



Green jobs in Europe and its application on labor market
Case of Green jobs in Denmark

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Abstract

Throughout last decades the green economy is developing in an up warding slope, several transformations have occurred on labor market. This dissertation focus on the incidence of the application of green jobs in labor market and how a transition to a greener labor force can occur in a effective way in an European context. The study reviews the green jobs literature and analyzes its different assumptions such as the green jobs development and needed skills. The aim of this study is to understand how green jobs can be applied in a labor market, how the transition of labor force is done and what is the impact of the development of green industries on the labor market.

A case study is conducted on Denmark as a successful experience in green jobs development. A review for the progress and the circumstances of applying the green jobs in the country is conducted, after analysing the outcomes it was obvious that the vocational training and technical education play a principal role in a successful transition to a greener labor market, in plus there is a necessity to a collaboration between authorities and labor unions in order to attain a comprehensible transformation without negative influences on labor market.

Key-words: Green jobs, green economy, Denmark, skills, labor market.

Resumo:

Nas últimas décadas a economia verde (*green economy*) tem tido um importante e significativo desenvolvimento desencadeando várias transformações no mercado de trabalho. A presente dissertação centra-se na incidência dos empregos verdes (*green jobs*) no mercado de trabalho europeu e nas condições necessárias para que a transição para uma força de trabalho mais verde possa ocorrer de forma eficiente. É feita uma revisão da literatura sobre os empregos verdes e são analisadas diferentes hipóteses aí avançadas nomeadamente no que respeita às competências necessárias ao desenvolvimento deste tipo de empregos. O principal objetivo deste estudo é o de compreender os impactos do desenvolvimento de empregos verdes no mercado de trabalho e, em particular, o de analisar os efeitos potenciais sobre o mercado de trabalho do processo de transição para uma economia mais verde.

Faz-se também um estudo de caso sobre a Dinamarca considerada como uma experiência bem-sucedida de desenvolvimento de empregos verdes. É feita uma análise das condições específicas existentes e do modelo concreto implementado neste país. A análise dos resultados mostra que a formação profissional e o ensino técnico desempenharam um papel decisivo para o sucesso da transição do país para um mercado de trabalho mais verde. Ficou ainda claro que uma transformação eficaz (portanto que minimiza os potenciais efeitos negativos existentes) do mercado de trabalho no sentido de o tornar mais verde necessita de formas de colaboração estreita entre as autoridades públicas e locais e os sindicatos.

Palavras-chave: empregos verdes, economia verde, Dinamarca, competências, mercado de trabalho.

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Introduction:

The green jobs are developing in an up warding slope, several transformations and changes have occurred on labor market. This dissertation focus on the application of green jobs in labor market and how a transition to a greener labor force can occur in a effective way in an European context. The aim of this study is to understand how green jobs can be applied in a labor market, how the transition of labor force is done and what is the impact of the development of green industries on the labor market.

Green economy

Green economy has arisen as a new branch of the economic science developing during the last years. Hence, it is known as the branch in the economic science recognized during the last twenty years according to which the economy is a contingent element of natural environment wherever it exists as a part thereof. The concept of the green economy involves ideas of many other branches of economic science like ecological economy, the environmental economy, theory of international relations and many others. However, the most voluminous, brief and accurate definition is probably the one conducted by the UNEP that claims that green economy aims to improve human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. (Sukhdev, Stone, & Nuttall, 2010).

In a green economy, growth in income and employment are driven by public and private investments that diminish carbon emissions and pollution, expand energy and resource efficiency, and avoid the loss of biodiversity and ecosystem services

The major objective for a transition to a green economy is to support economic growth and investment while increasing environmental quality and social inclusiveness (UNEP, 2011).

Sustainable development is not replaced by the concept green economy, but there is a rising recognition that attaining sustainability rests almost entirely on getting the economy in a right approach. Decades of creating new wealth within a “brown economy” based on fossil fuels have not substantially addressed social marginalisation, environmental distortion and resource diminution.

Sustainable development is easily translatable into economic terms: an increase in

well-being nowadays should not result in decreasing well-being tomorrow. Future generations should be allowed to at least the same level of economic opportunities and thus at least the equivalent level of economic welfare as is available to current generations.

To make the conversion to a green economy, specific empowering conditions will be vital. These empowering conditions consist of national regulations, policies, subsidies and incentives, as well as international market and legal infrastructure, trade and technical assistance (UNEP, 2011). Therefore a need for green labor market is that can assist in greening the economy and interpret with the new changes and variables.

Greening the economy is the most important phase in the transition to a green labor market, and that change is mainly driven by the long term trends towards the scarcity of resources and primary materials costs. In order to confronting these challenges governments have endorsed different policies that will be discussed later, in order to shift towards more efficient and available resources, that normally will imply a change in the labor market.

This differs through the additional conclusions reached by Cambridge Econometrics and Warwick Institute for Employment Studies (Cambridge Econometrics, 2011), which conclude that the potential for green jobs lies primarily with high and low-skilled jobs only and argues that the most important skills necessary for green jobs are those that are technological and would favor a focus as preparation for the changing labor market. These would be linked mostly to highly skilled and to an extent, to medium skilled jobs. This will be discussed in the part concerning the skills.

As to the productivity perspective a study (Jackson & Victor, 2011) focused on the transition to a sustainable society poses to considerable challenges for conventional economics. Institutional structures, accounting frameworks and macro-economic relationships all require significant reform. According to these authors Central to a new macro-economics for sustainability rely on the relationship between growth, productivity. In particular, a low-growth or slow-growth economy must reconcile labor productivity changes with the maintenance of full employments. This study highlights the 'productivity trap' that arises from the systematic pursuit of labor productivity and suggests two solutions of this trap. The first is to reduce working

hours, the most frequently cited avenue to combat unemployment in non-growing economies. The second is to engage in structural shifts towards low productivity growth sectors, and has renewed view on the investment function framed around increasing labor productivity. Innovation will also still vital but it will need to be targeted more carefully towards sustainability goals. Specifically, investments will need to focus more on resource productivity, renewable energy, clean technology, green business, climate adaptation and ecosystem protection(Jackson & Victor, 2011).

Green jobs

In the literature relating to green jobs, there is a great deal of article regarding climate and its effect on economy, but there is little peer-reviewed work relating directly to green jobs. The majority of the literature dealing directly with green jobs is limited to international organizations efforts, As this dissertation deals with the application of green jobs in labor markets, the review begins by looking into the different definition of green jobs. The literature then turns to the benefits of adopting a green strategies and the presentation of statistical information on green jobs in labor markets.

The literature highlights that green jobs will play an important role in the global economy. Since the mid 90's we are facing a deep redefinition of both theory and practice of Local Development as a consequence of the reformulation of relationships among society, nature, economy and enterprises(Pop, Dina, & Martin, 2011).

There is no single agreed definition of a green job. That makes it hard to compare studies of green jobs and has led some researchers to neglect the usage of the term. Some definitions of green jobs or related concepts focus on occupations and skills and emphasis on employment in industries that generates products of which are deemed to be of environmental benefits. In 1999 OECD/Eurostat defined the eco-industries that creates green jobs as industries producing environmental goods and services, such as renewables and resource management industries (ILO, 2012b). After, as an application on the labor economy. The United Nations Environment Program (UNEP) developed a broader industry-based definition of green jobs according to which green jobs are decent work contributing directly to reducing the environmental impact of economic activity, ultimately to sustainable levels. Other definition have been

generated but the boarder one that is published by the ILO that defines green jobs that are decent jobs that contribute to preserving and restoring the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency. Green jobs reduce consumption of energy and raw materials, limit greenhouse gas emissions, minimize waste and pollution, protect and restore ecosystem and enable enterprises and communities to adapt to climate change

Figure one shows that there is a distinction between employment in green economic sectors from an output perspective and job functions in all sectors from a environmentally friendly process perspective. Green jobs are all jobs that correspond to the dashed area and therefor any green job must be a decent one and relates to the production of green products or in an environmentally friendly process

Figure 1: *Green jobs as ILO*



Source : (ILO, 2013)

The absence of a common definition has followed by very different measures on green jobs and future potential in the European Union. In order to overcome this challenge, in 2010 the EU Commission published the report “Towards a greener labor market – The employment dimension of tackling environmental challenges” which includes a set of indicators to define green jobs. The Commission warned about applying a too narrow definition of “green economy” and “green jobs” that would risk missing out the wider economic and labor market effects of the environmental

challenge that is in many ways, comparable to the challenges of globalization, technological change or ageing

Different definitions of green jobs: just a difference of scope or really different concepts?

	ILO	UNEP	US Bureau of Labor Statistics
Definition	Green jobs are decent jobs that contribute to preserve or restore the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency.	Defines green jobs as work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.	Green jobs are either: A. Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources. B. Jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.

Differences	For a job to be green it must be a decent one.	The broader definition that include different types of jobs.	More general and similar to UNEP one.
Usage	Commonly used by different researchers specially in economy issues.	Usually used on environmental subjects.	Mostly in the American government reports and papers.
Sources	(ILO, 2013)	(Renner et al., 2008)	(Sommers, 2013)

As shown in the previous table there are three main definitions of green jobs every definition

Different organization and researchers have defined green jobs in different ways but there is no general comprehensive definition. Most, if not all, of the efforts have a number of limitations, in that they achieve such a definition that are either too broad or are focused only on selected industries and/or occupations.

The bureau of labor statistics – U.S. department of labor has restricted the green jobs to two dimension the first that jobs in businesses that produce goods or provide services that help the environment or conserve natural resources and secondly, jobs in which workers' responsibilities involve making their establishment's production processes more environmentally friendly or use fewer natural resources.

In the other hand the ILO defines green jobs as decent jobs that contribute to preserving and restoring the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency.

The two definitions the US department and the ILO are similar in a common issue of jobs that are related to preserving the natural resources and efficiency of usage of the environment.

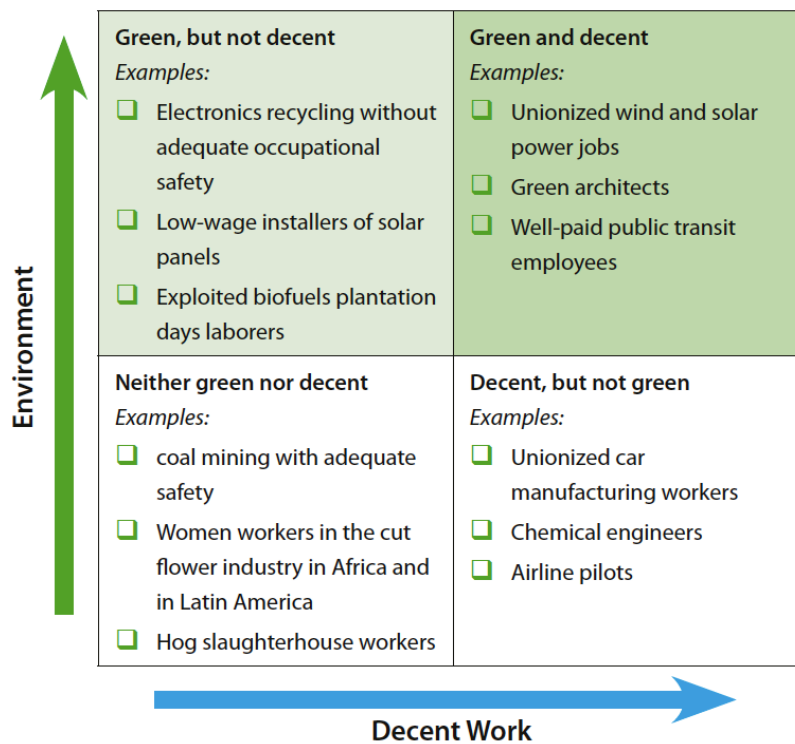
Are green jobs decent ones?

A narrow definition of green jobs may focus solely on the green credentials of a job. However, worker advocates and the ILO rightly emphasize that green jobs also need

to be decent jobs— pairing concerns like efficiency and low emissions with traditional labor concerns including wages, career prospects, job security, occupational health and safety as well as other working conditions, and worker rights. Of course, the precise nature and quality of jobs across the planet varies enormously.

Since 1999, the ILO has assumed theoretical, empirical and operational studies on decent work. Four main keys to measure decent work have been recommended by professionals from the different departments and sectors of the ILO, presented the suitability of indicators of the four main components of decent work: type of employment, social protection, workers rights, and social dialogue. (Ghai, 2003). If these four keys are available with a positive effect in a job then it must be decent.

Figure 2: *Highlights the diverse possible combinations of green / decent dimensions of jobs.*



Source : (Renner, Sweeney, & Kubit, 2008)

The UNEP’s definition is more environmentally oriented, defining green jobs as “work in agricultural, manufacturing, research and development R&D), administrative, and service activities that contribute substantially to preserving or

restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.” This definition has a more descriptive perspective, returns to narrowly defined environmental services. Mainly, it includes employment in manufacturing any goods or services that have reduced environmental influences than existing alternatives (Bowen, 2012). UNEP also argues that there is a range of greenness: in other words not all occupations are equally green. There are different grades to which technologies, products and business practices can be said to be green. An example: cleaning up pollution after the event is less green than preventing the pollution before it occurs.

UNEP also adds that green jobs should be decent one, offering adequate wages, safe working conditions, job security, reasonable career prospects, and worker rights. A job that is exploitative, harmful, fails to pay a living wage cannot be counted as a decent one.

And they consider the labor market to be influenced in four ways:

- In some cases, additional jobs will be created—as in the manufacturing of pollution-control devices added to existing production equipment.
- Some jobs will be replaced as in shifting from fossil fuels to renewables, from truck manufacturing to rail car manufacturing, or from landfilling and waste incineration to recycling.
- Certain jobs may be eliminated without direct replacement—as when packaging materials are discouraged or banned and their production is discontinued.
- Many existing jobs (especially such as plumbers, electricians, metal workers, and construction workers) will simply be transformed and redefined as day-to-day skill sets, work methods, and profiles are greened

The emphasis on sustainable development with decent work as a main goal in an environmentally greener economy creates an important opportunity for concerned organizations

A report issued 2013 by ILO focuses on the links between the environmental and the social dimensions of sustainable development, including their economic implications. It summarizes the growing body of evidence that the shift to a more environmentally sustainable economy is not only indispensable, including from a labour market perspective, but can in fact lead to net gains in employment, significant improvements in job quality and incomes, and advances in equity and social inclusion on a large scale.(International Labour, 2013)

These benefits are not recognized automatically, but contingent on the right policies. Similarly, appropriate and coherent policies are needed to mitigate the challenges environmental sustainability poses for the world of work. The ILO concludes that the process of structural change towards more sustainable patterns of production and consumption into a global transition to decent work for all (International Labour, 2013).

Diverse reports from the OECD and ILO have shown that there is some green jobs criteria and indicators for defining how green a job could includes references to the industry, the production method, the value-chain position and the awareness of the organization, the occupational profile, quality and greenness of workload (Martinez-Fernandez, Hinojosa, & Miranda, 2010)

Despite, all these diversities in concepts and criteria the common used definition by researcher is the ILO one, by that reason I will rely on this definition along this dissertation, in order to achieve a standardization of concepts and information.

2. The debates on green jobs in the economic literature

Benefits of adoption of a green strategy for a business

The conservative understanding concerning green economic and environmental protection is that it comes at an extra cost imposed on firms, which may influence their global competitiveness.

Companies are facing growing pressure to become cleaner and greener, various stakeholders push enterprises to diminish their destructive impact on the environment. This is now seen as firm's social responsibility, that business people often refer to as "corporate social responsibility"(May, Cheney, & Roper, 2007).

Still enterprises can reduce their environmental influences without affecting their economic performance by applying diverse innovation strategies. Such an approach should include strategies that might result in increased benefits or decreased costs, it is important to look at both sides of the balance sheet

Benefits

Better access to certain markets

First, reducing pollution and other healthy environmental influences may improve the whole image or the fame of a company, and therefore increase customer's loyalty or support sales efforts. Although this argument seems pretty honest, consumers may be aware of a company's environmental performance through its offer of green products, but they are less likely to be familiar with its environmental performance as measured by its emissions to water or the atmosphere. So companies need to focus on the green products. In the same way the eco products must have a competitive prices.

Second, and more specifically, purchasing policies of public and private organizations may stimulate green producers. It is becoming increasingly common for public administrations to include environmental performance as a criteria for selecting suppliers of goods or services. This phenomenon is known as green public purchasing (GPP). As an illustration (Kunzik, 2003) reported that, in general, the central U.K. government, in its Greening of Government Operations Policy, aims to the following:

- Encourage manufacturers, suppliers, and contractors through specifications to develop environmentally preferable goods and services at competitive prices.

(Positive Links Between Environmental and Economic Performance).

- Ensure that any products derived from wildlife, such as timber, plants, and leather goods, are from sustainable sources.
- U.K. Department of Environment, Transport, and Regions has a restriction to buy a minimum of 10% of electricity from renewable sources in order to enhance the renewable sources production.

In addition, private businesses have also taken steps to greening their supply chains. Apparently, all plants with ISO¹ certification are aware of their supplier's environmental performance as this is one of the criteria to be fulfilled to obtain the certification (Barla, 2007).

Knowing that most of public and private administrations are now involved in GPP², it seems that firms selling to governments or other businesses can have a better access to certain markets by enhancing their environmental performance.

Differentiating Products

Greener products or services can allow businesses to use a differentiation strategy so as to exploit niches in environmentally aware market segments and ecolabeling can present information about the environmental features of a product or service. The attractiveness of ecolabeling is increasing, especially in Europe.

In particular, sales of products with the European ecolabel went from €51 million in 2000 to €644 million in 2004. Customer's ability to purchase green product in general is important, despite the fact that the real amount committed to such buys may be less impressive. For example, 80% of French adults say they prefer to purchase ecoproducts, while 20% say they actually make such purchases regularly (Guilloux, 2006)

¹ International Organization for Standardization

² Green Public Procurement

Costs

Cost of Material, Energy, and Services

(Porter & Van der Linde, 1995) has stated that pollution is usually associated with a waste of resources, raw materials not being completely used, or waste of energy. “Pollution is a manifestation of economic waste and involves unnecessary or incomplete utilization of resources”

Also decreasing pollution is often corresponds to increasing productivity of used resources. From this perceptive Porter suggested that more severe and flexible environmental regulations, such as taxes and tradable permits, would be profitable for the economy, motivating innovations that can offset the cost of complying with these policies.

This is known as the Porter hypothesis (PH). Specially, this line of reasoning indicates that reducing pollution can cause a reduction of expenditures on raw material or energy.

Cost of Capital

Also an improved environmental performance can be related with a lower cost of economic capital. First, it is becoming quite clear that greener companies have an easier access to capital markets by the augmentation of the green mutual funds that is available now in most of the countries. Through these funds, green investors can be ensured that their money will be invested in firms that meet certain criteria. Secondly companies with improved environmental performance can benefits when they borrow from banks. Most banks have now team of specialists to evaluate the environmental performance of possible borrowers, more specifically to determine the size of potential liabilities related to polluted assets. Thirdly, information on the environmental performance of firms in general may influence shareholders and their reactions can be noticeable on the stock market. These fluctuations will affect the cost of capital. (Stefan & Paul, 2008)

Cost of Labor

A better image of the firm results in a better ambiance in the workplace and enhances higher productivity. Employee who feels proud of the firm for which they work can accomplish better objectives and tasks, but also enhance generosity and lead to a worthy circle of good reputation. This is especially significant in recruiting talented junior scientists, managers, and highly qualified candidates, many of whom basically would not work for a company with a low social and environmental profile. No one chooses to work for a untrustworthy company as compared to an alternative with a good trustworthy profile.

Improved environmental performance could then decrease the cost of labor by reducing the cost of illnesses, absenteeism, recruitment, and turnover. Some companies are aiming to an improved environmental performance to improve the satisfaction of their labor unions (Lankoski, 2006).

3. Green jobs in Europe: where and how many?

The Volume of green jobs within the European Union

According to the existing data, there are approximately 7,360,000 jobs in the EU 2013 in different green sectors (renewable energies, energy efficiency, organic agriculture, waste management, etc.). The available data is presented below in table 1. In the EU-27 more than 1,114,000 people are employed in the renewable energy sector. The eco-industries offer between 2.9-3.6 million jobs. The European insulation industry only represented 232,050 full time jobs in 2010 in house retrofitting jobs. The employment related with recycling sector and waste management touched 2 million jobs and there are 200,000 producers associated with organic farming. (Gil et al., 2013). From a different perspective the attractive sectors are renewable energies, waste management and recycling and sustainable transportation are the sectors where most of the jobs have been created. Countries with high importance of jobs are Germany, Denmark, France, Spain and Italy.

Table 1: *Green jobs sector and volume in EU:*

GREEN SECTOR	Existing green jobs (2007, 2008, 2009, 2010, 2012)	Number of jobs/€ invested ²	Potential for green jobs creation in 2020	Potential for green jobs creation in 2030	Potential for green jobs creation in 2050	Other data	Source of information
Eco-industries ³	2.9-3.6 million in 2008						(ECORYS, 2009)
	1,245,614 jobs in environmental management activities in 2008						(ECORYS, 2009)
Energy Efficiency in buildings	232,050 Jobs in EU insulation industry	25,900 total jobs/1 bill €	261,400-378,000 new jobs			250,000 new jobs annually if eco-efficient refurbishment rates increase 4%	(CECODHAS, 2009)
Renewable energy	1,114,210 jobs in 2010	52,700 total jobs/ €1 billion investments	2.7 million (based on, 20% RE target)	4.4 million (based on 45% RE target)	6.1 million (based on 100% RE target)		(Eurobserv'ER 2011)
Efficient transport & sustainable mobility	900,000 jobs in urban transport 900,000 jobs in railway for freight and passengers 2.1 million in efficient transport	21,500 total jobs/ €1 billion investments				70% more jobs per unit of investment in public transport than in building new road and bridge construction	(UITP for EU25) (Eurostat for EU27) (FoE, 2009) (Smart Growth America, 2011)
Organic farming	220,000-260,000 producers in 2009 197,000 holdings in 2008	6,600 total jobs/ €1 billion investments				10-20% more jobs per hectare than conventional farms	(FIBL, 2009) (Farm Structure Survey, 2007)
Biodiversity conservation		29,000 total jobs/ 1 € bill investments					
Waste & recycling sector	2 million jobs in 2008: 1,466,673 jobs in waste management and 512,337 jobs in recycling	21,300 total jobs/ €1 billion investments (70% recycling rate)	2,400,000 jobs (50% recycling rate) 2,963,000 jobs (70% recycling sector)			Recycling 10,000 tonnes of waste create between 6 and 12 more jobs than incineration and 25 more jobs than landfill deposition	

Source :(Gil, Lopez, & Murillo, 2013)

According to (EurObserv'ER, 2012) the overall employment impact of investment of every €1 billion per year in renewable energy sector is 52,700 jobs, the highest percentage among the green sectors. The European Union is the world leader in clean energy investments, spending nearly \$81 billion in 2010. Since 2009, China invested \$54.4 billion in clean energy technologies in 2010 comparing to the United States' \$34 billion. Over 85 percent of today's market for clean energy technologies is principally located in Asia and Europe

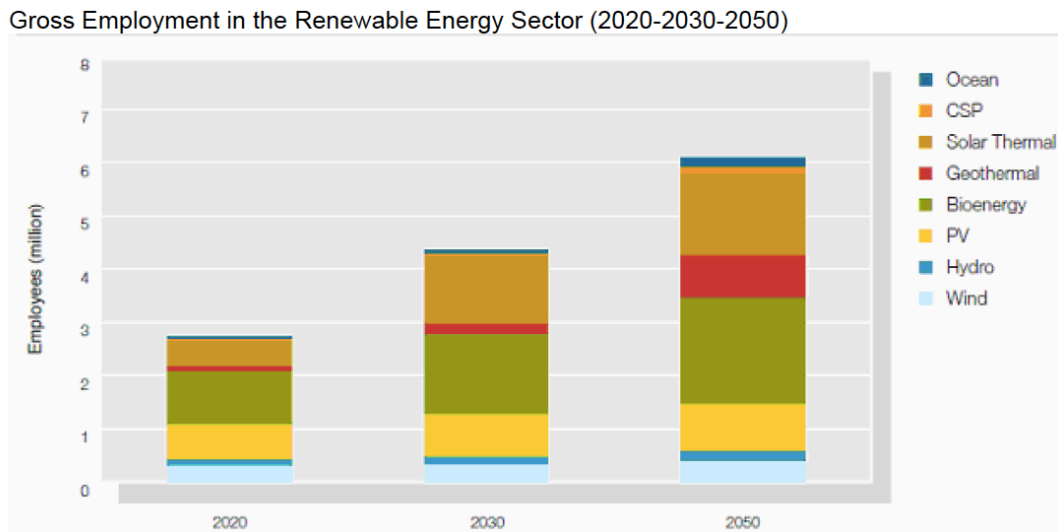
In a worldwide perspective, Germany's clean energy investments of \$41.2 billion came second in 2010, (after China), exceeding the United States, which actually ranks third

Renewable energy sectors employed more than 1,114,000 people in the 27 European Union Member States in 2010. This presents a 25% increase on the 2009. And there are expectations that this might rise exponentially, if the target will be reached of 100% renewable energy by 2050. In this case employment in the renewable energy sector would bring 6.1 million people into labor market. (Gil et al., 2013)

Job potential in renewable energy by 2020, 2030 and 2050

There are several reports available on job creation potential of a more ambitious transition towards renewable energy production. A good example is the "A 100% Renewable Energy Vision for the European Union" report, the European Renewable Energy Council proposed a strategy to achieve 100% renewable in the energy sector. Considering that the target of 45% renewable energy in final energy consumption in 2030 is met, this would offer gross employment of about 4.4 million in the renewable energy sector an annual average growth rate of about 6% by 2020 (2.7 million employees) (Zervos et al., 2010). If a target of 100% renewable energy by 2050 was to be followed, employment in the renewable energy sector would then bring 6.1 million people into work. This comprises an average annual increase of gross employment in these activities of 36% and 30% respectively as compared to 2009.

Figure 3:



Source : (Zervos, Lins, & Muth, 2010)

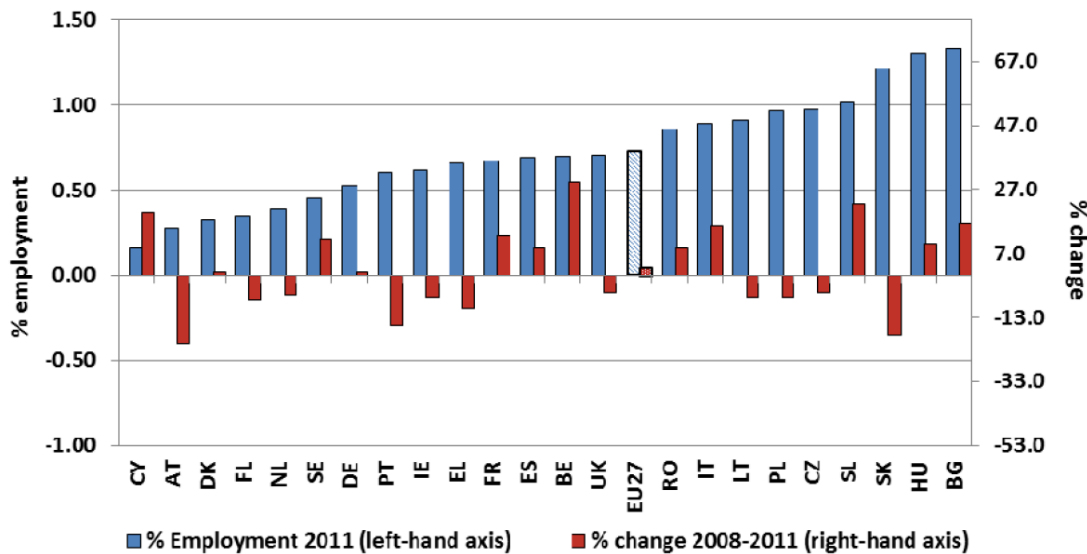
Statistical evidence on green jobs in EU within the literature

Eco-industries include a diverse set of sectors in the fields of environmental protection (waste management and resource management renewable energy, renewable raw materials and products). About 2.7 million people worked in the EU-27 eco-industry in 2008, which represented 1.22% of overall employment (people aged 15 - 64). In 2012, the total number of people employed in eco-industries is projected to be around 3.4 million.(ECORYS, 2012)

However, there is lack a systematic gathering of data on the development of eco-industries in the EU. Eurostat provides a database on the Environmental Goods and Services Sector (EGSS)

In 2011, water collection and treatment, sewerage and recycling only employed around 1.6 million workers in the EU, which made up 0.77% of total employment (15-64). The effect of these sectors on total employment remarkably varies across EU countries. As shown in the figure 4 , it varies from less than 0.5% (in Cyprus, Denmark, Netherlands, Finland and Sweden) to over 1% in Slovenia, Slovakia, Hungary and Bulgaria.

Figure 4: *Water collection, treatment, sewerage and recycling only, in 2011*

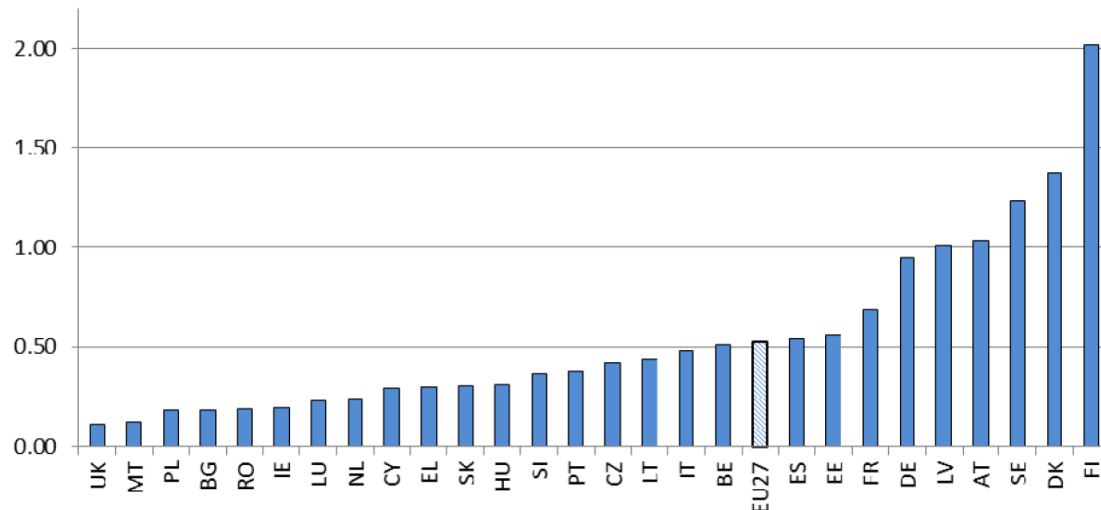


Source: EurObserv'ER barometer 2011

Still the green economy sector represents one of the fastest growing sectors in Europe. Between 2005-2009, it contributed to the creation of more than 300,000 jobs. According to the European Observatory of Renewable Energy, in 2010 about 1.1 million workers are employed in green activities in the EU27 (0.5% of total employment). Solid biomass, photovoltaic, and wind powers had higher numbers of employees across the EU as stated before.

However, significant diversities were observable among the member of EU states. Germany, France, Italy, and Spain exhibited the highest number of employees in 2011, even though Finland, Denmark, Sweden recorded the highest shares on total employment (between 1.2 and 2%). Contrariwise, other countries such as the UK, Malta, Poland, Bulgaria, Romania, and Ireland witnessed the lowest employment incidence of this sector (below 0.2%) that can be seen in this figure.

This figure 5: *Employment in the green jobs sector as % of share of total employment in every country 2011*



Source : EurObserv'ER barometer 2011

Green jobs and quality of jobs: do green jobs have more quality than other jobs and do they employ more qualified workers?

Skills and green jobs

Reviewing the skills required for green jobs, it becomes obvious that green jobs have a significant positive relationship between green jobs and new skills. Essentially, skills that controlled for country and season, technical skills, resource management skills and composite problem-solving skills turn out to be highly significant for green jobs (Dierdorff et al., 2009). That verifies previous studies that found that mainly technical skills were needed in order to develop green jobs.

Green transformation creates demand for new skills as current producers change activities to new markets and products. The most obvious examples are in the automotive sector and in ship manufacturing, reacting to low carbon demands for hybrid vehicles and offshore investment in wind and hydropower energy.

A study by (CEDEFOP, 2012) focus on employers claims of skill shortages for crucial

low-skill professions to green and greening industries such as electricians, insulation workers, and sheet-metal workers. The figure 6 presents an overview of the problem by highlighting in dark the cells corresponding to the occupations where the main skill shortages are identified. Skill shortages are particularly acute in countries (Germany, the Netherlands, UK, Denmark, Finland) where green industries are more developed.

The figure 6: *skills shortage in different occupation and countries*

	Nanotechnology Engineering technologist	Environmental Engineer	Energy Auditor	Transport Vehicle emissions inspector	Solar photo Voltaic Installer	Electrician	Insulation Worker	Sheet- metal Worker	Refuse collector
GR	+								
FI				+		+	+	+	
NL		+	+		+			++	+
UK						+	+	+	
DE	++	++		+		+	+	+	

Source: (CEDEFOP, 2012)

Note: Dark cells indicate skill shortage

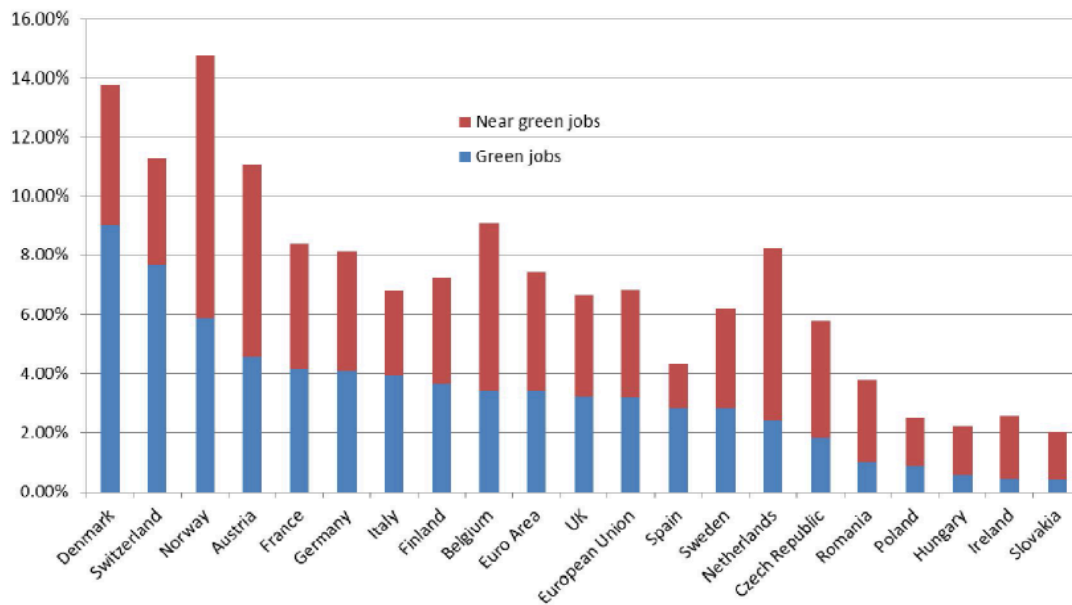
Skills needs are a reflection of demand for further competences and skills of existing workers and also increased demand for new competences.

These new environmentally driven skills related to new technologies such as solar thermal power or vehicle power trains, waste management, desalination and oil shale processing. They also relate to new management requirements since there are changes in production methods and implementation of new business models that focus on added value services (Strietska-Ilina, Hofmann, Haro, & Jeon, 2011).

4. Green job application: the case of Denmark

In the previous part a literature review was made concerning the green jobs definitions and its presentation in labor market and how it could be beneficial adopting a green strategy in plus a review on the skills shortage and the needs to a transformation to a green labor market. Which allowed forming a theoretical base concerning the green jobs. In the next part Denmark is taken as an example as it was a pioneer in the greening of industries and jobs

Figure 7 : Green and near-green job demand by country as % of total demand



Source:(Colijn, 2014)

Note: Country with less than 800 observations is eliminated

In this figure it is remarkable that Denmark has the higher green jobs demand within Europe and come as the second after Norway in near green jobs (indirect jobs) in 2013.

Brief presentation of the Danish labor market

In a brief review for the Danish labor market done by the OECD better life index early 2015, showed that in Denmark around 65% of the working-age population (aged 15 to 64) has a paid job and that women are still less likely than men to participate in the labor market. In Denmark, 70% of women are employed. Which is more than the OECD average of 58% and relatively close to the 75% employment rate of men in Denmark. This 5 percent point gender difference is much lower than the OECD average of 15 percentage points and suggests Denmark has been more successful in passing the gender constraints and barriers women face in accessing work. The index pointed out that employment focused on long-term unemployment can have a large undesirable effect on feelings of well-being and self-esteem can also result in a loss of skills, further decreasing employability. In Denmark, the percentage of the labor force that has been unemployed for a year or longer is now about 1.8%, lower than the OECD average of 2.8%. There is small difference on average between men and women in the OECD area when it comes to long-term unemployment. In Denmark, the long-term unemployment rate for men is lower than the same rate for women women, with respectively 1.6% and 2.0%.

The salaries and other monetary benefits that come with employment are also an important aspect of job quality. Danish people earn USD 48 347 per year on average, more than the OECD average of USD 36 118. (OECD, 2015)

Green Growth in Denmark

Green growth has a high ranking on Denmark's policy agenda, with objectives and strategies in place to decrease the usage of fossil fuels and Greenhouse Gases (GHG) emissions besides investing heavily in green technologies. Denmark does not have a lot of natural resources, but depends on a large extent on its human resources for its competitiveness. Denmark is a small developed and welfare economy dominated by small and medium enterprises, with limited number of multinational companies.

However, Denmark is among the world's innovation leaders, being ranked at the top

of the World Bank's Knowledge Economy Index and it ranked the fourth nations in the European Union's Innovation Scoreboard.(OECD, 2012b)

The country's high creativity capability is credited in part to its robust focus on human resources and education, a extensive culture of dialogue, involvement and cooperation, a flexible labor market, well-functioning infrastructures and administration. Denmark has competitive advantage in design, research and development, and its exports base comprise, aside from agriculture, elaborately transformed industrial products and services that have attained a worldwide recognition.

As was the circumstance with several countries after the 1973 oil crisis, Denmark determined as a target to develop its energy security by diminishing the dependence on imported oil. After civil opposition, Denmark has been one of the countries that refused nuclear power as the alternative to fossil fuels and in its place started early on developed impressive goals to move towards renewable energy production and improved energy efficiency.

That shows that green emphasis in the energy policy is not a new experience in Denmark. In the late 70s it became a main priority, while mainly driven by regulations and an effective use of fiscal policies to further green behavior among businesses and consumers (Strietska-Ilina et al., 2011)

This primary low-carbon policy attention set the country onto a green path before than most of other countries, with subsequent progressive effects for the local economy. As a consequence, Denmark is nowadays a world leader in windmill technology and also contains different world leading manufacturers of energy efficiency technologies. Excesses to other green policy areas and technologies such as water, air cleaning, waste incineration and recycling technologies have also occurred confirming Denmark as a strong competitive country in these areas.

The Danish government implemented several plans that are part of an overall strategy to deal with climate change and energy change. Climate change policy to 2050 is set to accelerate investment in green projects. A recent parliamentary agreement set targets for Denmark to generate 50% of its electricity supply from wind power by

2020. The Danish Government's vision is that Denmark must totally become 100% free of fossil fuels. The general national targets includes also the total gross energy consumption in Denmark should be reduced by 4% by 2020. The Danish country has made important improvements in reducing emissions and determined ambitious goals for future activities (Strietska-Ilina et al., 2011).

Figure 8: *Danish energy policy targets*

The Danish government's energy policy milestones up to 2050 In order to secure 100% renewable energy in 2050 the government has several energy policy milestones in the years 2020, 2030 and 2035.			
2020	2030	2035	2050
Half of the traditional consumptions of electricity is covered by wind power	Coal is phased out from Danish power plants. Oil burners phased out	The electricity and heat supply covered by renewable energy	All energy supply - electricity, heat, industry and transport - is covered by renewable energy

Source: (DEA, 2014)

Cities are having a progressively important role in the lives of worldwide populations. They also play an important role in reducing global emissions. People living in cities have lower per capita emissions but higher per capita GDP. Copenhagen as capital of Denmark exemplifies this, with a populations with half the per capita emissions in comparison with the rest of the country.(OECD, 2012a)

Copenhagen is one of the greenest and from the higher quality of life capitals in the world in the equivalent way (Denmark also ranks between the top countries in various green innovation indexes Clean technology). An element of the city's green growth policy lies in the creation of the Copenhagen Cleantech Cluster (CCC). The Capital Region of Denmark, included of more than 600 companies, many of which are global leaders in their field (C.C.C., 2012).

Denmark's green strategy schedule is only a part of the process, as authorities alone cannot undertake the alteration of an economy. Such transformation relies on cooperation and partnerships among central and local government, enterprises, and the community, which reflects democratic and involvement processes at work, underscoring green job creation.

Green jobs in Denmark

Policy design indicators for green jobs are starting to be developed. The OECD in 2010 presented a preliminary set of criteria and indicators referencing the industry, production process, value chain position, awareness of the business, occupational profile, job quality and green workload.

Also OECD stresses that understanding how green related jobs are generated needs better understanding of sectorial industry dynamics and drivers both in manufacturing and service sectors. One of these important drivers relies in the financial markets. For example, emissions trading specialists or brokers dealing exclusively with socially responsible investments (SRI). During the recent period, these financial specialists may have been brokers working with any number of stock exchanges originated in main cities around the globe. Nowadays whether in Wall Street or in the heart of Copenhagen, they create the financial instruments needed to put new energy or green infrastructure developments to work. Between them, they have a proficient knowledge of the political and financial motivators of green growth and where new green industries and investment opportunities can be activated.

As referred by (Martinez-Fernandez et al., 2012) financial specialists can be seen at work in Denmark's Danske Bank, for instance, they provided the expertise to permit Danske Bank to expand its investment in assets under managing in order to meet the Bank's social responsibility investment policy.(Martinez-Fernandez et al., 2012)

This illustrate that a new sort of job has been generated in the financial services sector, this essential activity is unlikely to be mentioned in the official statistics. Some studies claim that the nature of green jobs is actually dependent on their occupational profile.

The government expects that by 2020 the implemented policies will lead to new investments in energy and energy efficiency adding 12 billion to 20 billion Euros. This investment by role will generate a lot of jobs with up warding slope. From 2014 to 2020, the government expects an additional 7,000 to 9,000 jobs will be added to the green industries as mentioned on the official website of the Danish ministry of climate, energy and building.

Completing these government initiatives are the climate change strategies and local initiatives being established by the City of Copenhagen. The city is beginning a new climate strategy. The primary focus of this plan is to achieve the determined target of being the first carbon free capital all over the globe by 2025.

On its journey of being carbon free capital, Copenhagen predicted that new investments created from this move could generate between 28,500 and 35,000 new jobs (Strietska-Ilina et al., 2011).

The Capital Region of Denmark is helping these initiatives by introducing a climate strategy that spreads these benefits to the broader district. It's strategy to relies on helping different actors like municipalities, businesses and research institutions to collaborate more efficiently in order to meet the challenges of climate change.

The strategy and market motivators for green growth in Denmark are administrative, urban, energy, transport, waste and water management, innovation and clean-tech cluster policies. As noted before, these policy systems and approaches have been intensely rooted in Denmark's knowledge establishments, from the Danish Technology University, to the research and development corporations, which are international leaders in generating energy solutions.

These activities have generated an interior green labor market over time.

As research by DAMVAD (Nordic Socioeconomic and policy consultancy) demonstrates, such initiatives have shaped a labor market, with a green jobs multiplier effect across the whole Danish economy.

The green development externalities have been sustained internally, for example by the general commitment of environment standards such as ISO (International standards). In 2000, Denmark positioned as the second in Europe, for the number of businesses with ISO and environmental related accreditations, representing the benefits of first mover in the green development sector (Ulhøi, 2004). As companies agreed with government regulations jointly such initiatives have pushed Denmark to the top of the clean-tech global rankings. The process is considered as a solid testing ground in which international companies can experiment new green technologies, which moreover acts as a attraction for foreign direct investment.

Investment in Denmark is driving green development and green jobs. It is this green investment driven strategies that has led to remarkable outcomes, the formulation of pioneering green economic, innovation, urban development, infrastructure, transport and energy plans and legislative programs, which in the Greater Copenhagen District are being cohesive into a smart city plan but in the same way without formulating detailed green labor market architecture (Martinez-Fernandez et al., 2012).

The Danish system also involves a successful labor market structure that offers guidance, and a job or education to everybody who is unemployed. The ministry of employment also has a general responsibility for measures in relation to all clusters of unemployed persons, for example, both unemployed persons on social assistance, in addition to unemployed persons obtaining unemployment benefits. Generally, the ministry's programs do not target explicit sectors or types of professions, but aim to build a robust and flexible labor force, highlighting the OECD's 2012 recommendations that labor market policies must focus on generating market driven labor policies that are encouraging to creating the conditions favorable for employment development and not the protection of jobs exposed to organizational adjustment pressures.

Skills in Denmark

Denmark has a national system for Initial Vocational Education and Training (IVET), and also tertiary vocational education.

As discussed above, the main policy emphasis on guaranteeing that training reflects the requirements of economic growth, greening the economy, or related to the ongoing processes of structural modification. However, other EU member countries such as the United Kingdom, and particularly from other countries such as Singapore and the United States influenced Denmark's education and training systems.

Wages and working conditions are typically placed by cooperative agreements negotiated among trade unions and employers' organisations. That's lead to labor market system that is frequently referred to as the Danish Model. This uniquely Danish system is characterised by the social partners (employers, trade unions, government and the education sector) determine the rules of the market, and they are

in the greatest position to recognize changes in underlying labor market conditions. And normally it is believed that together they are the most successful way to prepare quick and realistic solutions, and adapt to new challenges. These stakeholders are consequently strategically and formally involved in the continuing process of developing the further education system (Strietska-Ilina et al., 2011).

The European Centre for the Development of Vocational Training (CEDEFOP) in 2012 analysed the IVET efforts related to green skills. Its report on Denmark concludes that there are no comprehensive skills response strategy has been developed as part of a comprehensible policy response to climate change and environmental deterioration. This seems somewhat disappointing observation. However, the report also concludes that the long-term green focus in Danish policy is already reflected in the educational sector. IVET, and tertiary programs have over time been altered to match the demand for skills and knowledge associated to green technologies and related to the ongoing reformation. This led to the formulation of competency based objectives for specific qualifications in IVET such as energy production, reuse of energy, waste management and construction (CEDEFOP, 2012). Adding to technical skills, individuals are encouraged to reach a number of general abilities relating to management, development, and communication. Colleges are also progressively present courses, which address the climate and energy challenge, from surveying and analyzing climate effects to the improvement of energy efficiency solutions.

In Denmark, there is political agreement that actions need to be taken to deal with the problem of climate change spreading across different layers of administration, from the nationwide and regional level to the municipalities level, as showed by several policy papers concerning climate change problems. Additionally there is a general agreement that the climate change challenge in economic terms is a double-edged sword offering both costs and benefits (Jamet, 2012).

This has caused that several of Danish businesses experiencing first mover benefits in the green industries of the future and in appealing foreign investment into the country. Therefore, in Denmark there is a self-reinforcing two-sided strategy: one concerns the

subjects of climate change, and the second focuses on business development and investment attraction. (Jamet, 2012)

In this context, policy is surrounded by a mixture of push and pull incentives. For example, tariffs might be raised on polluting energy sources (push). In turn, this could be shared with alternatives that favor consumers who use more environmentally friendly products or subsidies for novelty in climate solutions (pull). Yet, this policy outline does not focus entirely on development of precise types of green jobs. Rather, it aims to move the whole society in a more climate and environmentally friendly track while at the same time generating demand for new cleantech solutions (as mentioned before).

New and changing skills needs

Looking to new green jobs and greening of existing jobs, including skill needs for recently emerging green collar professions and with new and changing skills necessities for existing jobs in the background of greening the economy. Different industries are highlighted by government strategies as having of specific importance in driving the transformation of the economy. This might indirectly have a state-push effect on changing skills demands as mentioned in the previous paragraph. Additionally, the development of new green collar professions and the changing requirements for current jobs in Denmark will depend on Danish companies key competencies concerning green tech solutions.

The Danish Ministry of Foreign Affairs acknowledged Danish capabilities in energy and cleantech solutions. Cleantech includes known industries such as solar cells, wind power, bio-based plastic, advanced lithium batteries, nano-technologies and nano-coating, and plug-in hybrid cars. Other industries are also influenced by cleantech such as agriculture, manufacturing, waste management, and building construction (CEDEFOP, 2011).

Emerging green collar occupation

This part of the dissertation focuses on green collar occupations that result from policies to mitigate and familiarize to the impacts of climate change.

In most of the sectors in Denmark we could observe greening of existing professions over the past decades often driven by regulations and guidelines based on existing technologies. Recent policies to move more rapidly towards a low carbon economy are introducing further refinements to occupations and the rise of cleantech technologies a much wider concept than a green focus results in a technology convergence.

In the environmental technologies industries, new green jobs have quickly developed. As an example, wind turbine workers are now numerous. New cross-sectorial professions could also emerge, like in cleantech firms as in energy examination and energy efficiency services. Some developing jobs in cleantech are new; could be termed as hybrid for example the agricultural meteorologists, solar installers, bio energy specialists, energy assessors, green accountants and manager in renewable energy.

Generally, these progresses imply that a sectorial approach to study the greening of jobs is likely to be inadequate because it will not include jobs generating opportunities from the professional convergence between analytical skills service elements and technological skills elements describing how a business uses essential capabilities and technologies to present new knowledge intensive systematic services in a worldwide market for energy efficiency. (CEDEFOP, 2011)

As an application of the suggestions of the Danish Globalisation Council, a division was built to complement the cooperation in handling a dynamic identification of shifting skills and professional demands caused from development of new industries, sector merging and technological development. This unit conducted a study focused specifically on 80 cleantech businesses. It comprises an in-depth analysis of 10 firms characterised by remarkable growth and innovative capabilities and representative of the convergence of professional profiles that have been generated as a result of new

market opportunities.

By using a job function analysis, the study also analysed new and changing occupational demands at an upper-secondary profile for skilled workers. Main drivers and trends within cleantech over a 3-4 year perspective were inspected with a view to understanding the normal delay from when new needs are first recognised to the time a skilled employee with an upper secondary qualification joins the labor market. The study shaped 12 competency classifications relevant to 15 occupational profiles (CEDEFOP, 2011). The firms strongly recommended that current upper secondary vocational education should be revised as largely as possible rather than generating totally new jobs for two reasons:

- Firstly, it takes less time to restore current programs; not least because of the wide-ranging competency based way the educational order of qualification is designated.
- Secondly, for recruiting reasons it is better for companies that new qualifications do not alter titles often, as it usually takes times to build enough trust in the creditability of a new program

The analysis of job purpose in cleantech businesses determined that the current skills represent a solid basis for providing the competencies for developing cleantech skills. The conducted study concluded that there is no clear justification for the development of entirely new programs concerning cleantech. Instead it suggested that present qualifications be adjusted, by developing specific courses and formation programs in order to match the requirements of the cleantech.

Green businesses designated that there is a need for revision of existing vocational training competency targets in the following occupational profiles: auto mechanic, technical insulation, electro technician, supply technician; cooling technician; plastics technician, process technician; wind technician; industry technician; industry electrician and automation technician. However, the study does not take in consideration the variety of short programmes that already have been developed by the IVET³

³ Initial Vocational Education and Training

Skills needed to greening existing jobs

This Part concerns the greening of existing jobs as an outcome of policies to deal with the effects of climate change. A lot of sectors have experienced a continuing greening transformation in the labor market by time, starting already in the 80's as mentioned previously. For the period from 1997-2002 a total of 500 billion Danish Krone (around EUR 67 billion) was assigned to motivate employment growth of green jobs (CEDEFOP, 2011). The educational system has been changed progressively to support formal qualifications with green requirements of the labor market. Several programmes have been adjusted to match the demand for skills and competences related to green industries. But developments were mostly motivated by regulation, while recent development are significantly broader, with a real market pull, additionally enhanced by R&D and innovation investments in this field for enterprise creation.

Energy:

Denmark is one of the most efficient countries in energy in comparison with the other EU countries, Since 1980 the Danish economy has grown by 78%, while energy consumption has stayed more or less stable and CO₂ emissions have been reduced.

The portion of renewable energy in entire energy consumption has boosted significantly from 1994 to 2004, from 6.4 % in 1995 to 27.7 % in 2004 (Carvalho, 2012). The main renewable energy sector is the wind power, second is biomass and bio-waste energy share. The transformation towards greener energy has caused a significant growth in Danish exports of clean energy technologies, driven mostly by wind turbine industry.

The overall number of workers employed in energy industry was about 28,000 in 2004, of which the main part consists of persons with an upper secondary vocational qualification. Since 2003, the overall number of worker employed has increased and predictions show that employment will additionally increase by 20,000 people between 2004 and 2016.(Carvalho, 2012)

On the other hand, an ageing workforce might influence the demand over 50 % of the present workforce in the energy supply industry as most of its employees are above

than 50 years old. Predictable demand mainly concerns skills at an upper secondary vocational level. Also, the greening of related occupations is likely to drive other complementary green jobs.

Waste:

Denmark was the leading country in Europe to announce a prohibition on landfilling of waste that could be incinerated. The public objective for waste recycling is to be converted into clean energy sources. All municipalities have public incineration plants, and big cities normally have many of them.

Worker employed at the landfills were low skilled without training and the work could not be observed as attractive. Increasing demands for energy efficient and environment friendly solutions have changed the occupational profile for those workers at waste treatment facilities. Besides it has increased the attraction of those jobs. To adapt the changing of skills needed at the plants. The Danish Technological Institute implement the development of public labor market vocational training courses.

At each plant the waste must be rearranged in different groups to optimize recycling. For example waste from agricultural is turned into weed free soil, and then sold. Other inputs of waste will be used after treating for energy efficient heating or electricity. That is why employees at the workplace must have some of the following essential skills

- Identify the difference between chemical substances that let them able to treat waste correctly.
- To be capable to handle risky waste properly according to specifications to decrease associated risks to themselves and to others.
- To be able to categorize different forms of waste properly.

Construction:

Over the past decades, the total building stock in Denmark has increased by Approximately 40%. Simultaneously, construction in Denmark has the ability to minimize energy usage with climate-friendly solutions that decrease CO₂ emissions. There is a robust demand and attention on energy efficiency in the construction sector, High energy efficiency in buildings has been a political priority for long times and is

read as one of the main priority areas among the Danish Government's efforts to target energy and climate change challenges. The target for the construction sector includes a restoration of the current public building in order to improve overall energy efficiency and transforming them into green buildings. Vocational training already includes a course targeted to persons involved in construction systems that improve and supervise energy efficiency.(CEDEFOP, 2012)

Besides the jobs generated in building operations and construction, indirect jobs will most probably be created in industrial, administration, and consulting. The majority of these jobs are expected to be done by persons already working in construction sector. In general, energy efficient measures will lead to a greening of present occupations. Architects and designers must consider the whole life cycle of the building and that green buildings are designed as single, integrated systems, they should understand the various factors elaborated in green building such as efficient heating, cooling, lighting, appliances, passive solar, thermal mass and low effect building materials. Understanding the green building concepts and the national green standards and guidelines requires additional knowledge, training, and certification.

Potential of green growth job creation

The green development activities and programmes started by the Copenhagen Cleantech Cluster are considered by the Capital District of Denmark as an essential and cohesive part of their efforts to improve environmental outcomes as well as motivate growth and new jobs.

The cluster estimations are that about 600 clean-tech companies in the Region Zealand and Copenhagen employ some 78,000 people in 2012. (C.C.C., 2015)

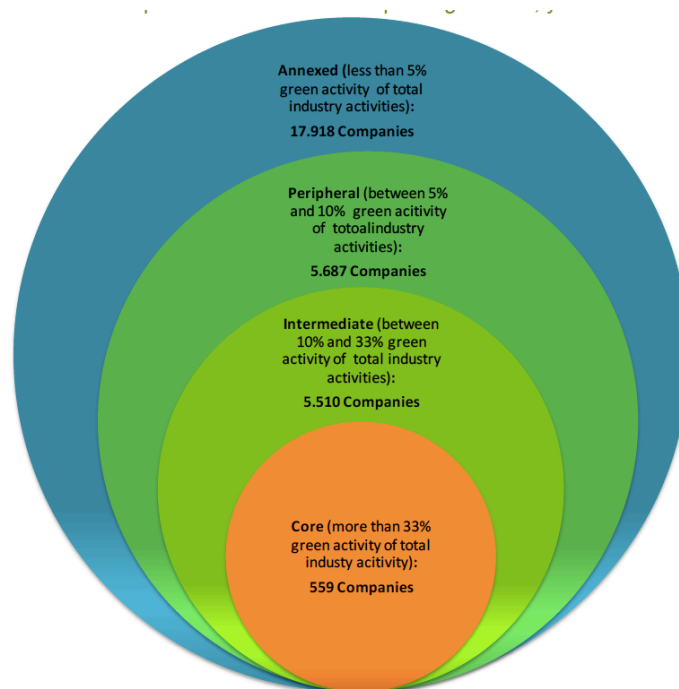
However, it must not be ignored that several of these firms operate across different markets at the same time. Hence, not all the employees that work in these firms work solely on clean-tech activities. In this regard the whole number of employee working in businesses undertaking clean-tech activities is around 34,000. An additional report prepared by DAMVAD estimates that the amount of work employed in the Greater Copenhagen area is around 25,000 people.(DAMVAD, 2011)

This growth reproduces the new technology tracks that can be seen reflected in Greater Copenhagen, where green growth is forcing innovative business and investment opportunities, in the process, creating demand for new jobs.

DAMVAD tried to measure the wider contribution such firms make to green growth. They divided companies into the following green growth categories and groups

- The core category of businesses belong to industries where it can be seen that more than one third, or 33%, of the industry activities are connected to green growth;
- The intermediate category of businesses belong to industries where between one third (33%) and one tenth (10%) of the industry's activities are related to green growth;
- The peripheral category of companies belongs to industries where it is noted that between one tenth (10%) and one twentieth (5%) of the industry activities are related to green growth;
- The annexed category of companies belongs to industries where it was found that less than one twentieth (5%) of the industry activities were related to green growth.

Figure 9: *the Percentage of Green Growth companies in Denmark*



Source :(DAMVAD, 2011)

This research shows how the demand for green development solutions extends beyond core green activity businesses. This is one of the causes that the Danish government has focused on integrating the green skills agenda into its present typical

education and training agenda. This allows the change of current policy to reflect the transformation to a greener economy and involve companies through the broad scale of the economy. The public policy of Denmark policy is concentrated about reaching the message out to all firms, not just those concerning completely in green development sectors of the economy.

5. Possibility of application of the Danish experience in other European countries

The Danish experience in development of the green economy is a leading and innovative one as it had the initiative in promoting strategies and plans to the independence on fossil fuel. That led to green jobs development and changes in labor market. The green economy offers huge opportunities for job creation, that's why other European countries also have started in progressing in the green innovations sector.

Green innovations have been in the heart of the Europe 2020 strategy for smart, sustainable and inclusive development and job creation. They are seen as important for Europe's economy to regulate to environmental and resource constraints. European expects that green innovations to deliver a significant contribution to strengthen the competitiveness of companies and, consequently, to the preservation or creation of new jobs. That's why the European commission launched it's eco-innovation action plan as part of it's EU2020 strategy in July 2011(Licht & Peters, 2014)

Different European countries have already started in endorsing regulation and putting strategies in order to catch the green development and to generate more jobs. For example, the UK Government has established a target which indicates that by 2020 more than 30% of the country's electricity will come from renewable sources of energy, in practice mostly from onshore and offshore wind farms (Hughes, 2011).

In Spain, in 2007 the Fundación Biodiversidad started the Empleaverde Program, with a innovative vision of green employment as a main line of new method of development to ensure economic growth. With an preliminary budget of 44.1 million Euros for the 2007-2013 period, it has ambitious aims such as assisting more than 50,000 people and encouraging the creation of some 1,000 companies in the environmental sector. Until 2010 the Program had supported 80 projects in which a vocational training model was applied and designed to encourage new economic activities and seek quantifiable accomplishments to benefit worker. This project offer

training for more than 28,500 workers, and help to switch about 850 companies over to the environmental sector. More than 550,000 workers are participating in one of the 2,000 actions provided by the Empleaverde program. (ILO, 2012a)

Therefore, different countries in Europe already started developing skills and endorsing regulation and strategies that by role will generate new green jobs. The implementation of the proposed strategy differs from country to other but it is observable that there is a focus in all countries on vocational training.

5. Conclusion

The green jobs are developing in an upward slope that will require cooperation between businesses stakeholders in order to keep pace with the growing demand of labor and to meet all of the challenges.

A shift to greener economy will be impossible if it is not totally integrated with labor market and the workforce upgrading. At the same time, the labor force is ageing and decreasing those that are not able to advance to new required skills and abilities are at a higher risk of being left behind and not able to take advantage from the new opportunities that green growth offers.

The Danish model has a successful application of the transition to a greener economy focused on the improvement of vocational training and education of workforce to let them able to keep up with the innovation and technology development.

Some European countries have systems to estimate for estimating future skills needs and occupational adjustment as the basis for state driven investment in new qualifications and associated education and training. These systems engage a combination of quantitative and qualitative assessment of labor market and occupational changes, reinforced by assistance from employers and trades unions.

These national systems have an essential weakness point in terms of accuracy and timing this weakness is however thrown into specific scope when there are main and rapid changes in competences and skills needed. The adequate step and scale of developing environmentally driven skills needs enabled existing systems to map, plan and recognise new competences and encourage changes to qualifications.

The need for improvements in the capability of current education, training and qualification systems is approximately acknowledged in all European union member states. Particular emphasis for improvement tended to be on initial vocational education and training, rather than continuing adult education or higher education (Strietska-Ilina et al., 2011)

There is no a strict model, which must be applied in all countries to attain a successful transition to a greener labor market, but there, is an overall outline that can be applied on every country depending on it's capabilities.

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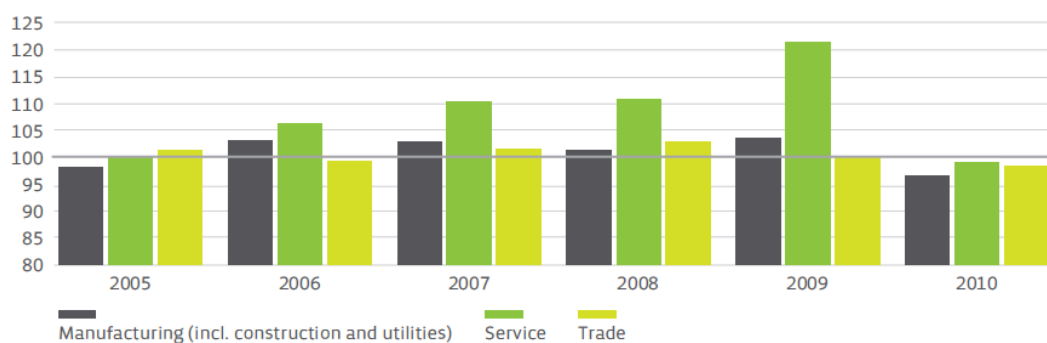
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6. Annex

Figure 1: Added value per full-time employee from green production in Denmark.



N.B: A value of 100 corresponds to the average productivity for the industry. The value of 110 means that the enterprises are 10% more productive than the average for the industry. (Agency, 2012)

Table 1: Skills profile of green/greening occupations: illustrative examples (OECD countries)

Sector	Occupations	Growth prospects	Skill profile
Recycling and waste management	Waste sorting and reception	Long-established	Low qualification (minimal on-the-job training)
	Recycling and waste technician/waste recycling operator	Vocational qualification	Low – medium qualifications depending on country
	Hazardous waste management	Growing demand in medium term due to tighter regulations	Medium and high level
	Sustainable design manager, recycling and reclamation engineer, co-ordinator of recycling activities, regulatory programme compliance officer	Rising longer term demand from other sectors	Medium to high level skills to address organisational sustainability issues and embed sustainability principles into product design and production techniques
	Railroad conductors, locomotive engineers, truck and bus drivers	Greening existing occupations	Topping up existing skills
	Automotive engineers, freight forwarders, fuel cell engineers, logistics analysts/ engineers/ managers, supply chain managers, transportation engineers and planners	Reorganisation and re-engineering of existing (and new) transportation systems	Medium and high level skills combined with sector specific pre-existing medium-high competencies
ICT	Smart grid and building specialists, database administrators	"Smart" ICT applications and changes in business model for billing and customer relations	Medium to high

N.B: ICT: information and communication technology. Source: (I. OECD, 2011)

Table 2: Denmark's green growth indicators

Economic opportunities and policy responses		
Innovation	Renewable energy R&D	H
	Environmental technologies R&D	H
	All purpose R&D	H
Patents important to GG	Environmentally related patents	H
	All patents	M
Environmental goods and services	Gross value add of EGS	M
	Employment in EGS	M
International financial flows	Official development assistance	L
The socio-economic context and characteristics of growth		
Economic growth, productivity and competitiveness	GDP growth	M
	Net disposable income	M
	Labour productivity	M
	Trade weighted unit labour costs	M
Labour markets, education and income	Labour force participation	M
	Unemployment rates	H
	Population growth	H
	Life expectancy	M
	Income inequality	M
	Educational attainment	H

N.B: High (H), Medium (M), Low (L) Source: (Martinez-Fernandez et al., 2012)

Table 3:

Distribution of employment by green sector in Europe 2010 (EurObserv, 2011)

	Country total	Solid biomass	Photovoltaic	Wind power	Biofuels	Biogas	Solar thermal	Ground heat pumps	Waste	Small hydropower	Geothermal energy
Germany	361,360	60,900	107,800	96,100	23,100	38,000	13,100	12,000	6,660	2,400	1,300
France	174,7365	60,000	58,100	20,600	15,200	965	8,070	3,800	3,700	2,500	1,800
Italy	108,150	7,000	45,000	28,600	9,900	2,600	4,900	150	1,000	3,000	6,000
Spain	98,300	8,000	19,500	30,750	29,000	1,350	6,000	0	1,500	1,600	600
Sweden	54,780	26,500	750	4,500	6,200	500	380	11,500	3,000	1,450	n.a.
Finland	48,620	35,000	100	6,400	3,200	300	<50	2,900	250	420	0
Austria	41,600	17,400	4,400	3,300	7,900	1,500	4,700	1,100	150	1,100	50
Denmark	36,400	5,800	400	25,000	1,300	700	450	100	2,500	50	100
United Kingdom	31,700	2,000	5,000	9,200	5,300	6,000	900	1,500	1,500	250	<50
Poland	28,450	7,500	<50	7,000	9,600	1,000	1,250	1,500	<50	300	200
Belgium	22,670	2,700	6,200	3,000	9,400	0	420	450	250	50	200
Czech Republic	20,200	3,500	8,000	350	5,800	0	1,400	800	50	300	n.a.
Netherlands	19,180	250	2,300	2,600	4,000	1,880	1,420	1,700	4,480	<50	500
Portugal	17,450	3,700	3,500	4,450	3,000	0	1,875	100	300	400	100
Romania	16,800	13,500	<50	1,500	750	<50	250	100	n.a.	400	200
Greece	12,920	3,000	4,250	1,570	350	0	3,000	100	n.a.	550	100
Hungary	11,550	2,000	100	1,400	6,600	<50	150	400	50	<50	750
Latvia	9,300	5,500	<50	<50	3,500	<50	<50	100	<50	50	n.a.
Slovakia	7,030	800	1,000	0	4,500	<50	130	50	<50	300	150
Lithuania	5,850	3,000	<50	900	1,500	<50	<50	150	n.a.	<50	100
Bulgaria	5,470	1,100	350	3,000	300	<50	70	100	n.a.	300	200
Ireland	3,500	600	<50	2,000	350	0	300	100	<50	<50	n.a.
Slovenia	3,375	1,800	800	0	250	165	60	50	<50	100	100
Estonia	3,100	1,500	<50	350	<50	<50	<50	1,000	n.a.	<50	0
Cyprus	1,095	50	160	475	<50	<50	310	0	n.a.	0	0
Luxembourg	500	50	<50	<50	<50	<50	<50	100	<50	<50	0

Table 4:

Predicted changes in employment volumes – Medium- and low-skilled occupations in Europe

Country	Occupation						
	Energy auditor	SPV installer	Transport inspector	Electrician	Insulation worker	Sheet-metal worker	Refuse collector
Finland	Possible increase but scale unknown	Possible increase but scale unknown	Ageing workforce may cause replacement demand	Possible increase but scale unknown	Possible increase but scale unknown	Ageing workforce may cause replacement demand	Possible increase but scale unknown
Netherlands	Increased demand, scale dependent on government subsidy	Increase not likely unless production costs drop	No change in short term	Increase due to introduction of fibre optic cabling	Short-term stability, possible long-term growth	No change predicted	No change predicted
Germany	Possible growth in commercial sector but dependent on higher energy costs	Not identified for short term, but possible in longer term	Decrease due to less (and safer) car use	Continuing replacement demand, due to current skill shortages	Likely to increase, exacerbated by ongoing skill shortage	Unknown	Limited change in demand anticipated
UK	Increase likely, volume unknown	Decrease due to reduction in subsidy for power generated from large-scale installations	Possible reduction, depending on government plans to reduce frequency of vehicle testing	Unknown, depends on state of construction industry	Large potential increase over the next five years, but depends on full implementation of proposed legislation	Ageing workforce may cause replacement demand	Possible increase but scale unknown
Italy	Unknown, will depend on regulation and state of economy	Unknown, will depend on technological change, regulation and state of economy	No information available	No information available	No change over the next five years	No information available	No information available

NB: Green cells = short-term employment growth predicted; orange cells = employment volume decrease predicted; blue cells = no change in the short term, but possible medium-term growth. (CEDEFOP, 2012)