



GREEN TRANSITION CALLS FOR SKILLED WORKERS

Members of Danish
Metalworkers' Union
(Dansk Metal) build and
secure the green transition



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SKILLED WORKERS SHAPE THE FUTURE

The world's first offshore wind farm, Vindeby, was built in 1991 off the coast of Lolland. It pioneered Denmark's leading position in wind turbine technology, and today Denmark is still at the forefront of the global green transition.

With the Danish Climate Act and the Paris Agreement, we have committed ourselves to becoming a carbon-neutral society by 2050 at the latest.

By 2030, we must have reduced our CO₂ emissions by 70 per cent compared to 1990 levels. And in the industrial sector alone, we must ensure that we become carbon neutral by the end of 2030.

Russia's invasion and war against Ukraine clearly show that Europe is facing a historic green transition to ensure that we are no longer

dependent on fossil energy from authoritarian regimes.

Our climate and energy policies have become a security issue. This increases the pressure and must increase the speed to figure out how to implement our political ambitions in this field.

This is positive news for the green transition and our children and grandchildren.

Fortunately, developments are moving fast in the search for new technologies that can be used for future renewable energy sources and new green fuels. The members of the Danish Metalworkers' Union are at the forefront of Denmark's efforts to develop and build new green technologies. For instance, skilled metalworkers, industrial technicians and refrigeration

technicians will produce wind turbines, heat pumps, and other equipment and machines that make up green transition.

Unfortunately, the work can be slowed down before it even gets started because we are far from having enough skilled workers to do the job. If we are to have any chance at all at achieving our great green ambitions, we must find effective solutions not only here and now, but also in the long run.

This leaflet gives insight into selected new technologies that will be used in the green transition and which groups of professions that will use the new technologies.

We wish you pleasant reading.

Copenhagen, August 2022



CLAUS JENSEN
PRESIDENT OF
DANISH METALWORKERS' UNION
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THE GREEN TRANSITION SETS THE AGENDA IN DENMARK AND IN EUROPE

Over the past years, broad and ambitious political agreements have helped accelerate the green transition. Together with a broad majority of the political parties in the Danish Parliament, the government has decided to quadruple the total production of wind energy and onshore solar power by 2030—and the ambition for offshore wind power is to quintuple production over the next eight years.

An increased district heating network and individual heat pumps will also be crucial for Denmark's plan to phase out natural gas in households in the coming years. By 2035 at the latest, the use of gas boilers for domestic heating must be phased out¹.

At the same time, new green technologies will play a key role in reaching our climate goals. Fortunately, we are now on the threshold of developing these technologies and putting them into production. Green energy and fuels must be produced on a large scale so that ships, planes,

and heavy road transport of the future can move from A to B on hydrogen, methanol, ammonia or something different. And in the near future we will use the underground in Denmark to store CO₂ rather than extract oil and gas.

THE EU BOOSTS ITS AMBITIONS—AND CREATES MANY JOBS IN DENMARK TOWARDS 2050

With Russia's invasion of Ukraine, the need for energy independence has become an absolute priority for the EU. Many EU countries are facing a far greater transition to green energy than it is the case in Denmark. Therefore, the Danish export of green energy to our European neighbours also represents a major business and export opportunity in the years to come. It only increases the demands on the speed of the green transition and advances the need for labour. The EU's 'Fit for 55' climate package is helping to make European countries independent of Russian natural gas, but it also sets the



Additional employment for more than 745,000 full-time jobs in Denmark by 2050

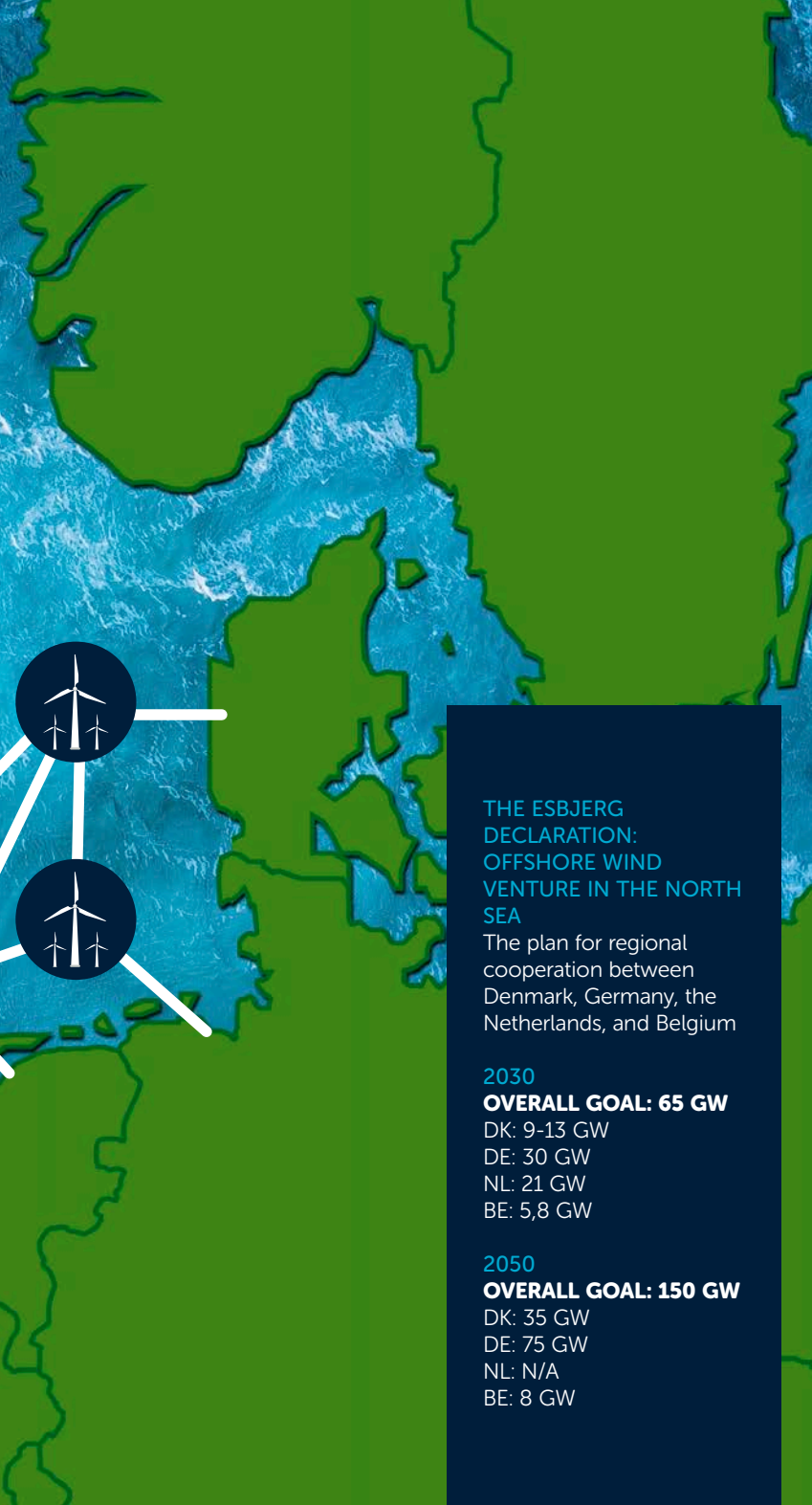
The Economic Council of the Labour Movement and Danish Metalworkers' Union

1. The climate agreement on green power and heating 2022, A greener and safer Denmark, Denmark can do more II, Government Report, 2022 page 13

overall goal of a reduction of greenhouse gas emissions by 55 per cent by 2030.

Most recently, a historic declaration has been signed between Denmark, Germany, Belgium, and the Netherlands to make the North Sea a green powerhouse for the whole of Europe. *The Esbjerg Declaration* states that 65 GW of offshore wind should be available by 2030, and the capacity should be increased to at least 150 GW by 2050. Ultimately, it will be possible to supply 230 million households with green power. This corresponds to about half of all European households.²

An analysis conducted by the Economic Council of the Labour Movement and the Danish Metalworkers' Union show that the green political objectives in the Esbjerg Declaration will lead to more than 745,000 full-time jobs in Denmark towards 2050. Of these, 40 per cent will be carried out by skilled workers, equivalent to 10,800 more skilled workers employed each year over the next 28 years.³



THE ESBJERG DECLARATION: OFFSHORE WIND VENTURE IN THE NORTH SEA

The plan for regional cooperation between Denmark, Germany, the Netherlands, and Belgium

2030

OVERALL GOAL: 65 GW

DK: 9-13 GW

DE: 30 GW

NL: 21 GW

BE: 5,8 GW

2050

OVERALL GOAL: 150 GW

DK: 35 GW

DE: 75 GW

NL: N/A

BE: 8 GW

2. The Declaration of Energy Ministers on The North Sea as a Green Power Plant of Europe, The Danish Ministry of Climate, Energy and Utilities, 2022

3. 150 GW offshore wind in the North Sea can create up to 745,000 full-time jobs in Denmark, The Economic Council of the Labour Movement, 2022

THE GREEN TRANSITION INCREASES THE NEED FOR SKILLED WORKERS IN DENMARK

Denmark's contribution to the global green transition is undeniable, especially when you take into account the green export. Denmark ranks fourth among Europe's top performers when measuring the share of green products and services in the total exports. In 2019, green exports accounted for around 7 per cent, equivalent to DKK 91 billion (USD 13 billion). At the same time, around one in eight industrial workers is involved in the production of green products and services. This trend has been growing strongly over the years⁴.

In particular, Denmark's leading position and strong know-how in wind technology play a major role in the international context. Countries that are newcomers to the transition cannot effectively replicate the technology and consequently

rely on the knowledge already available in the market.

Therefore, it is more efficient to make use of the production and know-how in Denmark rather than to start production abroad. Consequently, it is important that going forward we invest in the development of wind power production in Denmark.

However, wind technology does not stand alone. Denmark must also be at the forefront of the development of other green technologies and the export of renewable energy and green fuels. This emphasizes the need for skilled workers—now and in the future.

TREMENDOUS NEED FOR SKILLED LABOUR TOWARDS 2030

One of the biggest problems facing the Danish labour market

is the mismatch of skills and jobs. Skilled workers in particular will be in short supply in the near future. If the green transition is included in the calculations, the mismatch only gets worse, and the need for skilled workers increases.

An analysis conducted by The Educational Secretariat for Industry (Danish: "Industriens Uddannelser") shows that the planned investments in the green transition will amount to DKK 420 billion (USD 61 billion) by 2030. This corresponds to a need to employ people for 116,000 full-time jobs in the period 2022-2030 in the industrial sector alone, which corresponds to an average of 14,500 additional full-time jobs per year⁵.

The industrial sector will need about 57,000 full-time jobs from skilled workers and about

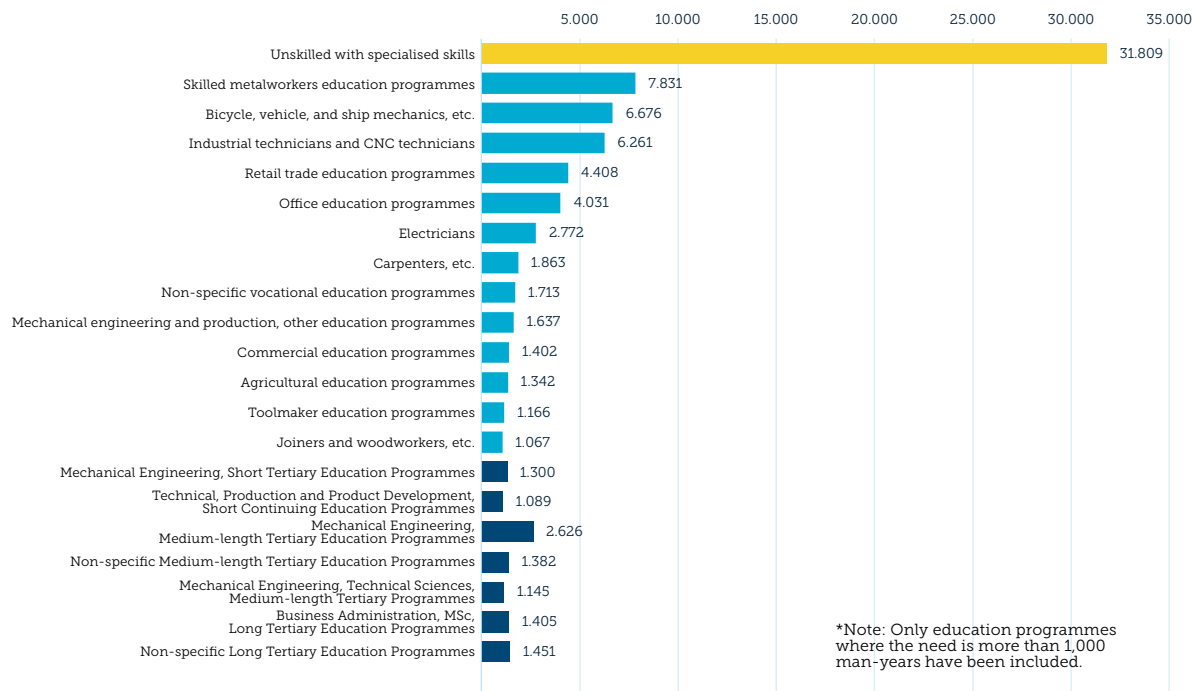
The consequence of not acting now and securing the necessary workers and competences will be that the transition will not become a reality.

Danish Metalworkers' Union

4. The green transition: Industry is becoming greener, Economic Council of the Labour Movement, 2020

5. The investment amount was calculated in 2022 before the war in Ukraine, which is why the expected investment framework up to 2030 is projected to be even higher due to the political agreement 'Denmark can do more II', entered into on 25 June 2022.

The total need for labour divided into groups of professions up to year 2030*



32,000 full-time from unskilled workers with specialised skills. The three groups of skilled workers the industrial sector will need in particular are skilled metalworkers, mechanics and industrial technicians. There will also be a need for people with higher university degrees, especially in the technical field, but the number of full-time jobs is less than for unskilled workers, around 27,500.

This huge additional demand for labour comes at a time when the

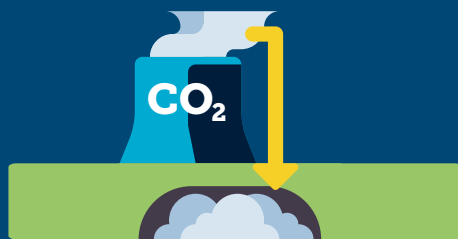
industrial sector already lacks skilled workers. In May 2022, almost three out of four union representatives in the Danish Metalworkers' Union stated that they lack qualified labour⁶. Therefore, the massive investments in the green transition come under pressure because the necessary labour is not available.

The consequence of not acting now and securing the necessary workers and competences will be that the transition will not become a reality and that we will not reach

our climate goals. At the same time, we will not succeed in freeing ourselves from Russian natural gas.

The workers that the green transition needs cannot simply be sourced abroad. It needs to be educated, trained, and fine-tuned here in the country as we gradually develop and scale up production of the new green technologies in close cooperation with the labour market partners.

6. Survey of union representatives, May 2022, Danish Metalworkers' Union



CARBON CAPTURE AND STORAGE (CCS)

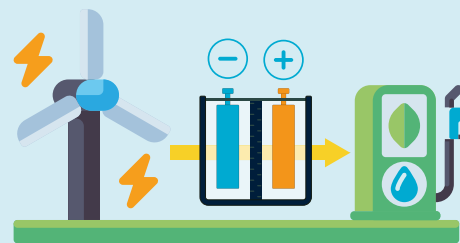
Carbon Capture and Storage (CCS) refers to the capture and storage of CO₂. Examples include CO₂ emissions from waste-derived energy plants, cement and insulation material production, or emissions from incineration of biomass⁷.

The technology has great potential to capture CO₂, which is then stored in the underground. The technology has gained momentum in recent years, since it also has become a political priority for both Danish and foreign legislators. Most recently in April 2022, the UN Intergovernmental Panel on Climate Change indicated that the CCS technology is a necessity if the world is to meet the climate targets of the Paris Agreement⁸.

In December 2021, a broad political agreement was reached in Denmark to secure the capture, transport, and storage of CO₂. The agreement implements a total subsidy pool of DKK 16 billion (USD 2,3 billion) The pool will be divided into two rounds of competitive tender processes in 2022 and 2023, respectively. The funding will be used to develop the technology and build the infrastructure needed to collect, transport, and store CO₂ in Denmark.

7. CS—carbon capture and storage, Danish Energy Agency

8. Climate Panel: Energy efficiency and more solar and wind are key tools to reduce CO₂ emissions, Ministry of Climate, Energy and Utilities, 2022



POWER-TO-X (PTX)

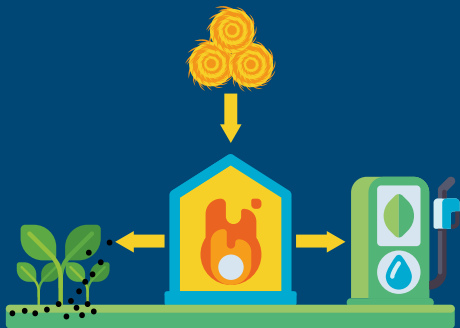
In Denmark, our electricity system is based on wind energy. This means that at times it is very windy, and the system produces more electricity than we need. Conversely, there are periods when it is not windy enough to cover the electricity demand. To avoid exporting power cheaply or importing power when we need it, we need a method of storage. This is Power-to-X. By using this technology, we can produce fuel that can be used in periods when there is no wind and in places where electricity cannot be used.

Power-to-X is a technology in which green electricity (power) is converted into something else (x), such as hydrogen. The electricity comes from renewable energy sources in the form of wind turbines, solar cells or wave power. In essence, green power is converted into something else (fuels) and can subsequently store energy. The hydrogen is produced in so-called electrolysis plants, which splits water into oxygen and hydrogen.

The technology will play a significant role in Denmark's ability to meet its climate goals. In particular, the technology will play a role in the development of green alternative fuels for heavy road transport, aircraft, ships, agriculture as well as parts of the industrial sector. Power-to-X will also be especially useful for those parts of our production that cannot be electrified.

In March 2022, a broad political agreement was reached in the Danish Parliament to have a 4-6 GW electrolysis capacity in 2030. The agreement has allocated DKK 1.25 billion for the competitive tendering of the PtX technology⁹.

9. Development and promotion of hydrogen and green fuels, (Power-to-X strategy), 2022



PYROLYSIS

Pyrolysis is a technology that can store CO₂ as biochar, oil, or a type of gas. With this technology, residue and waste products from the agricultural and waste sectors can be converted into gas and oil that can be used and refined into liquid fuels, such as aviation fuel which can replace fossil fuel. The residual product, biochar, can be used as a soil improvement agent and has a potentially large climate impact, as it can bind a large part of the carbon from the original biomass. Biochar decomposes very slowly and the carbon content is stored in the soil for a long time, thereby removing it from the atmosphere.¹⁰

With the establishment of a new Green Fund, agreed on by a broad majority in the Danish Parliament in June 2022, funds will be allocated to the development of pyrolysis technology in Denmark.¹¹

10. Call for applications: (The Pyrolysis Pool 2022)

11. Establishment of a Green Fund, agreement between the Government, Venstre - the Liberal Party of Denmark, the Green Left (Socialistisk Folkeparti), the Danish Social Liberal Party (Radikale Venstre), the Red-Green Alliance (Enhedslisten) and the Conservative People's Party (Konservative Folkeparti), 24 June 2022



EXPANSION OF THE DISTRICT HEATING NETWORK

In June 2022, a broad majority of the political parties in the Danish Parliament agreed on more green heat and a faster expansion of district heating. The agreement means that natural gas will no longer be used to heat Danish households after 2035. And by 2030 at the latest, Denmark must be supplied with 100 per cent green gas. This will be done by providing green heating to Danish households but also by making Denmark independent on Russian natural gas.¹²

Hence, Danish households have to replace their gas boilers with district heating or individual heat pumps. District heating is based on several different heat sources, and these sources can be connected to produce heat. For example, the heat can be produced by burning waste, wood chips, straw or using wind, solar heat and geothermal energy.¹³

12. Climate agreement on green power and heat 2022, A greener and safer Denmark, Denmark can do more II, Government, 2022

13. Facts about district heating, March 2022

DIFFERENT TECHNOLOGIES CALL FOR DIFFERENT SKILLS

The green transition requires research, innovation and development of existing and new technologies. Common to all technologies is the demand for skilled workers who will construct, maintain and operate the many facilities, equipment and machinery needed. There will be a need for many different groups of professions and skills across levels of education. However, the demand will increase significantly especially within the different professions in the Danish Metalworkers' Union due to the expansion of offshore wind and the development of new technologies.

EXPANSION OF OFFSHORE WIND

In the coming years, we will see an increasing electrification of the Danish energy infrastructure. Among other things, this will include a great need for the installation of a large number of offshore wind turbines. Recent political agreements have set the pace for further acceleration and increased expansion of offshore wind turbines. The ambition is to offer at least 4 GW of offshore wind for establishment in 2030¹⁴.

14. Climate agreement on green power and heat 2022. A greener and safer Denmark. Denmark can do more II, Government, 2022

As a result of the new technologies, demand will increase significantly, particularly in within the group of professions in Danish Metalworkers' Union.

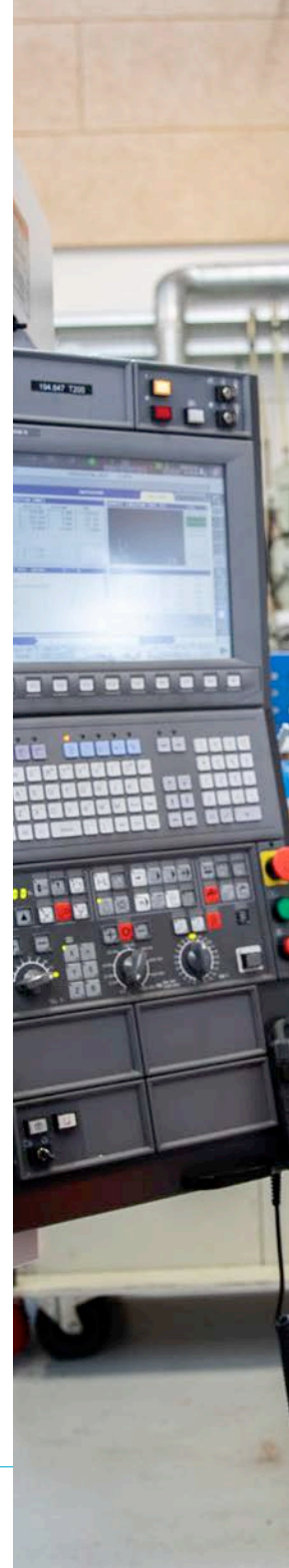
Danish Metalworkers' Union

Again, skilled metalworkers and automation engineers will be crucial to the plans.

We will also see massive investment in onshore wind and solar energy in the coming years. This is where skilled metalworkers specialising in energy technology will help build solar energy systems.

CARBON CAPTURE AND STORAGE

CCS is a well-known technology in which massive political investment has been made to ensure that Denmark becomes a zero-emission country and a net importer of CO₂. In the long term, this certain technology could be developed into a major export industry by storing CO₂ from other countries in the Danish section of the North Sea. This can be done by using the existing oil and gas drilling platforms to store the captured CO₂. This could happen as early as 2025 in the North Sea. For example, this is where skilled metalworkers with specialised knowledge of high-pressure systems, material selection, corrosion





conditions, etc. will build and maintain CCS systems and transport units for CO₂.

The investment in CCS technology is expected to generate more than 10,000 full-time jobs until 2030¹⁵. Up to 3,000 jobs are expected to be retained in the Danish section of the North Sea in connection with offshore activities for the transport and storage of CO₂. Among others, this includes industrial technicians, skilled metalworkers, mechanics, ship fitters, etc.¹⁶

POWER-TO-X

Power-to-X will help deliver alternative green fuels like hydrogen, ammonia and methanol to our ships and planes. For example, skilled metalworkers and industrial technicians will ensure that electrolysis plants are built and maintained.

The new green fuels for ships require retrofitting ship engines so that they can operate on renewable energy. These are green propellants such as electricity, ammonia, methanol, and hydrogen. The ship fitters from the Danish Metalworkers' Union will be the people that will retrofit the engines of the fleet.

COWI has calculated that the manufacturing, transport, and construction phases of the PtX plants alone will generate an employment effect of more than 10,000 full-time jobs towards 2030¹⁷. In addition, the facilities must be operated and maintained.

15. The employment effects in the industrial sector from investments in the green transition, COWI on behalf of Industriens Uddannelser, June 2022

16. Retention of labour in the North Sea for the establishment of CCS plants, Danish Metalworkers' Union, September 2021

17. The employment effects in the industrial sector from investments in the green transition, COWI on behalf of Industriens Uddannelser, June 2022



FASTER EXPANSION OF DISTRICT HEATING

The expansion of district heating to Danish households will be crucial to reducing the overall emissions of the households. The political ambition is clear: From 2035, no homes in Denmark will be heated by gas boilers, and all gas in Denmark will be green by 2030¹⁸. Here, skilled metalworkers specialising in energy technology and district heating will be involved in the rapid expansion of the district heating network in the coming years.

New heat sources are entering the district heating network by using wasted water, surplus heat and biogas. This is where refrigeration engineers will ensure that companies, data centres, and many others take advantage of the recycling of surplus production.

18. Climate agreement on green power and heat 2022, A greener and more secure Denmark, Denmark can do more II, Government, 2022

OVERVIEW OF SELECTED GREEN TECHNOLOGIES AND ASSOCIATED PROFESSIONS OF THE DANISH METALWORKERS' UNION ^{19,20}

TECHNOLOGY	TRADE GROUP
Offshore wind turbines	Skilled metalworkers Automation technicians with a specialisation in wind energy Industrial and CNC technicians Ship assistants
Onshore wind turbines	Skilled metalworkers Automation engineers with a background in wind energy
Power-to-X	Skilled metalworkers Industrial technicians Ship fitters Automation technicians Electronics technicians
Carbon capture and storage	Skilled metalworkers (collection, distribution and transport of CO ₂) Industrial technicians and CNC technicians Automation technicians Ship assistants Ship fitters Truck mechanics Electronics technicians
Solar energy systems	Solar installer
Expansion of district heating	Skilled metalworkers Welders
New heat sources into the district heating network	Refrigeration technicians Skilled metalworkers Automation technicians

19. Based on interviews conducted by the Danish Metalworkers' Union, 2022

20. The employment effects in the industrial sector from investments in the green transition, COWI on behalf of Industriens Uddannelser, June 2022



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