

The potential for green jobs in Denmark

The Green ThinkTank of 3F (the United Federation of Danish Workers) has asked the Economic Council of the Labour Movement, ECLM, to catalogue and describe the total potential for green jobs in Denmark based on a number of specific, relevant green activities that are each a step on the road towards a green transition.

Since we divide green jobs into temporary and permanent jobs, our first finding is that green activities can potentially create temporary green jobs for up to 58,000 people a year. These jobs are associated with establishing a new energy infrastructure and with energy renovation. Second, we find that green activities can potentially create 15,000 permanent green jobs. These jobs are associated with exports and jobs related to operating the new green infrastructure. Green job creation derives from the combined contributions of nine relevant green activities; see Table 1.

Table 1. Potential for green jobs, persons

	Temporary jobs	Duration	Subsequent permanent jobs
Establishing four waste sorting facilities	140	5 years	200
Establishing two biorefineries	1,500	5 years	400 / 2,000*
Installing 1 GW of offshore wind turbines annually	15,000	6 years	1,500
Installing 1,500 MW of onshore wind turbines	4,500	5 years	50**
Energy renovating private homes	12,600	35 years	
Replacing 750,000 gas- and oil-fired boilers with heat pumps	8,400	20 years	
Expanding the district heating network from the current 64% to 70%	16,000	10 years	
Doubling district heating exports		0-10 years	6,400
Doubling water technology exports		0-10 years	6,400
Total (maximum)	58,000	5 years	15,000 / 17,000*

Note: *) In a calculation based on the ADAM model (Annual Danish Aggregate Model), the Danish Agriculture & Food Council finds that establishing a biorefinery will generate about 1,000 jobs for some years after the construction phase, dropping to 200 over time (Source: Economic consequences of bioenergy production at Maabjerg, July 2012).

***) 200 MW of new capacity. The remainder is attributable to the replacement of older turbines.

Source: ECLM on the basis of various sources; see main text

Job creation from the individual green activities is based on the input-output calculations founded on various external cost assessments. In some cases direct external assessments of employment effects are used. Employment effects include direct employment and indirect contributions through supplies from Danish subcontractors in the value chain. It should be noted that the calculations do not include derived effects on the economy, including the fact that the financing of the activities has not been taken into account; see Box 1.

In the following, we describe the assumptions behind the figures in Table 1 for each of the nine activities. It should be noted that the figures in Table 1 are rounded values for the effects described in the sub-sections.

Box 1. Displacement of other economic activities

It should be noted that in most cases, the underlying calculations do not take into account that green activities will displace other economic activities that also create jobs.

The short-term risk of displacement is generally assessed to be limited as regards temporary job creation related to capital investments, unless several large-scale activities are initiated simultaneously. In the first place, Denmark is currently in a situation where the job market still has plenty of available labour, particularly outside major urban areas where the implementation of many of the green activities can be expected. Second, 3F's Green ThinkTank anticipates that these investments could be financed via pension funds and foreign investors without displacing other Danish investments or consumption. In the opposite case – if, for example, the activities are dependent on public investments – the risk arises of other public investments or public spending being displaced due to the stringent fiscal policy frameworks currently in place. Private consumption also risks being displaced, for example, if homeowners have to finance energy renovation out of their own pockets.

As regards permanent employment and activities with a long investment horizon, green jobs must be expected to displace other jobs to a great extent, based on the standard assumption that in the long term it is the labour supply that determines employment. Although the green transition will thus not directly create more jobs in the long-term, in a broad sense it *can* create better jobs by virtue of more efficient use of resources and green technology exports.

Source: ECLM

Establishing four waste sorting facilities

3F's Green ThinkTank has a vision that four large waste sorting facilities can be established in Denmark of a size corresponding to an investment of DKK 150-200 million per facility – in other words, a total investment of around DKK 700 million. We estimate that this would, in round figures, create 700 green jobs spread over the years it would take to establish the facilities. This would comprise both direct employment in connection with constructing the facilities and derived employment from subcontracts. Overall this would translate into the creation of 140 temporary jobs on average if the investments are spread over five years; see Table 1.

Our estimate is based on calculations using the latest input-output table in the Danish national accounts for 2011. Against this background, calculations show that capital investments of DKK 1 million in current prices create 1.14 jobs, machinery investments 1.07 jobs, and investments in buildings (excluding dwellings) 1.51 jobs. To adjust for inflation and productivity increases – and based on a conservative estimate – we use a factor of one job per DKK 1 million in 2015 prices.

3F's Green ThinkTank itself assesses that, once operational, the facilities will provide jobs for about 100 people. To allow for indirectly derived employment, we use a factor of 1 for the relationship between indirect and direct employment; in other words, each person directly employed in the industry indirectly creates a job for another person. Thus permanent job creation is assessed at jobs for 200 people.

Establishing two biorefineries

3F's Green ThinkTank has a vision that two biorefineries can be established in Denmark. The Maabjerg Energy Center (MEC) project is a model.

Basing its calculation on the ADAM model, the Danish Agriculture & Food Council¹ has assessed that 2,450 jobs will be created during the construction phase, and these jobs are expected to be spread over two years. The Danish Agriculture & Food Council also expects the MEC plant to generate about 1,000 jobs for some years after the construction phase, declining to around 200 jobs in the long term².

¹ Economic consequences of bioenergy production at Maabjerg, July 2012, the Danish Agriculture & Food Council

² 'The 200 extra persons employed represent MEC employees and the extra employees in the agricultural and food industry following a potential rise in animal production'; see footnote 1.

As mentioned earlier, the underlying calculations have been conducted using the ADAM model. The total increase in capital stock (the investments) amounts to DKK 3.4 billion (2012 prices). With reference to the section on waste facilities, the application of a standard IO multiplier would result in an employment effect of around 3,400 jobs spread over two years³.

The reason the employment effect is considerably smaller in the ADAM-based calculation (2,450) is probably that the model contains various automatic rules for how the economy reacts to this type of increase in activity level. One is sluggishness on the part of the industry sectors in assimilating labour. This contributes to reducing the immediate employment effect, which on the other hand extends over more years than might normally be expected. We assume that this is part of the explanation why the Danish Agriculture & Food Council finds that employment will rise by slightly more than 1,000 people for several years after the construction phase. Another important effect is that a higher activity level puts upward pressure on pay rates, albeit also sluggishly. This impairs competitive strength and displaces export jobs, not so much in the short term but the effect would be complete displacement in the long term, even though the green activities are sustained; see Box 1. In the ADAM calculation, a further assumption is that operating the facility directly increases employment by 100 people in the long term. This creates a long-term job effect of 200 jobs, including derived effects.

To ensure consistency between the calculations across the activities, we use an IO multiplier instead of the ADAM calculations to calculate the temporary employment effect in the construction phase. The total investment sum for two facilities like the MEC plant is DKK 6.8 billion in 2012 prices. Here we use a multiplier of 1.10 jobs per DKK 1 million and thus obtain an employment effect of 7,480 jobs, to be spread over the years it takes to build the facilities. We allow for a five-year construction phase for both facilities, whereby the temporary job creation ends at 1,496 jobs a year on average.

As regards the permanent employment effect, we use the Danish Agriculture & Food Council's assessment of 200 people per biorefinery, which is assumed to include indirect contributions.

Installing 1 GW of offshore wind turbines annually in the North Sea by 2020

The EU Commission expects that the production capacity for EU offshore wind must be increased from 9 GW in 2014 to 27 GW in 2020⁴, or about 3 GW annually for six years. Most of the expansion is expected to take place in the North Sea. 3F's Green ThinkTank has therefore asked us to calculate the potential for green jobs in Denmark under the assumption that a third will come from Danish-produced turbines, or 1 GW annually.

In an analysis from 2013⁵ the ECLM compared three different calculations of job creation through the production and installation of offshore and coastal wind turbines. The ECLM finds that all three methods lead to a rule of thumb whereby 1 MW generates 15 temporary jobs. Since we do not differentiate between offshore and coastal wind turbines, this can be grossed up to 15,000 jobs annually for five years. The underlying calculations are of the same type as that described in the section on waste sorting facilities and thus do not take into account such factors as displacement effects.

The number of permanent jobs created from operations, maintenance and service is estimated at 1,500 annually including indirect contributions. The estimate is based on DONG's assessment that the operation and maintenance of the Anholt wind farm of 400 MW employs 70-100 people (directly). The total capacity considered here is 6 GW, or 15 times higher than that produced by the Anholt wind farm.

³ Capital investment of DKK 3,400 million and roughly calculated using an employment multiplier of one job/DKK 1 million.

⁴ Joint Research Centre, EU Commission, August 2015

⁵ Employment effect of new coastal wind farms, 2013, ECLM

Installing 1,500 MW of onshore wind turbines

Based on the Energy Agreement of 2012, 3F's Green ThinkTank estimates that 1,500 MW of onshore wind turbines remain to be installed in the period from 2015 to 2020. The replacement of older turbines accounts for 1,300 MW of the 1,500 MW of onshore wind capacity. The net increase in onshore wind capacity is thus assessed at 200 MW.

According to the same calculation principle as above, the employment effect of installing 1,500 MW of onshore wind turbines can be estimated at 22,500 jobs, which, spread over five years, translates into an average of 4,500 green jobs a year. It should be noted that installing onshore wind turbines requires significantly fewer resources than for offshore installations, but on the other hand, the resources needed to dismantle and dispose of the older turbines have not been included.

The number of permanent jobs created from operations and service is estimated at 50 a year, including indirect contributions, because onshore turbines are easier to maintain than offshore wind turbines, and the 200 MW of new capacity is slightly less than half of that produced by the Anholt wind farm; see the section above.

Energy renovating private homes

According to 3F's Green ThinkTank, the Danish Building Research Institute (SBI) has calculated that it would cost DKK 200 billion to renovate the building envelopes of all older homes in Denmark. In 2013, in an analysis conducted for 3F's Green ThinkTank, the ECLM calculated the effects of a corresponding activity using a job multiplier of 2.2 jobs per DKK 1 million. This is a relatively high figure that assumes high employment content as well as the predominant use of Danish-produced materials. SBI expects that the work will be ongoing until 2050. We thus estimate that temporary jobs will be created for 12,600 people a year, based on the assumption that the total job creation will be spread over 35 years.

Replacing 750,000 gas- and oil-fired boilers with heat pumps over 20 years

In 2013 the ECLM carried out a calculation for 3F's Green ThinkTank according to which the replacement of 400,000 oil-fired boilers with heat pumps would generate 11,250 jobs a year over an eight-year period. This gives a total of 90,000 jobs. In these calculations, we scale up the effect by a factor of 1.875, corresponding to the difference between 750,000 and 400,000 replacements, and distribute the effect over 20 years. Thus we obtain a temporary job effect of 8,438 jobs every year for 20 years.

Expanding the district heating network from the current 64% to 70% in 10 years

The Danish District Heating Association's Green Energy thinktank assesses that a 10-year expansion of the district heating network, which currently supplies heating to 64% of Danish households, to provide heat to 70% of households would create jobs for 7-8,000 people every year. We assume this is the direct employment effect and, like the calculations for waste sorting facilities, add a 100% indirect employment contribution. Thus we obtain a temporary employment effect of 14,000-16,000 jobs for 10 years.

Doubling district heating exports

According to the Danish District Heating Association's Green Energy thinktank, a doubling of district heating exports would amount to DKK 8 billion and is expected to be able to generate 4,000 permanent jobs in the district heating sector. We assess that this would indirectly generate a further 2,400 jobs in other sectors⁶.

⁶ On the basis of IO calculations of industrial exports in 2011, we expect exports to create an average of 0.8 jobs per DKK 1 million in total.

Doubling water technology exports

A doubling of water technology exports is expected to boost employment in the water sector by 4,000 people⁷. Using the same principle as above, we expect further indirect employment for 2,400 people outside the sector. Thus we obtain a figure of 6,400 people in terms of permanent job creation.

⁷ WATER VISION 2015