bridge this cost gap, policy incentives are needed in the near- and medium term. To enable a supply-side push, investment and operational support and access to low-cost capital are needed and facilitated through innovative contracting models to kick-start production of renewable hydrogen near industrial clusters, European governments can establish a framework

6. Fuel Cells and Hydrogen Joint Undertaking (FCH). SMR yields app. 1kg of hydrogen per 3.65kg natural gas.
7. Based on Article 27(3) and 28(5)

for (large-scale) integrated RES/power-to-X projects with grid tariff exemptions for electrolysers connected to RES in 'landing zones'.

At the same time, strong demand-side policies are needed to secure early off-take, especially in the form of quotas, public procurement requirements and carbon pricing.

Enable physical delivery
Towards and beyond 2030, European renewable hydrogen clusters will grow in both number and scale. To further harness the systematic synergies between large-scale generation from variable renewable energy sources and the indirect electrification of heavy industry and transport, driven by a growing renewable power-to-X economy, such clusters can be connected by regional hydrogen back-bones which will, in time, grow into a pan-European hydrogen grid.

This will enable a steady supply of renewable hydrogen for industrial purposes – and the physical delivery of renewable energy, as either electrons or molecules, for end users. By mandating construction of a hydrogen grid, European policymakers also send a strong investment signal to OEMs and sub-suppliers, allowing them to invest in new production capacity.

Existing infrastructure is an important consideration in the design of the future hydrogen backbone grid, and policymakers and TSO's should already today commit to making new infrastructure 'hydrogen-ready', e.g. when investing in re-gasification facilities for LNG or new pipelines.

"Hydrogen clusters can be connected by regional hydrogen back-bones which will, in time, grow into a pan-European hydrogen grid."

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The Ørsted vision is a world that runs entirely on green energy. Ørsted develops, constructs, and operates offshore and onshore wind farms, solar farms, energy storage facilities, renewable hydrogen and green fuels facilities, and bioenergy plants. Moreover, Ørsted provides energy products to its customers. Ørsted is the only energy company in the world with a science-based net-zero emissions target as validated by the Science Based Targets initiative (SBTi). Ørsted ranks as the world's most sustainable energy company in Corporate Knights' 2022 index of the Global 100 most sustainable corporations in the world and is recognised on the CDP Climate Change A List as a global leader on climate action. Headquartered in Denmark, Ørsted employs 6,836 people.

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