



European  
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# SETIS

Information For Decision-making

*No. 19 – December 2018*



## **JOBS AND SKILLS IN THE ENERGY TRANSITION**

## SETIS Magazine

### *Jobs and skills in the energy transition*

No. 19 - December 2018

### *The relevance of the water-energy nexus for EU policies*

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# EDITORIAL

The European **Commission's 10 priorities**<sup>1</sup> for 2015-19 include the stimulation of investment and the creation of jobs. Thanks to progress made, the Energy Union project is on track to deliver jobs, growth and investment as part of **the EU's transition to a low-carbon, secure and competitive economy**<sup>2</sup>. Clean energy industries are becoming more established and new jobs are being created in the energy sector and the wider economy<sup>3</sup>.

The European Commission's communication on **Clean Energy for all Europeans**<sup>4</sup>, released as part of the **Clean Energy Package**<sup>5</sup>, presents an opportunity to speed up the **clean energy transition**<sup>6</sup>. In 2016 the renewable energy sector in Europe employed over 1 400 000<sup>7</sup> people, directly or indirectly, and around one million were employed in the energy efficiency sector. Policies proposed under this package are estimated to create another 700 000 jobs in construction, 230 000 in engineering and 27 000 in the iron and steel sectors, compared with 2014<sup>3</sup>.

Energy innovation requires new talent to address the social and entrepreneurial aspects of changing energy systems. These challenges are significant, especially for those employees who will need to re-skill or even change sector entirely.

This edition of SETIS Magazine takes a closer look at the jobs- and skills-related aspects of the clean energy transition. It examines the monitoring and projection of changes in employment, as well as efforts to identify and resolve skills needs. Renowned experts from the wider international research and policy community assess the state of the art and present the latest findings of the clean energy employment assessment field.

<sup>1</sup> [https://ec.europa.eu/commission/priorities\\_en](https://ec.europa.eu/commission/priorities_en)

<sup>2</sup> [https://ec.europa.eu/commission/sites/beta-political/files/third-report-state-energy-union\\_en.pdf](https://ec.europa.eu/commission/sites/beta-political/files/third-report-state-energy-union_en.pdf)

<sup>3</sup> While jobs related to the supply of carbon intensive energy sources in the EU decreased by 67 000 from 2008 to 2014, green jobs in the energy sector increased by over 400 000 during the same period (data from Eurostat).

<sup>4</sup> EC Communication (2016) 860: Clean Energy for all Europeans

<sup>5</sup> <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans>

<sup>6</sup> EC Staff Working Document (2016) 405: Impact Assessment

<sup>7</sup> EurObserv'ER, *The State of Renewable Energies in Europe*, 17<sup>th</sup> edition, 2017 (2016 figures)

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## Integrated SET-Plan

# NEWS

The European Strategic Energy Technology Plan (SET Plan) aims to transform the way we produce and use energy in the EU, achieving EU leadership in the development of technological solutions to reach the 2030 energy and climate goals.

The SET Plan, supported by its Strategic Energy Technologies Information System (SETIS), is the key implementing instrument of the European Commission's Energy Union Research and Innovation (R&I) Strategy.

The SET Plan, supported by its Strategic Energy Technologies Information System (SETIS), is the key implementing instrument of the European Commission's Energy Union Research and Innovation (R&I) Strategy. A SET Plan Steering Group (SG) meeting took place in September 2018. The discussions between the SG Members and the European Commission (EC) focused on the reporting obligations of the EU Member States (MSs) according to the [Regulation on the Governance of the Energy Union](#)<sup>1</sup>. MSs are expected to deliver a final draft version of their [National Energy and Climate Plans \(NECPs\)](#)<sup>2</sup>, covering the fifth dimension of the Energy Union, by the end of 2018. SET Plan is key to implementing the fifth dimension of the Energy Union, i.e. Research, Innovation and Competitiveness. The discussion focused on how the SET Plan can facilitate this reporting task, building upon its achievements and ongoing activities with regard to the endorsed [Implementation Plans \(IPs\)](#)<sup>3</sup>.

The Chairs of the temporary working groups on 1) Consumers and 2) Energy efficiency in buildings informed that the relevant IPs are almost finalised, and that both documents will be summited briefly to SG members for final adoption through written procedure. The same procedure will be applied for the endorsement of the IP on Nuclear Safety.

The SG meeting also hosted representatives from [EUROGIA2020](#)<sup>4</sup>, the [EUREKA](#)<sup>5</sup> cluster for low-carbon energy technologies. They highlighted the common objectives of SET Plan and EUROGIA2020, to accelerate the development and deployment of low-carbon technologies through the coordination of national research efforts and funds. They presented the joint call with a focus on the [Renewable Energy: Solar](#)<sup>6</sup>, [CSP](#)<sup>7</sup>, [Wind](#)<sup>8</sup>, [Geothermal](#)<sup>9</sup> and [Ocean](#)<sup>10</sup>. The goal is to generate project ideas in these low-carbon sectors that will contribute to the execution of the relevant SET Plan IPs in these areas.

This year's SET Plan Conference will take place in Messe Wien in Vienna (Austria) on 20-21 November 2018. It will take stock of progress towards the SET Plan actions, following the finalisation of the relevant [Implementation Plans](#)<sup>3</sup>, and aims to identify how publicly and privately funded R&I efforts at European and national level contribute to the EU's energy transition. It will highlight the importance of making synergies and developing partnerships among public and private actors to implement R&I activities with real impact. Discussions will address the challenges of meeting the objectives for 2030 and 2050, the financial instruments in support of R&I, the EU's position in the world, and the importance of engaging cities and regions. Registration is open and participation is free. You can find out more on the [conference website](#)<sup>11</sup>.

- 1 EC communication (2016) 759 :Proposal for a Regulation on the Governance of the Energy Union
- 2 <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union>
- 3 <https://setis.ec.europa.eu/actions-towards-implementing-integrated-set-plan/implementation-plans>
- 4 <http://www.eurogia.com/>
- 5 <http://www.eurekanetwork.org/>
- 6 [https://setis.ec.europa.eu/system/files/set\\_plan\\_pv\\_implementation\\_plan.pdf](https://setis.ec.europa.eu/system/files/set_plan_pv_implementation_plan.pdf)
- 7 [https://setis.ec.europa.eu/system/files/set\\_plan\\_-\\_csp\\_initiative\\_implementation\\_plan.pdf](https://setis.ec.europa.eu/system/files/set_plan_-_csp_initiative_implementation_plan.pdf)
- 8 [https://setis.ec.europa.eu/system/files/setplan\\_wind\\_implementationplan\\_0.pdf](https://setis.ec.europa.eu/system/files/setplan_wind_implementationplan_0.pdf)
- 9 [https://setis.ec.europa.eu/system/files/setplan\\_geoth\\_ip.pdf](https://setis.ec.europa.eu/system/files/setplan_geoth_ip.pdf)
- 10 [https://setis.ec.europa.eu/system/files/set\\_plan\\_ocean\\_implementation\\_plan.pdf](https://setis.ec.europa.eu/system/files/set_plan_ocean_implementation_plan.pdf)
- 11 <http://www.setplan2018.at/>

# FOREWORD

## RENEWABLE ENERGY JOBS: THE EU WITHIN THE WIDER GLOBAL CONTEXT

Renewable energy offers a range of socio-economic benefits, including employment creation and the stimulation of local, national and regional economies. IRENA's Renewable Energy and Jobs - Annual Review provides regular assessments of employment generation along the value chain. In the [latest edition](#)<sup>1</sup>, we estimate that in 2017, some 10.3 million people were employed in the sector worldwide<sup>2</sup>, up from 7.1 million in our first annual assessment in 2012. The solar photovoltaic (PV) industry has enjoyed the fastest expansion. It now employs close to 3.4 million people, putting it ahead of bioenergy, hydropower and wind power.

*“ In 2017, some 10.3 million people were employed in the sector worldwide, up from 7.1 million in our first annual assessment in 2012 ”*

Even though an increasing number of countries derives benefits from renewable energy, employment remains concentrated in a handful of countries — primarily

China, Brazil, the United States, India, Germany and Japan. Germany and other Member States of the European Union (EU) played a pioneering role in creating markets, manufacturing equipment and deploying renewables. Yet, policy uncertainties and reversals have presented challenges in recent years, during a time when China and some other Asian countries boosted their investments. Not only did they encourage domestic deployment with the help of feed-in tariffs, auctions, and other measures, but they also created strong manufacturing capabilities through preferential credit and land policies and local content rules.

2016 is the most recent year for which complete renewable energy employment estimates are available for Europe. IRENA estimates that the number of jobs reached 1.27 million<sup>3</sup>. The solid biomass and wind power industries have the largest workforces, with about 389 000 and 344 000 jobs respectively. Biofuels follow with about 200 000, and biogas with 71 000 jobs; altogether, bioenergy employs some 660 000 people. Solar PV employment has been cut in half from 220 000 to just under 100 000 in the space of five years, reflecting reduced domestic installations and lagging competitiveness in module manufacturing. The remaining technologies — hydro, solar water heating, geothermal energy and CSP — together employ about 140 000 people.

- 1 IRENA, *Renewable Energy and Jobs*. Annual Review 2018
- 2 This figure includes direct and indirect employment. However, due to data limitations, only direct employment is included for large hydropower.
- 3 The IRENA estimate for the EU is principally based on data published by EurObserv'ER in its annual [State of Renewable Energies in Europe](#). However, IRENA relies on national renewable energy employment assessments wherever they are available and adjusts the EurObserv'ER estimates accordingly. This is the case for [Austria](#), [Germany](#), [Spain](#) and the [United Kingdom](#). Further, IRENA excludes waste-to-energy and includes only those heat pump sector jobs that can be seen unambiguously as renewables-based.



**RABIA FERROUKHI**

Rabia Ferroukhi joined IRENA in 2011, and is currently Deputy Director of the Knowledge, Policy and Finance division. She also leads IRENA's Policy Unit, which is responsible for work on a range of renewable energy policy issues including design, socio-economic benefits and integrated resource management. She brought to this position over 20 years of experience in the fields of energy, development and environment. She has worked in both public and private sectors, including with governments in the Middle East and North Africa, energy companies in the Mediterranean region and the GCC, and international institutions. Dr. Ferroukhi holds a Masters in Applied Economics and a Ph.D. in Economics from the American University in Washington DC.



### MICHAEL RENNER

Michael Renner is a Programme Officer in IRENA's Knowledge Policy and Finance Centre in Abu Dhabi, with a focus on the socio-economic benefits of renewable energy. Prior to joining IRENA in 2017, he was a Senior Researcher at the Worldwatch Institute, a US-based research organisation. His principal focus since the early 1990s has been

on the linkages between environment, energy and employment. He was lead author of *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World* (UNEP, 2008), and has consulted for the ILO on this topic. Michael holds a Master's degree in international relations from the University of Amsterdam.



### CELIA GARCÍA-BAÑOS

Celia García-Baños is an Associate Professional in IRENA's Knowledge Policy and Finance Centre in Abu Dhabi. Within the Policy Unit, she works on a diverse range of subjects including the socio-economic benefits of renewable energy. Prior to joining IRENA, she worked with the Sustainable Bioenergy Research Consortium at the Masdar Institute, researching molecular

and biochemical screening of mangrove sediments in Abu Dhabi for biomass-degrading enzymes. Celia is a chemical engineer from the Industrial Engineering School of the Technical University of Madrid.



### ARSLAN KHALID

Arslan Khalid is a consultant who specialises in the analysis of renewable energy policies and the socio-economic impacts of renewables. His work on the socio-economic benefits of renewables is focused on employment impacts, and has resulted in regular publications including the IRENA *Renewable Energy and Jobs – Annual Review* series. He has also contributed to the research and development of several studies on renewable energy policies using both qualitative and quantitative methods. He holds a masters in Engineering Systems and Management from Masdar Institute.

“ Europe’s wind industry is a global technology leader, especially in the offshore segment, where the continent’s 15.8 GW of installed capacity at the end of 2017 represented 84% of the global total ”

The wind power sector is Europe's brightest spot. According to [Global Wind Energy Council data](#)<sup>4</sup>, of the ten countries with the largest installed wind capacity in the world, half are European. During 2017, four EU countries — Germany, the United Kingdom, France and Belgium — were among the ten that added the most capacity worldwide. IRENA estimates EU wind

power employment in 2016 at close to 344 000, a 10% increase over 2015. Germany represented nearly half of this total, followed by the United Kingdom, Denmark, the Netherlands, France and Spain.

Europe's wind industry is a global technology leader, especially in the offshore segment, where the continent's 15.8 GW<sup>5</sup> of installed capacity at the end of 2017 represented 84%<sup>6</sup> of the global total. Export markets hold considerable importance, yet competition is intensifying internationally and various incentives for localisation are reshaping the supply chain. More than 80%<sup>7</sup> of European wind firms have either a manufacturing or commercial presence in other parts of the world.

With some 325 000 jobs, Germany continues to have Europe's largest renewable energy workforce. The United Kingdom ranks second, followed by France, Poland, Spain and Italy. But the contrast between Germany's wind and solar PV sectors couldn't be

more stark. The country's 160 000-strong wind workforce is equal to the number of wind power employees in the next ten largest European markets combined. However, the loss of competitiveness in PV manufacturing and the contraction of domestic installations (annual capacity additions fell from a peak<sup>8</sup> of between 7.4 and 7.6 GW in 2010-2012 to 1.75 GW in 2017) translated into the loss of three quarters of the 142 700 jobs that existed in 2011.

With adequate policy support, European and global renewable energy deployment will continue to drive the low-carbon energy transition and generate growing numbers of jobs. IRENA's work on *Leveraging Local Capacity* indicates that a typical 50 MW solar PV plant requires a total of close to 230 000 person-days<sup>9</sup> of work along the entire value chain, from project planning and equipment manufacturing to construction and installation, operations and maintenance, and finally decommissioning. An onshore

wind farm of the same size requires about 144 000 person-days<sup>10</sup>. Offshore wind farms are typically of much greater size than onshore installations. A 500 MW facility requires some 2.10 million person-days<sup>11</sup> of work.

The role of renewables in the European and global energy system keeps expanding, even as the sector undergoes realignments and regional shifts. In line with IRENA's latest energy transformation scenario<sup>12</sup>, jobs in the sector could rise from 10.3 million in 2017 to 23.6 million in 2030 and 28.8 million in 2050. In addition to deployment and industrial policies, education and training of new workers is essential to avoid skill gaps. Further, to retain skilled and experienced employees, ensuring job quality (attractive wages, good working conditions and opportunities for career advancement) is critical. The transition also needs to embrace fairness, providing adequate adjustment support to fossil fuel-dependent workers and communities.

4 Global Wind Energy Council: *Global Wind Statistics 2017*

5 Wind Europe, *Wind in power 2017: Annual combined onshore and offshore wind energy statistics*

6 Global Wind Energy Council, *Global Wind 2017 Report: A snapshot of top wind markets in 2017 – Offshore Wind*

7 Wind Europe and Deloitte, *Local impact, global leadership: The impact of wind energy on jobs and the EU economy, 2017*

8 [https://www.solarwirtschaft.de/fileadmin/media/pdf/2016\\_3\\_BSW\\_Solar\\_Faktenblatt\\_Photovoltaik.pdf](https://www.solarwirtschaft.de/fileadmin/media/pdf/2016_3_BSW_Solar_Faktenblatt_Photovoltaik.pdf)

9 IRENA, *Renewable energy benefits: Leveraging local capacity for solar PV, 2017*

10 IRENA, *Renewable energy benefits: Leveraging local capacity for onshore wind, 2017*

11 IRENA, *Renewable energy benefits: Leveraging capacity for offshore wind, 2018*

12 IRENA, *Global Energy Transformation: A roadmap to 2050, 2018*





## ARTICLE

# THE TRANSITION TOWARDS COOPERATIVE, CONNECTED AND AUTOMATED MOBILITY (CCAM): WHAT IMPACT CAN IT HAVE ON EMPLOYMENT IN THE EU?

The future of transport will be marked by new technologies such as vehicle connectivity and automation, together with mobility services like ride-sharing or car-sharing. The combination of these technologies and services can have a disruptive effect, enabling new business models in place of the legacy vehicle ownership-based model. With improved safety and conditions (including accessibility), travel demand is expected to rise significantly. At the same time, it is anticipated that these new technologies will bring deep changes in the labour market, progressively reducing the relevance of some occupations and skills, while at the same time opening up new business opportunities and requiring new and more advanced skills.

The term **Cooperative, Connected and Automated Mobility (CCAM)**<sup>1</sup> enshrines the concept of a future mobility in which all actors are connected,

communicating and interacting in a seamless and automated way. Recently, the third and last part of the **Europe on the Move package**<sup>2</sup> was presented by the European Commission, including a **communication on automated mobility**<sup>3</sup>. While CCAM may well reduce demand for professional drivers, it could also help to make jobs in driving more attractive and to remedy the current shortage of drivers. In response to the **Council conclusions on the digitalisation of transport**<sup>4</sup>, the European Commission has already undertaken a **review of the expected socio-economic impacts of automated and connected vehicles on the EU economy and jobs**<sup>5</sup>.

### Concerns about job destruction due to automation

History has shown that even if effective technologies implementation affects workers negatively in the short term<sup>6</sup>, technology advancements can lead to

‘ *The maintenance and repair industry will require ICT skills in addition to traditional vehicle repair skills* ’

higher **job creation**<sup>7</sup> in the long run. Estimations of the number of jobs at risk of automation produce divergent results based on the approach followed. For instance, **47% of US jobs**<sup>8</sup> have been estimated to be at risk of computerisation, while only **9% of jobs in OECD**<sup>9</sup> countries are considered at risk. Nowadays, Automated Vehicles (AVs) cannot perform all the tasks required in most driving-related jobs, and there is much uncertainty whether they ever will<sup>10</sup>.

### Occupations at risk of job displacement by CCAM

According to different scenarios, the current 3.2 million truck-driving jobs in Europe may decrease to 2.3 or even to 0.5 million by 2040<sup>7</sup>.

Drivers and mobile plant operators working in land transport who are in danger of technological substitution amount to approximately 1.5% of total EU-15 employment in 2012. Those who require new training to keep performing the job, working in metal and machinery and related trades in wholesale, retail and repair of motor vehicles, amount to 0.7% of total EU-15 employment in 2012<sup>11</sup>. Impact on employment is not restricted to the land transport sector but will affect all sectors in which drivers are employed, such as warehousing and support, wholesale trade and postal and courier activities.

### Future requirements of the workforce

It is relevant to note that both occupations (metal, machinery and related trades, as well as drivers and mobile plant operators) have low levels of ICT use, whereas **the land transport sector will depend increasingly on ICT-based and specialised equipment and products in the future**<sup>12</sup>. In addition, **the maintenance and repair industry will require ICT skills in addition to traditional vehicle repair skills**<sup>13</sup>. In this context, a shortage of ICT professionals has been identified for 2020<sup>14</sup>.

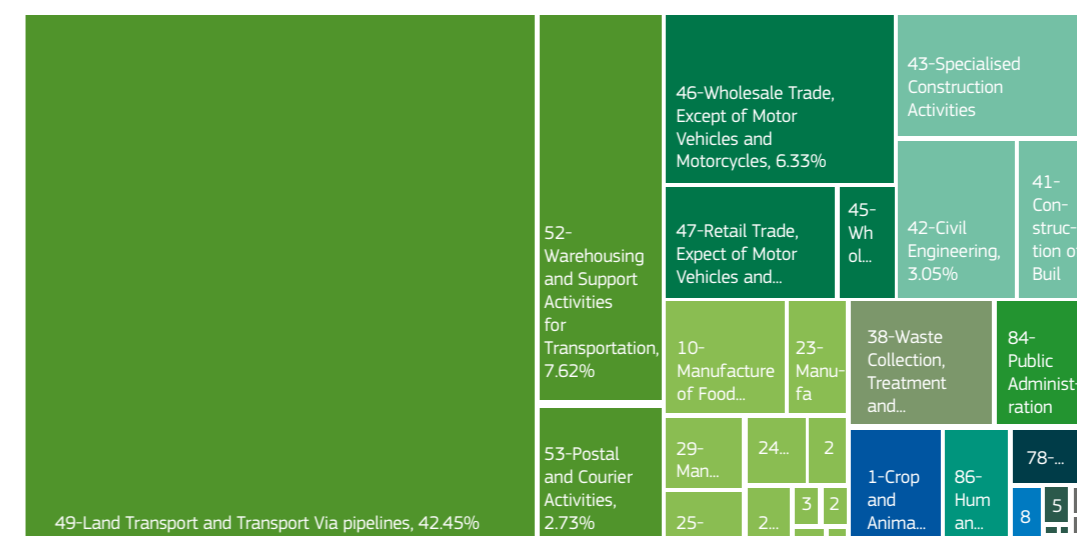


Figure 1: Sector-specific distribution of drivers and mobile plant operators in EU-15 (2012)<sup>15</sup>

Source: European Commission Joint Research Centre

<sup>7</sup> ITF, *Managing the Transition to Driverless Road Freight Transport*, International Transport Forum Policy Papers, No. 32, OECD Publishing, Paris, 2017.

<sup>8</sup> Frey et al., *The future of employment: How susceptible are jobs to computerisation?*, 2016.

<sup>9</sup> Arntz, M., T. Gregory and U. Zierahn, *The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis*, OECD Social, Employment and Migration Working Papers, No. 189, OECD Publishing, Paris, 2016.

<sup>10</sup> Todd Alexander Litman, *Autonomous Vehicle Implementation Predictions: Implications for Transport Planning*, Victoria Transport Policy Institute Publishing, 2018.

<sup>11</sup> <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/analysis-possible-socio-economic-effects-cooperative-connected-and-automated-mobility-ccam>

<sup>12</sup> [https://skillspanorama.cedefop.europa.eu/sites/default/files/EUSP\\_AH\\_Automotive\\_0.pdf](https://skillspanorama.cedefop.europa.eu/sites/default/files/EUSP_AH_Automotive_0.pdf)

<sup>13</sup> <https://www.mercatus.org/system/files/Thierer%26Hagemann-RoadblockstoDriverlessCars%28FINAL%29.pdf>

<sup>14</sup> <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52016SC0195>

<sup>15</sup> According to NACE rev. 2 classification for economic activities in the European Union.



### MONICA GROSSO

Monica Grosso is a transport economist with a PhD in Transport, Logistics and Territory and Applied Economics. She has worked since 2017 at the Sustainable Transport Unit of the European Commission Joint Research Centre (JRC), Ispra, Italy. She is part of the Transport Research and Innovation Monitoring and Information System (TRIMIS) Team and is also involved in research on the socio-economic impact of Cooperative, Connected and Automated Mobility.

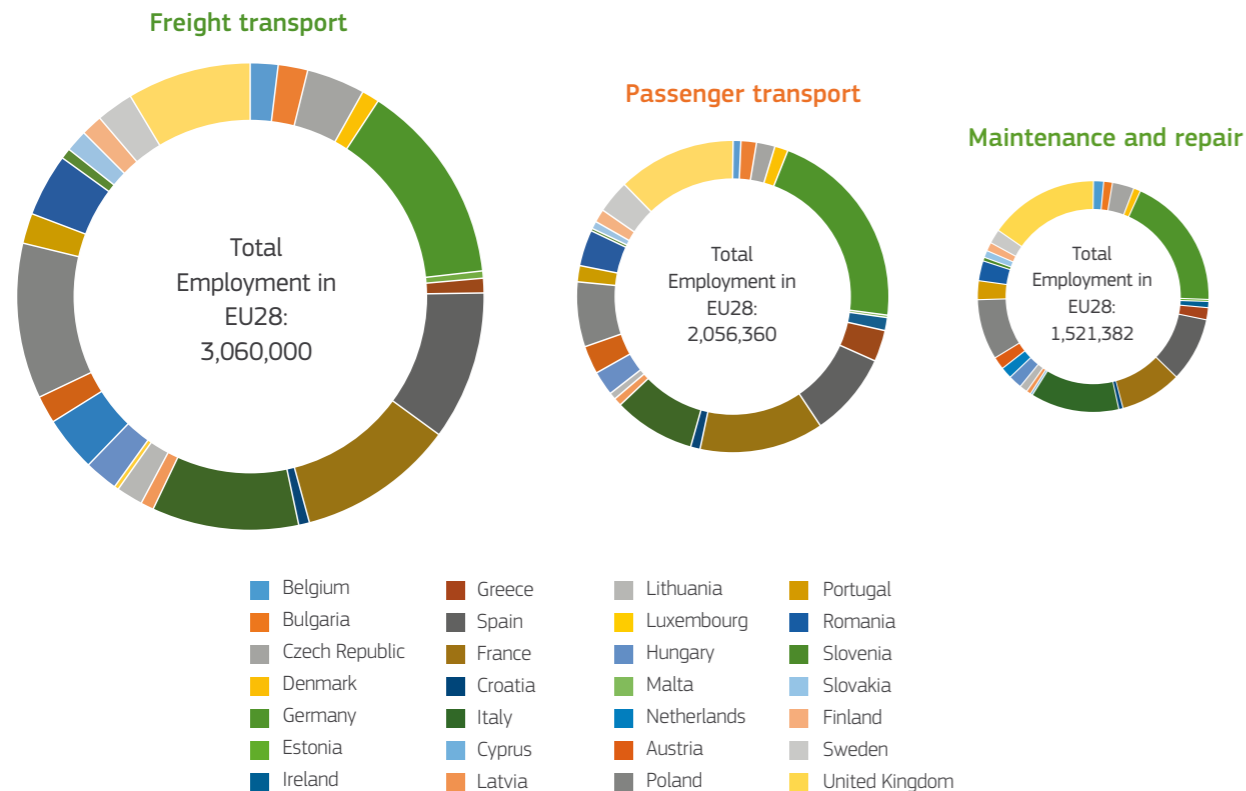


Figure 2: Total employment in freight transport, passenger transport, maintenance and repair (EU-wide and Member States distribution).  
Source: European Commission Joint Research Centre



#### BIAGIO CIUFFO

Biagio Ciuffo received his Ph.D. in transportation engineering from the Department of Transportation Engineering of the University of Napoli Federico II in 2008. He then joined the European Commission Joint Research Centre (JRC), Ispra, Italy, assessing the sustainability of traffic- and transport-related measures and policies. He is project leader for

various projects concerning the reduction of CO<sub>2</sub> emissions in road transport and the effect of automated/connected vehicles on transport and society. Ciuffo has published more than 50 papers in peer-reviewed journals and conference proceedings on transportation engineering. He is Associate Editor for the IEEE-Transaction on Intelligent Transportation Systems and acts as reviewer for several international journals and conferences.



#### MARÍA ALONSO RAPOSO

María Alonso Raposo holds a degree in Industrial Design Engineering and Human-Computer Interaction. She joined the Sustainable Transport Unit at the European Commission Joint Research Centre (JRC), Ispra, Italy, in 2016 as a technology and policy analyst on autonomous road transport. The main focus of her work is the

analysis of the social and economic implications of a Cooperative, Connected and Automated Mobility, in support of EU policy-making in this area.

#### New occupations or reallocation?

Fulfilling future skills demand might offer opportunities for the reallocation of employees. Some highly qualified mechanics might move to higher-paying jobs in the information sector<sup>12</sup>. Experienced drivers could apply their skills in remote control rooms for monitoring Connected Automated Vehicles (CAVs)<sup>7</sup>. It is very difficult to predict the qualifications and characteristics of future jobs as driven by the wider economy, but recent labour market experiences suggest that new occupations will tend mostly towards the higher end of skills distribution<sup>7</sup>.

#### What can be done to facilitate a smooth transition to the workforce of the future?

The impacts of CCAM on employment are largely influenced by the speed of introduction of new technologies and mobility changes. The more gradual the introduction, the higher the probability that the negative implications on employment will be absorbed by the European economic system. A slow CAV uptake or an informative awareness campaign can lead workers to qualify on time and mitigate the transition costs for them<sup>7</sup>. Retraining or income assistance programmes could be used to support the transition<sup>15</sup>.

<sup>15</sup> [https://www2.deloitte.com/content/dam/insights/us/articles/3876\\_Making-the-FoM-work/DUP\\_Making-FoM-work-reprint.pdf](https://www2.deloitte.com/content/dam/insights/us/articles/3876_Making-the-FoM-work/DUP_Making-FoM-work-reprint.pdf)

<sup>16</sup> Sector-specific (footnote: According to NACE rev. 2 classification for economic activities in the European Union) distribution....

# ARTICLE

## COAL REGIONS IN TRANSITION INITIATIVE: HARNESSING THE MOMENTUM OF CLEAN ENERGY TRANSITION TO BUILD SUSTAINABLE JOBS AND GROWTH FOR ALL EUROPEANS

Around 20 000 delegates and observers are expected in Katowice, Poland, in December this year, to negotiate the global response to climate change. The venue of this year's COP<sup>1</sup> is part of an emblematic redevelopment project financed by the European Regional Development Fund<sup>2</sup> and implemented over the past eight years. The International Congress Centre where the delegates will discuss the follow-up to the Paris Agreement stands on the site of a former coal mine where the last tonne of coal was extracted less than 20 years ago.

The city of Katowice will provide the perfect setting for discussions on the future of coal regions and on the future of workers which rely on the fossil-fuel economy. The challenge is substantial, as coal delivers almost half<sup>3</sup> of the electricity generated around the globe. In Europe, coal miners face an uncertain future due to declining coal consumption. Lessons from the past show that the socio-economic impacts of coal mine closures can be felt across generations.

That is why *'just transition'*<sup>4</sup> is becoming an important area for public intervention across the European Union.

The decline of coal production in Europe is nothing new. However, what is often overlooked is the fact that there are still 41 regions with active coal mining activities across 12 Member States. The coal industry is a major source of employment. It is estimated that the coal sector currently employs 237 000 people within the EU, the vast majority of whom work in coal mining. Another 215 000 indirect jobs are estimated to depend on coal activities. Coal jobs present the particularity of being regionally concentrated. That is why coal mine closures, if not accompanied by long-term regeneration plans, risk drowning the affected regional economies. To give a sense of perspective, in the region of Silesia, which hosts this year's COP, the coal sector provides over 80 000 jobs<sup>5</sup>.

<sup>1</sup> <http://cop24.gov.pl/>

<sup>2</sup> [http://ec.europa.eu/regional\\_policy/en/funding/erdf/](http://ec.europa.eu/regional_policy/en/funding/erdf/)

<sup>3</sup> It was 41% in 2014 according to <https://www.iea.org/etp/tracking2017/coal-firedpower/>

<sup>4</sup> <http://www.just-transition.info/>

<sup>5</sup> Alves Dias et al., *EU coal regions: opportunities and challenges ahead*, JRC Science for Policy Report, 2018





**ALEKSANDRA  
TOMCZAK**

Aleksandra is a policy coordinator on coal issues at the Directorate General for Energy, and is the main contact point for the Commission's new Platform for Coal Regions in Transition. She holds Masters' Degrees from the College of Europe and Sciences Po Bordeaux and a Bachelor's Degree from Cardiff University. She speaks Polish, English and French and has basic knowledge of Bulgarian and Spanish.

The challenge of enabling 'just transition' is likely to accelerate as the market for fossil fuels use shrinks year by year. In the period between 2014 and 2017, 27 coal mines were shut down across eight Member States, and more coal mines are expected to close before the end of 2018. Repercussions for employment can be serious. Indeed, an analysis carried out by the Commission Joint Research Centre<sup>5</sup> shows that 109,000 coal mining jobs are at risk due to the lack of competitiveness of coal mines in certain regions.

Member States and Regions play a leading role in designing and managing the transition on the ground in coal mining communities, but the EU has a clear role to play.

Commission services have been working with pilot coal regions over the past 18 months under the **Coal Regions in Transition Initiative**<sup>6</sup> in order to better understand the challenges, needs and potential for assistance at EU level. The Initiative was initially announced in the **Clean Energy Package**<sup>7</sup>, which stressed the importance of enabling clean energy transition on the ground.

Today, the European Commission is working with 10 pilot coal regions in six Member States and operates a permanent multi-stakeholder Platform which helps to identify best practice, drawing lessons from previous transition experiences, and linking coal regions with project ideas, experts, funds and support programmes.

The Initiative aims to deliver on two objectives:

- First, to assist regions which rely on the fossil fuel economy in establishing tailor-made and forward-looking transition strategies.
- Second, to facilitate the identification and implementation of pilot projects which can kick-start the process of structural transformation, create jobs and facilitate environmental rehabilitation.

There are ample opportunities for funding and support for transition-related activities and projects at EU level through the European cohesion policy, including well-established funding mechanisms such as the **European Regional Development Fund**<sup>8</sup> and the **European Social Fund**<sup>9</sup>, through the **European Globalisation Adjustment Fund**<sup>10</sup>, the **Structural Reform Support Service**<sup>11</sup>, the **European Investment Advisory Hub**<sup>12</sup>, Horizon

2020<sup>13</sup>, the **Research Fund for Coal and Steel**<sup>14</sup>, the **EU Emissions Trading System mechanism**<sup>15</sup> and **LIFE programme**<sup>16</sup>.

The Coal Regions in Transition Initiative is designed to connect coal regions with opportunities for support at EU level, whilst facilitating peer-to-peer learning and exchange of best practices.

Positive impacts can already be seen on the ground. Coal regions in Slovakia and Greece are benefiting from the support of the Structural Reform Support Service<sup>11</sup> in preparing tailor-made transition strategies. Priority projects are being identified in coal regions in Germany, Poland and Czech Republic for discussion with European Commission experts before the end of 2018. In the region of Silesia, cohesion and regional development funds are in the process of being re-prioritised to ensure that projects with the potential to kick-start the structural and technological transition of the region can be more easily co-funded from EU funds.

*‘ The Coal Regions in Transition Initiative connects coal regions with opportunities for support at EU level, whilst facilitates peer-to-peer learning and exchange of best practices ’*

Clean energy transition presents clear opportunities for coal regions and even for coal miners. Examples from the UK and USA show that former coal miners, especially those with technical training, can easily be employed in wind energy projects. The European Commission and the Secretariat for the **Coal Regions in Transition Platform**<sup>17</sup>, to be established in time for COP24<sup>1</sup>, will continue assisting coal regions to identify new opportunities for growth and to deliver more sustainable jobs in the future.

6 <https://ec.europa.eu/energy/en/topics/oil-gas-and-coal/coal-and-other-solid-fuels>

7 <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans>

8 [http://ec.europa.eu/regional\\_policy/en/funding/erdf/](http://ec.europa.eu/regional_policy/en/funding/erdf/)

9 <http://ec.europa.eu/esf/home.jsp?langId=en>

10 <http://ec.europa.eu/social/main.jsp?catId=326&langId=en>

11 [https://ec.europa.eu/info/departments/structural-reform-support-service\\_en](https://ec.europa.eu/info/departments/structural-reform-support-service_en)

12 <http://eiah.eib.org/>

13 <https://ec.europa.eu/programmes/horizon2020/en/>

14 [http://ec.europa.eu/research/industrial\\_technologies/rfcs\\_en.html](http://ec.europa.eu/research/industrial_technologies/rfcs_en.html)

15 [https://ec.europa.eu/clima/policies/ets\\_en](https://ec.europa.eu/clima/policies/ets_en)

16 <http://ec.europa.eu/environment/life/>

17 <https://ec.europa.eu/energy/en/coal-regions-transition-platform-working-groups>

**Paola Mazzucchelli**  
EUREC's Secretary General

**TALKING  
TO SETIS**





**PAOLA MAZZUCHELLI**

Paola Mazzucchelli has been EUREC's Secretary General since 2008. She is in charge of the day-to-day management of the association, including the strategic definition of its priorities related to renewable energy research and education. She has extensive experience in managing European co-funded projects, working on energy-research related projects since 2002. She coordinated the KnowRES project from 2014 to 2016. She has coordinated the secretariat of the European Technology and Innovation Platform on Renewable Heating and Cooling since 2016. She is a member of the International Association of Facilitators, and has in-depth expertise in leading strategy meetings and workshops for the definition of research priorities for several renewable energy technologies.

## ABOUT EUREC'S STRATEGY TO DEVELOP THE RIGHT SKILLS FOR THE ENERGY TRANSITION

EUREC, the association of European renewable energy research centres, has been leading several projects to support the development of human resources to enable a prompt transition towards a sustainable energy system.

### European Master in Renewable Energy

Since 2002, EUREC has been coordinating a **European Master in Renewable Energy**<sup>1</sup>, whose objective is to train post-graduate students to fulfil growing industry demand for specialised renewable energy expertise. The three-semester Master programme is taught in nine universities around Europe (Carl-von-Ossietzky Universität Oldenburg, Germany; Hanze University of Applied Sciences, The Netherlands; IST Lisbon, Portugal; Loughborough University, UK; MINES-ParisTech, France; National Technical University of Athens, Greece; Northumbria University, UK; Universidad de Zaragoza, Spain; and Université de Perpignan, France). It aims to equip students with technical skills integrated with knowledge of technological, strategic, social and economic issues. The students can specialise in one of several subjects: wind, PV, solar thermal technologies, ocean energy, grid integration, or sustainable fuels for transport.

### Knowledge Centre for Renewable Energy Jobs

In 2014, together with other European associations working in the field of renewable energy (Bioenergy Europe, ESTELA, EGEC, Assorinnovabili, OEE), EUREC launched the **Knowledge Centre for Renewable Energy Jobs**<sup>2</sup>, creating an online platform to provide job intelligence to industry, candidates and academic and training institutions. This was done alongside an analysis of the skills needed by the industry to ensure that the education and training courses provided are tailor-made to the sectors' needs.

In the clean energy transition, it is acknowledged that new areas of activity will emerge, while others will disappear or be transformed to adapt to the fast-evolving energy environment. EUREC has, therefore, developed the Knowledge Centre for Renewable Energy Jobs to:

- Identify areas where skills need to be updated or acquired to help reduce skills gaps and skills shortages in the renewable energy sector

- Identify skills that are transferable from traditional sectors to the new renewable energy sectors
- Develop training recommendations to reduce the knowledge and competence gap in the renewable energy sector.

The data collection, both of industry needs and workers' competencies, was carried out on the basis of surveys specifically targeted at the two groups, and via specific interviews with selected industry representatives and candidates. A screening and analysis of the most wanted profiles was also published regularly, in order to highlight the type of competencies most wanted per sector. (See Figure 1)

### KnowRES project results

The results of the **KnowRES project**<sup>2</sup> highlighted the need for engineers and technicians equipped with Science Technology Engineering and Mathematics (STEM) skills, but also for specialised profiles such as financial and legal specialists who understand the Renewable Energy sector in order to contribute to RE projects and deployment. Competencies in management, business, entrepreneurship, economics and finance need to be developed to complement technically-oriented education. A need for trainers and teachers is also forecast, to accompany the deployment of new programmes. Multidisciplinary programmes are identified as better suited to new jobs that cross occupational boundaries.

### European Master in Sustainable Energy System Management

To address this challenge, EUREC, together with Hanze University of Applied Sciences, The Netherlands, Universidad de Zaragoza, Spain, and Università di Pisa, Italy, launched a new post-graduate Master programme in 2015, dedicated to **Sustainable Energy System Management**<sup>3</sup>. The aim of the programme is to train a new generation of professionals with the interdisciplinary knowledge, skills and tools to make the energy transition happen. This programme focuses on the business and economic aspects of the energy system. It provides economic and management skills and the technical knowledge needed to lead the energy transition.

1 [www.master.eurec.be](http://www.master.eurec.be)  
2 [www.knowres-jobs.eu](http://www.knowres-jobs.eu)

Sectors	Tree most wanted profiles	Short term recruitment forecast	Needed skills and competencies	Locations
<b>Biomass</b>	<ul style="list-style-type: none"> <li>&gt; Engineer (various disciplines)</li> <li>&gt; Business developer/technical sales</li> <li>&gt; Research engineer</li> </ul>	71% of companies will be recruiting	<ul style="list-style-type: none"> <li>&gt; German language skills</li> <li>&gt; Sales skills</li> <li>&gt; Multitasking skills</li> </ul>	Lithuania, Austria, Germany, UK
<b>Geothermal</b>	<ul style="list-style-type: none"> <li>&gt; Drilling engineer</li> <li>&gt; Project manager</li> <li>&gt; O&amp;M plant manager</li> </ul>	91% of companies will be recruiting	<ul style="list-style-type: none"> <li>&gt; Hydro-geologist</li> <li>&gt; Reservoir engineer</li> <li>&gt; Chemist</li> </ul>	Turkey, France, Germany, Italy, Hungary
<b>Ocean</b>	<ul style="list-style-type: none"> <li>&gt; Project manager</li> <li>&gt; Structural research engineer</li> <li>&gt; R&amp;D engineer</li> </ul>	74% of companies will be recruiting	<ul style="list-style-type: none"> <li>&gt; Health and Safety</li> <li>&gt; Technical skills, soft skills (multitasking and problem solving)</li> </ul>	Scotland, UK, France
<b>PV</b>	<ul style="list-style-type: none"> <li>&gt; Technical researcher</li> <li>&gt; O&amp;M field technician</li> <li>&gt; Engineer (project planning)</li> </ul>	63% of companies will be recruiting	<ul style="list-style-type: none"> <li>&gt; Soft skills</li> <li>&gt; Language skills</li> <li>&gt; Legal expertise</li> <li>&gt; Marketing, lobby skills</li> </ul>	Algeria, Morocco, China
<b>Small hydro power</b>	<ul style="list-style-type: none"> <li>&gt; Technical sales</li> <li>&gt; Field service technician (O&amp;M)</li> <li>&gt; Mechanical design engineer</li> </ul>	60% of companies will be recruiting	<ul style="list-style-type: none"> <li>&gt; Project managers, business developer, Technical sales, legal, environmental managers</li> </ul>	Market shift to Africa, North America and Asia
<b>Solar Thermal</b>	<ul style="list-style-type: none"> <li>&gt; Technology researcher</li> <li>&gt; Chief, sales and marketing officer</li> <li>&gt; O&amp;M technician</li> </ul>	80% of companies will be recruiting Due to difficulties, forecast need to be reassessed	<ul style="list-style-type: none"> <li>&gt; Soft skills</li> <li>&gt; O&amp;M technicians</li> </ul>	South Africa, USA, India

Figure 1: Profiles, skills and competencies for the RES sector. Source: Renewable Energy Jobs Barometer

### Living Lab approach for sustainable energy education

EUREC is always striving to support the adoption and introduction of new concepts and projects at European level which could further develop a strongly qualified workforce to support the transition towards a renewable-based energy system. Together with several of its members, EUREC recently developed the 'Living Lab approach for sustainable energy education' (LILA4SEE). The LILA4SEE concept builds on existing initiatives which focus on technical education in the area of renewable and sustainable energy, with a view to adding a multidisciplinary component, while testing and implementing innovative new aspects. This new approach will better train and re-train employees to respond to the complex challenges related to the transition towards a sustainable energy system. This needs a more holistic approach to succeed.

The core of the LILA4SEE concept is based on the set-up and upgrade of living labs. Living labs are defined as physical environments where stakeholders from universities (professors and students from different disciplines), companies, research institutes, public agencies (e.g. at local level) and end-users of the technology, collaborate to create a strategy. The aim is to develop case-based modules (problem-based learning and more), innovative courses and train-the-trainer strategies related to renewable energies in a real-life context. The implementation of such an approach will have a double impact:

- To upgrade the competence profiles of researchers and engineers for the energy transition
- To enhance the capacities of European universities

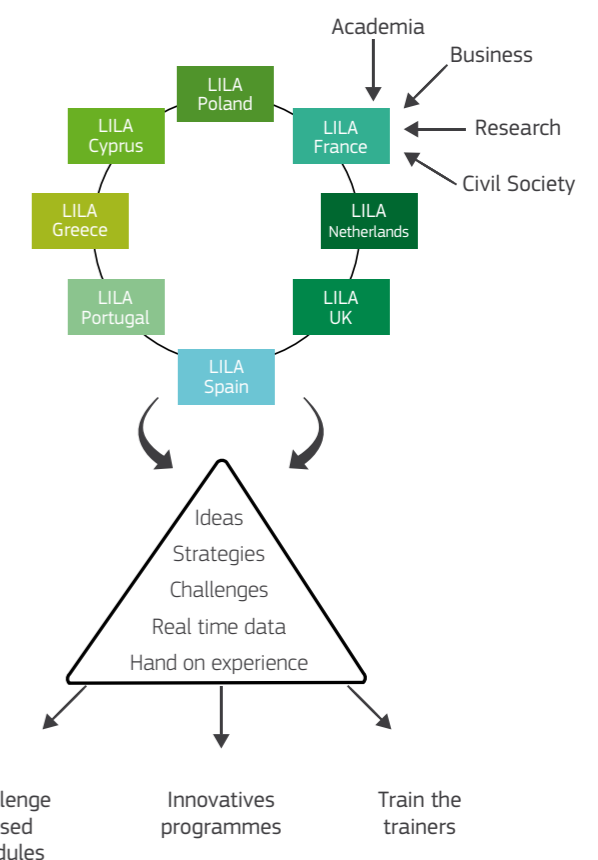


Figure 2: The Living Lab approach for sustainable energy education. Source: LILA4SEE proposal



**Marc Marsidi**  
ECN part of TNO

**Ton van Dril**  
ECN part of TNO

# TALKING TO SETIS

## ABOUT EUROBSERV'ER: QUANTIFIES CURRENT EUROPEAN UNION JOBS AND TURNOVER IN RENEWABLES

### What is EurObserv'ER and when did it start monitoring socio-economic processes in the EU RES sub-sectors?

Deployment of renewable energy technologies in European Union Member States has been monitored by the EurObserv'ER project<sup>1</sup> since 1999. The work is supported by DG ENER<sup>2</sup> for the four-year period, 2017-2020. The EurObserv'ER consortium consists of the French Observ'ER and many other partners, in various compositions over the years. Originally, 15 countries were monitored; currently, the scope encompasses all 28 Member States. The focus of the monitor was initially limited to capacity and energy data, but gradually, more and more indicators were included and quantified. In 2008, when the Dutch member (ECN part of TNO<sup>3</sup>) joined the team, EurObserv'ER started reporting on two socio-economic indicators: employment and turnover. The 2017 Edition of the annual publication, *The State of Renewable Energies in Europe*<sup>4</sup>, features a new approach for deriving these socio-economic indicators.

### What are the main benefits of the new EurObserv'ER employment assessment methodology?

The relative impact on the job market of renewable energy technologies varies per country, depending on, among other factors, the location of production facilities, trading activities and feedstock production, but also on non-technology-related aspects such as the efficiency of the labour force and wage levels. Secondary effects are also significant, such as jobs in information and communication technology or payroll services, which play a role in the installation and exploitation phase. The main benefit of the new methodology<sup>5</sup> is that every Member State is analysed in the same way, thereby improving cross-country comparison; this makes the assessment more powerful, as the scope and definitions are guaranteed to be the same. Another positive aspect of the methodology is transparency. The data is, for the most part, publicly available via Eurostat, and the methodology is well documented and published on the EurObserv'ER website. The approach is therefore fully transparent and can be used by other research institutes, consultants, and governmental agencies. Finally, this is a bottom-up approach, based on investments, the generation of money flows, and the creation of jobs per country, technology, and economic sector. This allows the

researcher to gain a better understanding of the impact of a technology on the job market, such as the impact of the manufacturing industry and the effect of increased deployment on a national economy.

### What are the most important recent trends in RES employment in Europe?

The EurObserv'ER employment estimate for the EU in 2016 amounted to 1.4 million people, roughly similar to the estimate for 2015 (less than 1% reduction). This result is a balance of changes occurring at the technology level. A decrease in employment was observed for wind power (-2%), solar photovoltaics (-15%), hydropower (-20%), biogas (-9%), solar thermal heat and power (-6%) and geothermal (-30%). An increase was observed for solid biomass (+2%), heat pumps (+4%), biofuels (+15%) and renewable municipal solid waste (+5%). The EurObserv'ER analysis confirms that early mover countries which succeed in capturing a share of the European or worldwide renewable energy technology market, still benefit today from setting up their own manufacturing industry. Examples are found in the wind energy sector, where European firms are serving both European and worldwide markets. In economic terms, the combined turnover related to renewable energy in the 28 European Union Member States reached EUR 149 billion in 2016, down slightly from 2015 (EUR 151 billion -1%). The largest share can be attributed to wind power (26% of total EU renewable turnover), solid biomass (21%), and the heat pump sector (20%).



**MARC MARSIDI**

Marc Marsidi is a renewable energy researcher at ECN part of TNO. He has worked on a broad range of topics, varying from renewable energy technologies to energy efficiency in the industrial sector. Marc has worked on the energy transition in the Netherlands, Germany and Belgium, and has extensive experience in the paper and board industry. At ECN part of TNO, he has helped to improve the socio-economic models used to determine the impact of renewable energy technologies deployment on the European job market.



**TON VAN DRIL**

Ton van Dril is a senior researcher at ECN part of TNO. He has an MSc in civil engineering and an M.A. in Economics, and joined ECN Policy Studies in 1993. He advises the Dutch government and the European Commission on a broad range of energy policy issues. He advises the Dutch

Government on energy efficiency policies and the Social Economic Council (SER) on the National Energy and Climate Agreement, coordinating the input of the knowledge institutes. He is responsible for the economic section of the annual National Energy Outlook. He is advisor for the SER committee on energy transition and employment.

1 [www.eurobserv-er.org](http://www.eurobserv-er.org)  
2 Under the service contract number: N°ENER/C2/2016-487/SI2.742173 in the Horizon 2020 Energy programme  
3 As of 1 April 2018, ECN joined forces with TNO and has become 'ECN part of TNO'. Website: <https://www.tno.nl/en/focus-areas/ecn-part-of-tno>  
4 EurObserv'ER, *The State of Renewable Energies in Europe*, 17<sup>th</sup> edition, 2017  
5 <https://www.eurobserv-er.org/pdf/renewable-energy-employment-effects-methodology-report-2018>



**Vincent Berrutto**

Head of the Energy Unit at EASME

**Amandine De Coster-Lacourt**

Project Advisor at EASME

# TALKING TO SETIS

## ABOUT BUILD UP SKILLS: UPGRADING ENERGY EFFICIENCY AND SUSTAINABILITY SKILLS IN THE BUILDING SECTOR

How has the BUILD UP Skills initiative evolved since it was launched in 2011? What were its main milestones?

Europe has set ambitious targets for buildings energy performance, whether for renovations or new buildings. All new constructions should be **Nearly-Zero Energy Buildings**<sup>1</sup> from 2020 onwards, in line with the **Energy Performance of Buildings Directive**<sup>2</sup>. This means not only tighter performance standards in terms of energy consumption and airtightness, but also an increased use of renewables. At the same time, technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), prefabrication of building components and 3D printing, to name but a few, are becoming more widespread and are expected to bring important benefits in terms of energy performance.

However, the smartest buildings or the best retrofit opportunities would not exist without a qualified workforce to build them. Ensuring the highest quality construction work is essential to maximising the building's energy performance. As illustrated in many studies, actual energy consumption in buildings is often significantly higher than predicted consumption. Poor quality construction and the lack of efficient interaction between trades onsite play a large role in this performance gap.

With close to 21.1 million people employed in the broader construction sector in 2015 across the EU, it constitutes a major source of employment in many **European countries**<sup>3</sup>. It is largely dependent on the evolution of its human capital, both in terms of the availability of workers and the quality of the workforce. While skills shortages and mismatches remain important, energy efficiency and digitalisation are two of the most influential drivers affecting the need for skills<sup>3</sup> in the sector. At the same time, the construction sector is characterised by low predictability due to economic fluctuations, strong time constraints for the delivery of projects, the fragmentation of the sector across a multitude of crafts and professions, and the many small players involved. This means that few companies can afford the costs of training their workforce.

The BUILD UP Skills initiative<sup>4</sup>, coordinated by the Executive Agency for Small and Medium-sized Enterprises (EASME), was set up in 2011 to boost the continuing or further education and training of craftsmen, other onsite construction workers, and systems installers. To cater for specificities in construction markets and educational systems, it was important to focus on the national level. With European financial support, 30 projects were funded in 2011-2012 to gather key stakeholders from the energy, education, training and building sectors in **'National Qualification Platforms'**<sup>4</sup>. The platforms mapped the existing workforce, qualification programmes, gaps and barriers, and future skills needs. On this basis, national roadmaps were developed. One of the main findings was that 3 million workers in Europe would need training on energy efficiency and renewable technologies by 2020. The importance of breaking silos between crafts and professions was also clearly highlighted.

*With close to 21.1 million people employed in the broader construction sector in 2015 across the EU, it constitutes a major source of employment in many European countries*

In 2013-2014, a second batch of 22 projects was funded to turn the national roadmaps into action by designing new qualifications and training schemes and improving existing ones. More than 8 500<sup>5</sup> people across Europe were trained in 805 pilot courses, representing more than 27 000 hours of training. These figures might seem low when seen against the objective of upskilling 3 million workers, but it should be stressed that BUILD UP Skills was never intended



**VINCENT BERRUTTO**

Vincent Berrutto is the Head of the Energy Unit at the European Commission's Executive Agency for Small and Medium-sized Enterprises (EASME). He is responsible for the energy efficiency priorities under the Energy Challenge of *Horizon 2020*, the EU Programme for Research and Innovation (2014-2020). Prior to joining EASME, Vincent Berrutto was dealing with sustainable energy issues in other services of the European Commission, as well as in the French government. He holds a PhD in science and 25 years of professional experience.

1 <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings/nearly-zero-energy-buildings>  
2 Directive 2018/844/EU of the European Parliament and of the Council  
3 European Construction Sector Observatory (ECSO), *Analytical Report – Improving the human capital basis*, April 2017.  
4 <http://www.buildup.eu/en/skills>  
5 Conservative estimate, not counting people trained after the end of the project (e.g. 10 000 workers in the Netherlands).





*“ BUILD UP Skills training and qualification schemes address a common goal: the upskilling of building professionals ”*

to fund the actual running of training courses. Rather, its objective is to initiate a new dynamic at national level to be continued through other means (national support, structural funds, commercial training, etc.), based on learnings from the European seed money.

<sup>6</sup> <http://www.kpmc.lt/kpmc/en/>

<sup>7</sup> <http://www.statybininkai.lt/?lang=en>

From 2014 onwards, the Horizon 2020 Framework Programme provided continued support to BUILD UP Skills. The focus was shifted to large-scale multi-country qualification and training schemes, while also addressing white collar professions (engineers, architects, building managers, etc.). Seventeen projects are ongoing or have recently been finalised.

The EU contribution to BUILD UP Skills since 2011 amounts to EUR 38 million, showing the importance of the EU commitment in this field.

#### Which Member States were particularly successful in developing and implementing skills improvement strategies for better uptake of EE and RES in the building sector?

BUILD UP Skills training and qualification schemes address a common goal: the upskilling of building professionals. However, they differ widely in the way they were implemented, whether in terms of course duration, target groups (roofers, bricklayers, electricians, etc.), share of practical vs theoretical training, or type of training material developed. This has to do with national specificities in construction sectors, housing stocks or vocational education systems. A comparison between projects is therefore not always straightforward.

There are success stories in many of the projects supported by BUILD UP Skills, but two countries come to mind. The Netherlands has been very actively involved in the initiative since the beginning, with strong involvement from the leading national organisations. No less than 10 000 workers were upskilled through an innovative application for smartphones, available in Dutch, but also in English and Spanish. The Dutch partners have also taken the opportunity offered under Horizon 2020 to join international consortia, which allowed them to expand the app to white collar professions and to emerging technologies such as BIM. This is a very good example of how BUILD UP Skills can help a national initiative to reach a European dimension. In Lithuania, the project funded worked with over 150 construction professionals and trainers through 12 training programmes. A fully-fledged certification scheme was set up and endorsed by the [National Qualifications and VET Development Centre](#)<sup>6</sup>, as well as the [National Builders Association](#)<sup>7</sup>.

But we should also look beyond individual projects' achievements. BUILD UP Skills project teams have gradually evolved into a community of committed professionals eager to learn from each other. To support this, EASME has organised ten European Exchange Meetings since 2011<sup>4</sup>, creating opportunities for projects to exchange common challenges and best practices. In addition, four technical working groups have been working on solutions around the long-term financing of training schemes, mutual recognition of

skills and qualifications, innovation in training, and mechanisms to boost demand for skilled workers.

Overall, with more than 50 projects now finalised, we can identify some of the main success factors. First of all, the capacity to mobilise the key national stakeholders has been a major contributor, an absolute prerequisite to establish the credibility of any new training scheme. Innovation in the delivery of training has also been essential, in particular finding more attractive, time-effective and user-friendly ways to convey technical knowledge on energy efficiency, such as e-learning platforms and apps. Fostering a better understanding between different crafts and professions also brought important benefits in terms of reducing errors on the construction site that have an impact on buildings' energy performance. The training of trainers was equally important, as good trainers are the backbone of any successful skills development process. Last but not least, the projects that dedicated effort to the recognition of energy skills (e.g. through public registers of qualified workers) achieved some real and lasting benefits in terms of visibility and market acceptance.

#### What are the experiences of multi-country qualification and training schemes?

Multi-country qualification and training schemes are often a natural evolution of the national projects that were funded in the first phases of BUILD UP Skills. As a national scheme becomes more mature, there is often interest from stakeholders to expand it to more countries, thereby facilitating the mobility of professionals and creating a level playing field. Advantages of multi-country schemes include the opportunity to reach out to more professionals and to address a larger range of professions and subjects.

As an example, the [PROF/TRAC project](#)<sup>8</sup> developed a European qualification scheme, setting out minimum skill levels for professions involved in the design, construction, refurbishment, and operation of the whole Nearly-Zero Energy Buildings value chain. The project enabled the training and certification of nearly 130 trainers from 23 countries, who then went on to train over 1 300 architects, engineers and building managers in pilot courses.

One of the main difficulties encountered when deploying multi-country schemes relates to the differences of maturity between national vocational education and qualification systems, as well a lack of mechanisms to ensure mutual recognition between them. Indeed, there can be wide differences in the national definitions of competence profiles and learning outcomes for a given profession. We lack the tools that would allow for easy comparison and evaluation of the energy efficiency skills of building professionals across Member States.

<sup>8</sup> <http://profrac.eu/open-training-platform-for-nzeb-professionals.html>

#### How will the BUILD UP Skills initiative evolve in the future?

BUILD UP Skills stands at the crossroad of several policy areas, in particular energy, construction, the internal market, employment and vocational education. As a result, we see a lot of potential to develop new avenues in the future.

For the coming years, the focus will be on boosting the demand for skilled building professionals. The Horizon 2020 Secure, clean and efficient energy Work Programme for 2019-2020 includes a topic welcoming proposals in this field. These proposals are expected to develop market level actions and/or support legislative changes. This may include, for example, tools facilitating the mutual recognition of energy skills and qualifications in the construction sector across countries; initiatives raising the awareness of home/building owners and tenants about the benefits of using skilled professionals; and support to public authorities to develop new legislative frameworks, such as requirements for skilled workers in public procurement. We look forward to receiving excellent proposals developing these types of concept.

*“ There is a clear lack of training and qualification schemes in the field of Building Information Modelling ”*

Lately we have seen a lot of interest in skills development in the field of Building Information Modelling, as there is a clear lack of training and qualification schemes in this field. This might indicate a need to focus future BUILD UP Skills support on skills for emerging technologies such as IoT, 3-D printing, and smart appliances. The idea here would be to have better trained professionals making the most of these technologies to leverage the energy performance of buildings and tap into their full energy-saving potential. Another area of focus could be apprenticeships, to better include sustainable energy-related skills in vocational education and training in the construction sector from the very start. These and further options will be assessed as we move closer to the implementation of the next multi-annual financial framework.



**AMANDINE DE COSTER-LACOURT**

Amandine De Coster-Lacourt has worked since 2015 as Project Advisor at the Executive Agency for Small and Medium-Sized Enterprises (EASME). She is in charge of a portfolio of projects in the field of energy efficient buildings, including the Concerted Action of Member States for the Energy Performance of Buildings Directive. She also coordinates the BUILD UP Skills initiative on the upskilling of construction professionals. Prior to this, she worked at the Research & Innovation Directorate General of the European Commission and in the renewable energy sector.



## ARTICLE

GREENING WITH JOBS: EMPLOYMENT EFFECTS OF  
TRANSITIONING TO ENERGY SUSTAINABILITY

Climate change, driven by forces such as deforestation and fossil fuel use, defines today's global challenges. With the Paris Agreement, countries have agreed to take action to limit global warming to 2°C.

Emissions related to the use of fossil fuels to meet energy demand (e.g. electricity, heat, transportation and industry) are the largest contributor to greenhouse gas accumulation (IPCC 2014)<sup>1</sup>. Indeed, action in the energy sector alone can achieve the goals laid out in the Paris Agreement. This includes reducing the share of fossil fuels in the energy mix, increasing the share of renewable energy sources (e.g. wind, solar photovoltaic, biomass and geothermal), and improving energy efficiency across the economy (IEA, 2015)<sup>2</sup>, as depicted in Table 1.<sup>3</sup>

The energy sector is tightly linked to other sectors of the economy; changes in the energy sector will not only affect employment in the sector itself (direct effects) but will also affect other sectors (indirect effects) because of these tight linkages (see, for example, Cassar, 2015<sup>4</sup>; Garrett-Peltier, 2017<sup>5</sup>; OECD, 2010<sup>6</sup>; Stehrer & Ward, 2012<sup>7</sup>; WEF & IHS CERA, 2012<sup>8</sup>; Wild, 2014<sup>9</sup>).

Using EXIOBASE, a multiregional input-output table that serves as a model of the worldwide economy, the ILO (2018)<sup>10</sup> estimated the potential impact on worldwide, economy-wide employment of the adoption of the changes suggested to specific countries and regions by the International Energy Agency (2015)<sup>11</sup>. By 2030, a global economy that

- 1 IPCC, *Climate change 2014: Mitigation of climate change*, Cambridge University Press, New York, 2014.
- 2 International Energy Agency, *Energy technology perspectives 2015: Mobilising innovation to accelerate climate action*, Paris, 2015.
- 3 These changes are the IEA's suggested path to achieve the goal of the Paris Agreement. They are not necessarily linked to each country's Nationally Determined Contributions.
- 4 Cassar, I., *Estimates of output, income, value added and employment multipliers for the Maltese economy*, Central Bank of Malta, Valletta, 2015.
- 5 Garrett-Peltier, H., 'Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model', *Economic Modelling*, 61, 2017, 439–447.
- 6 OECD, *OECD economic outlook 2009*, OECD Publishing, Paris, 2010.
- 7 Stehrer, R., & Ward, T., *Monitoring of sectoral employment*, European Commission, Brussels, 2012.
- 8 WEF, & IHS CERA., *Energy for economic growth: Energy vision update 2012*, World Economic Forum, Geneva, 2012.
- 9 Wild, R., *Type I employment multipliers and effects for the UK for reference year 2010*, Department for Business, Innovation & Skills, London, 2014.
- 10 ILO (International Labour Office), *World Employment and Social Outlook 2018: Greening with jobs*, ILO, Geneva, 2018.
- 11 As described in ILO (2018), the scenario takes into account the projection in electric car sales. See chapter 2 and Annex 2 in ILO (2018) for the data and methods used for the projections.

	OECD countries	Non-OECD countries
<b>Total primary energy demand</b>	<b>-17%</b>	<b>-19%</b>
Renewables	50%	29%
Fossil fuels and nuclear	-28%	-29%
<b>Total fuel input electricity and heat generation</b>	<b>-9%</b>	<b>-19%</b>
Renewables	45%	52%
Fossil fuels and nuclear	-23%	-31%
<b>Total final energy demand from transport</b>	<b>-27%</b>	<b>-30%</b>
Fossil fuels and nuclear	-34%	-36%
<b>Total buildings, agriculture, fishing and other</b>	<b>-15%</b>	<b>-14%</b>
Fossil fuels and nuclear	-29%	-27%
<b>Total gross electricity generation</b>	<b>-6%</b>	<b>-11%</b>
Renewables	40%	49%
Fossil fuels and nuclear	-39%	-38%

Table 1: Changes in energy sources by 2030 suggested by the IEA to achieve the 2-degree scenario. Source: IEA, 2015.

acts to limit climate change will have 0.3 per cent more employment than an economy that follows the business as usual path. That is, some 18 million jobs could be added to the economy following steps to limit global warming to 2°C. Because of efforts to increase energy efficiency and renewable energy, job creation will take place in the construction sector, the manufacture of electrical parts and machinery, the mining of copper ores, and the renewable energy sector (e.g. solar photovoltaic, wind and hydro). As a result of this transition, jobs will also be lost; losses are concentrated in sectors closely related to fossil fuel extraction and the generation of electricity from fossil fuels (e.g. petroleum and coal)<sup>10</sup>.

On a regional scale, Asia and the Pacific, the Americas and Europe will experience net job creation. Africa and the Middle East, given their reliance on fossil fuels,

will experience net job losses. The job losses predicted for the Middle East and Africa can be avoided with policies to diversify their economies. Similarly, net job creation will only occur if emerging industries find adequately skilled workers to satisfy demand<sup>10</sup>.

The projected changes, and the assumptions therein, highlight the complementary policies needed to maximise the creation of decent jobs and to protect workers who may lose out from these changes. These complementary policies include, as highlighted by the ILO's *Guidelines for a just transition to environmentally sustainable economies and societies for all*, skills development policies, industrial policy, macroeconomic policy, active labour market policies, social protection policies and policies to promote social dialogue (ILO, 2015)<sup>12</sup>.

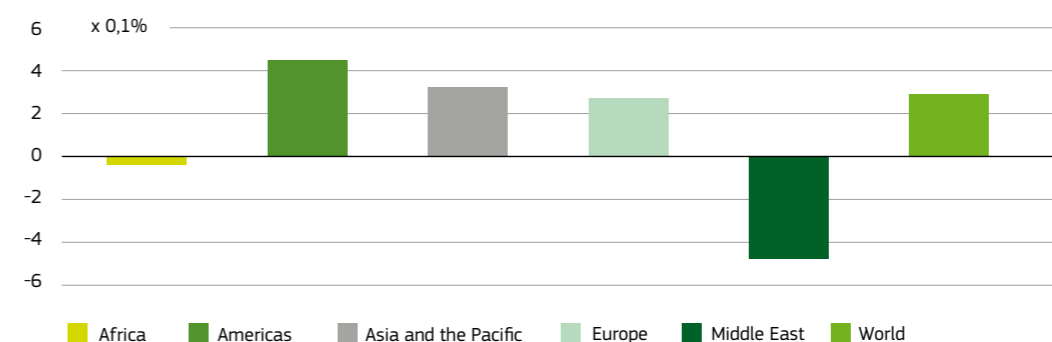


Figure 1: Energy sustainability and employment in 2030 by region<sup>13</sup> Source: ILO, 2018.

- 12 ILO (International Labour Organization), *Guidelines for a just transition towards environmentally sustainable economies and societies for all*, ILO, Geneva, 2015.
- 13 Percentage difference in employment between the sustainable energy scenario and the IEA 6°C (business-as-usual) scenario by 2030. Appendix 2 in ILO (2018) provides further methodological details on the data and methods used.



GUILLERMO MONTT

Guillermo Montt has been a Senior Economist at the Research Department of the International Labour Office (ILO) since 2016. He leads research on the relationship between employment, decent work and the transition to a green economy. Prior to joining the ILO, Guillermo worked for the OECD at the Directorate for Education and Skills and the Directorate for Employment, Labour and Social Affairs. A Chilean national, he holds a PhD. in Sociology from the University of Notre Dame.



**Wolfgang Eichhammer**

Physicist

**Matthias Reuter**

Industrial Engineer

# TALKING TO SETIS

## ABOUT ODYSSEE-MURE: AN INDICATOR APPROACH TO THE EMPLOYMENT EFFECTS OF ENERGY EFFICIENCY

**What are the main characteristics of the ODYSSEE-MURE project?**

The ODYSSEE-MURE project<sup>1</sup> offers a comprehensive monitoring of energy efficiency (EE) trends and policy evaluation in all EU Member States, Norway, Serbia and Switzerland. It relies on two complementary internet databases and analytical tools which are regularly updated by a network of national teams in EU Member States, Norway, Switzerland and Serbia:

- ODYSSEE: detailed EE and CO<sub>2</sub> indicators with data on energy consumption, the activities driving energy demand and the related CO<sub>2</sub> emissions.
- MURE: database on all EE measures implemented at EU or national level (including searchable classifiers, a description and impact evaluation).

Analytical support tools have been developed in order to make the analysis interactive and attractive to decision makers and other actors involved in EE.

One of these tools, the *Facility on the Multiple Benefits of Energy Efficiency (MB-EE)*<sup>2</sup>, aims to quantify the impacts of EE policies on twenty different indicators, covering environmental, social and economic aspects (Figure 1).

**How are employment effects addressed as part of the Facility on the Multiple Benefits of Energy Efficiency (MB-EE)?**

One of the MB-EE indicators focuses on the employment effects of EE measures in the residential sector, using input-output (IO) analysis. EE measures in residential buildings generally require up-front investment, which is recouped through reduced energy costs in subsequent years. Additional investment in EE triggers short-term economic demand impulses, leading to higher production in the relevant industries. To estimate the resulting effects on employment from EE (e.g. from energy saved in heating residential buildings) we considered investments made for the insulation of the building envelope and for the renewal of heating systems. These investments were used as an input for the change in demand in the IO analysis, which results in a change in gross value added (GVA) in various sectors affected directly and indirectly (through intersectoral flows). Based on these changes in GVA, we estimate

the additional jobs in fulltime equivalents (FTE) using national statistics on the average FTE per GVA in the branches considered.

**Which energy efficiency measures and other influencing factors are considered in the employment estimation?**

The EE measures we consider in our analysis, which aim to improve the thermal insulation of the building envelope, include insulating material, plastering and heat-absorbing glazing. The measures are thus matched to the sector 'Constructions and construction works' (F)<sup>4</sup>, whereas investments in EE technology for heating, ventilation and air conditioning are matched to the sector 'Machinery and equipment' (C28)<sup>4</sup>. Changes in demand by households for fuels and electricity due to energy efficient refurbishment are represented in the sector 'Coke and refined petroleum products' (C19)<sup>4</sup> as well as in the sector 'Electricity, gas, steam and air conditioning' (D35)<sup>4</sup>. For the latter, we also address the energy saved in households in monetary terms to calculate the changes in demand in these sectors.

*“ To estimate the resulting effects on employment from energy efficiency, we considered investments made for the insulation of the building envelope and for the renewal of heating systems ”*

**What types of investment are taken into account as part of the analysis?**

The investments associated with energy savings regarding heating were provided by the *Invert/EE-Lab Model*<sup>3</sup>, run by TU Wien, which provides projections for annual net investments in building envelopes and in Heating, Ventilation, Air Conditioning technologies (HVAC) in residential buildings for European countries up



**WOLFGANG EICHHAMMER**

Wolfgang Eichhammer is a physicist with professional experience, gathered in various countries of the European Union and worldwide, in designing and evaluating energy efficiency and renewable and climate policies. He has been a research associate since 1991 in the Competence Center Energy Policy and Energy Systems of the Fraunhofer Institute for System and Innovation Research (ISI) in Karlsruhe. He was Deputy Head of the Competence Center in the years 2001-2011. Since 2012, he has been Head of the Competence Center Energy Policy and Energy Markets. Eichhammer is Professor for Energy Efficiency and Energy Systems Modelling at the Copernicus Institute of Sustainable Development at Utrecht University, The Netherlands.

<sup>1</sup> Overall co-ordination ADEME, Technical coordination by Enerdata and Fraunhofer ISI: [www.odyssee-mure.eu](http://www.odyssee-mure.eu)

<sup>2</sup> <http://www.odyssee-mure.eu/data-tools/multiple-benefits-energy-efficiency.html>

<sup>3</sup> <http://www.invert.at/>

<sup>4</sup> According to NACE rev. 2 classification for economic activities in the European Union





Figure 1: Overview of the indicators considered in the MB-EE Facility. Source: ODYSSEE-MURE

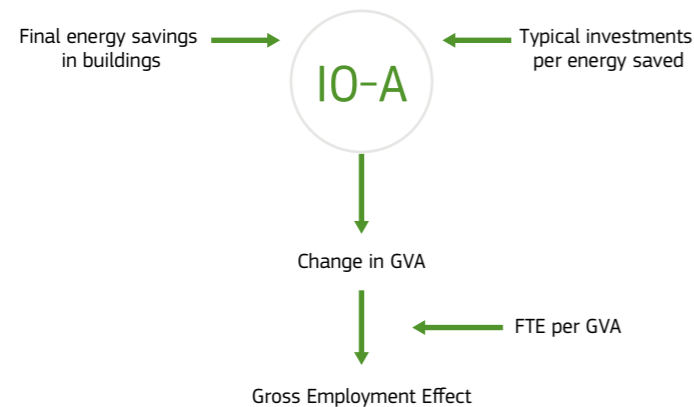


Figure 2: Analysis scheme of employment effects triggered by EE measures. Source: Fraunhofer ISI

to 2030. Only investments improving the EE of buildings are considered. Regular construction and refurbishment costs are excluded from the analysis.

**What is the underlying approach in terms of calculating energy savings when calculating employment effects?**

The MB-EE Facility of ODYSSEE-MURE determines employment effects based on top-down (TD) savings, i.e. calculated using the energy statistics of the ODYSSEE database, or based on bottom-up (BU) savings, i.e. based on policy evaluations from the MURE database. The first

also captures savings (and hence employment effects) which cannot be related directly to a policy measure but which may be due to market transformation.

For the nine European countries considered, employment estimated with the top-down savings approach amounts to around 1,400,000 FTE.

Figure 4 compares employment effects for Germany from top-down and bottom-up savings, showing that employment effects are generated beyond policy programmes. Top-down savings show 569,000 FTEs in



Figure 3: Employment effects based on top-down energy savings in European countries in the period 2010 to 2015. Source: ODYSSEE-MURE

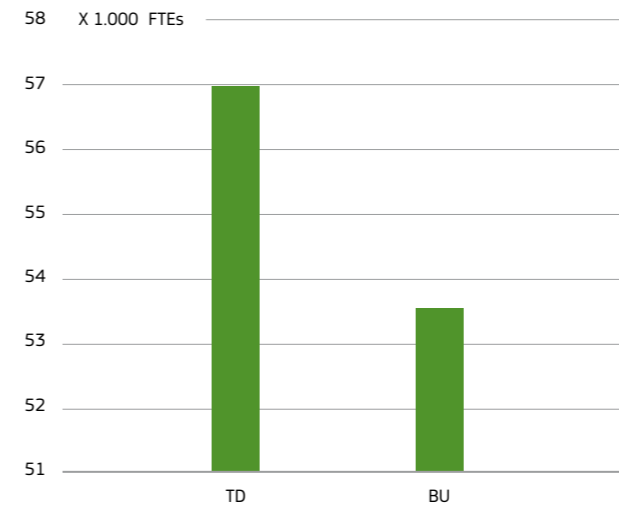


Figure 4: Employment effects for both top-down and bottom-up savings in Germany for 2010 to 2015. Source: ODYSSEE-MURE



**MATTHIAS REUTER**

Matthias Reuter studied industrial engineering at the University of Flensburg, specialising in Energy and Environmental Management. He has been a researcher at the Competence Center Energy Policy and Energy Markets since March 2012, and an external PhD student at the Chair of Energy Efficiency at the University of Geneva since August 2015.

total, mostly associated with the branches 'machinery and equipment' (234,000 FTE) and 'construction and construction works' (224,000 FTE). Considering only bottom-up savings related to EE policies targeting heating consumption in households (mainly the KfW programmes regarding residential buildings)<sup>4</sup>, about 535,000 FTE were generated.

**What are the potential weaknesses and advantages of the MB-EE Employment effects approach?**

The employment effects calculated are gross effects, excluding factors such as displacement effects and indirect second order effects through additional tax revenues, export/imports of EE related goods, etc. However, the indicator approach developed may be gauged with more detailed modelling studies and can easily be extended from year to year, making it attractive for policymakers to include MB-EE in their reporting.

<sup>4</sup> The 'Kreditanstalt für Wiederaufbau' (KfW) is a promotional bank offering financing of purchase, renovation and energy-efficient modification of existing or new properties.

# Lidia Borrell-Damian

Director Research and Innovation at the EUA

# TALKING TO SETIS

## ABOUT EUROPE'S UNIVERSITIES AND THE SET PLAN: LESSONS FROM THE UNI-SET PROJECT

What are the findings of the UNI-SET project on skills demand in clean energy sub-sectors and of graduates by higher education institutions?

The FP7 UNI-SET project<sup>1</sup>, entitled 'Mobilising the Research, Innovation and Educational Capacities of Europe's Universities in the SET Plan', supported the participation of universities in the SET Plan process and in EU energy research in general. Coordinated by the European University Association (EUA)<sup>2</sup>, in partnership with KU Leuven and several universities in InnoEnergy, it mapped the activities of European universities in the energy field and produced an online, interactive tool that displays master's, doctoral and research programmes related to the sector. Additionally, the UNI-SET project surveyed potential energy field employers to gain insight into the current and future demand for professional skills and knowledge in the sector.

As part of these activities, which mobilised representatives from more than 700 universities, we identified skills needed in several areas of the SET Plan priority actions, such as smart grids, system simulation, conventional technologies, renewable technologies, energy efficiency and energy systems control. These are listed in the UNI-SET 'Energy Transition and the Future of Energy Research, Innovation and Education: An Action Agenda for European Universities' (Action Agenda)<sup>3</sup>.

Furthermore, we found that more than 70% of universities engaged<sup>4</sup> in energy-related research reported regular university-business collaboration, but much less in master programmes. In fact, many of these programmes are rather siloed on average, i.e. 70% of the 579 master's programmes included in the UNI-SET survey are purely in Science, Technology, Engineering and Mathematics (STEM) disciplines. But at least 18% combined STEM and Social Sciences and Humanities (SSH), usually business and management. This is roughly equivalent to 26 000 and 6 600 students respectively<sup>5</sup>.

All the facts and discussions led us to conclude that emerging skills needs follow the rapid pace of change in the European energy system. This, in turn, affects the

spectrum of professional skills required in the energy sector. Therefore, action needs to be taken immediately, and there is a lot of potential for more collaboration between universities and companies to integrate these new skills needs into their curricula and programmes.

*'The UNI-SET project surveyed potential energy field employers to gain insight into the current and future demand for professional skills and knowledge in the sector'*

To show the extent of the exercise, let us look at a few numbers summarising participation: over 200 universities and 100 companies took part in the UNI-SET surveys<sup>6</sup>, and over 700 did so in a series of high-level events. First, six small, targeted 'professional profile identification workshops' were hosted by several university members of KIC InnoEnergy<sup>7</sup>, namely KU Leuven, UPC BarcelonaTech, Grenoble INP, Royal Institute of Technology (KTH), Jagiellonian University and Karlsruhe Institute of Technology (KIT). Second, to reach out to the large university community, five 'Energy Clustering Events' (ECEs), gathering 120 participants each, were organised around the main SET Plan priority actions. The Workshops and ECEs brought together professors, researchers and companies engaged in producing and delivering innovative educational programmes to better equip graduates with skills for the labour market. The ECEs were hosted by the National University of Science and Technology (NTNU), Politecnico di Torino, Politehnica di Bucharesti, Imperial College London and KU Leuven.



LIDIA BORRELL-DAMIAN

Lidia Borrell-Damian has been Director for Research and Innovation (R&I) at the European University Association (EUA) since 2014. She is responsible for the overall portfolio of EUA's R&I activities, coordinating EU R&I policy development based on the evidence provided by EUA universities and National Rectors' Conferences. Her areas of work include EU Funds for R&I; the European Research Area priorities; the EU Digital Agenda; Open Science and Doctoral Education. She coordinates scientific policy input through the EUA-Energy and Environment Platform (EUA-EPUE), and manages relations with major energy EU stakeholders in the SET Plan, such as the European Energy Research Alliance (EERA) and InnoEnergy. Lidia Borrell-Damian holds a Doctorate in Chemistry, Chemical Engineering Specialty (photovoltaics), from the University of Barcelona (1987).

1 [www.uni-set.eu](http://www.uni-set.eu)  
2 <https://eua.eu/>  
3 <https://energy.eua.eu/downloads/publications/energy-transition.pdf>  
4 202 European universities were engaged in the survey  
5 The UNI-SET Universities Survey Report 2017  
6 <https://energy.eua.eu/component/attachments/attachments.html?id=298>  
7 <http://www.innoenergy.com/>





*UNI-SET has enabled us to build an extensive network of universities and their business partners, ready to engage further in the development of new short programmes and modules*

#### What are the main points for action to overcome remaining skills mismatches?

Through UNI-SET, we identified a range of actions that can support universities to prepare graduates in the best possible way for their future roles as researchers or professionals in the labour market. One is, of course, to interact more with industry, for instance through mobility programmes. Another is the development of state-of-the-art short programmes and modules in close collaboration with business. Companies and other stakeholders (e.g. city councils) are increasingly interested in educational content and delivery by

universities. However, the collaboration focuses on common research interests, and collaboration in education is not yet the norm.

UNI-SET also provided some practical recommendations to address multidisciplinary needs based on pioneering interdisciplinary teams in universities. In the *Action Agenda*, we covered this dimension by looking at the technical, economic, political and societal needs of the areas above, and provided examples of how to integrate them in, for instance, master programmes or individual courses. The study also covered cross-cutting issues such as data analytics, urban planning and energy markets. Universities can use the *Action Agenda* as a basis to develop new courses, including intended learning outcomes and employment skills, which are at the core of any higher education curriculum.

#### How will UNI-SET work continue in the future?

UNI-SET has enabled us to build an extensive network of universities and their business partners, ready to engage further in the development of new short programmes and modules. This would be a way to produce teaching and learning material based on state-of-the-art knowledge, to educate, train, or re-train professionals and researchers for the labour market. We cannot anticipate when research and innovation breakthroughs are going to take place, but we can build the human resource foundation, i.e. people equipped with the most up-to-date knowledge to address the SET Plan priority actions, to ensure a sustainable energy future for Europe.

For EUA, this will take place through our **Energy & Environment Platform**<sup>8</sup>. We will continue to promote the UNI-SET outputs such as the *Action Agenda* and the *Roadmap for European Universities in Energy*<sup>9</sup>, as we did in the first ECE after UNI-SET, hosted by Université La Lorraine, in March this year. We are regularly consulted by the European Commission, as part of the stakeholders' community engaged in the implementation of the SET Plan, and we contribute through our pan-European network of experts in energy research and education. We are exploiting fully the outcomes of UNI-SET to further build a network of universities and businesses to serve the objectives of the SET Plan. We are doing so in collaboration with two other large pan-European associations in the energy research landscape, the **European Energy Research Alliance (EERA)**<sup>10</sup> and **KIC InnoEnergy**<sup>11</sup>. The common position we published in June this year, with consensus views on energy for the new **Framework Programme Horizon Europe**<sup>12</sup>, demonstrates our commitment to working towards a sustainable energy future.

<sup>8</sup> <https://energy.eua.eu/>

<sup>9</sup> <https://eua.eu/component/publications/publications/78-position/628-roadmap-for-european-universities-in-energy%20.html>

<sup>10</sup> <https://www.eera-set.eu/>

<sup>11</sup> <http://www.innoenergy.com>

<sup>12</sup> <https://energy.eua.eu/news/29:horizon-europe-should-aim-for-a-sustainable-energy-future.html>

## ARTICLE

### THE EFFECTS OF VEHICLE ELECTRIFICATION ON EMPLOYMENT IN GERMANY: IMPLICATIONS OF THE JOINT RESEARCH PROJECT ELAB 2.0

The automotive industry is set to undergo an unprecedented transformation. Nowadays, value creation is related to more than merely vehicles. It encompasses countless services around mobility, for which the ongoing digitalisation of products and processes has been decisive. Society's expectations of transport have evolved too: it should be seamless and sustainable. In order to meet such demands, automotive manufacturers and suppliers will face technological, economic and social challenges.

Efforts towards the decarbonisation of the mobility sector, i.e. compliance with **CO<sub>2</sub> emission legislation**<sup>1</sup>, have resulted in the electrification of vehicle drivetrains, among other developments<sup>2</sup>. Moreover, stagnating demand in Europe for automobiles, due to market saturation, continuous globalisation and the relocation of production facilities into emerging markets such as India and China, threatens to affect European car production.

The consequences of this evolution concern the entire automotive value chain. First, the distribution of market share associated with the various powertrain technologies

is shifting: the volume of components and powertrains produced for vehicles with internal combustion engines (ICEs) is declining, while production volumes for vehicles that use electric motors and traction batteries (hybrid and battery electric vehicles; HEVs and BEVs) are increasing. Furthermore, Germany suffers additional pressure due to competition from low-wage countries.

*Continuous globalisation and the relocation of production facilities into emerging markets such as India and China, threatens to affect European car production*

<sup>1</sup> [https://ec.europa.eu/clima/policies/transport/vehicles/cars\\_en](https://ec.europa.eu/clima/policies/transport/vehicles/cars_en)

<sup>2</sup> Electric vehicles combine an energy efficient powertrain system with the opportunity of using renewable energy sources.



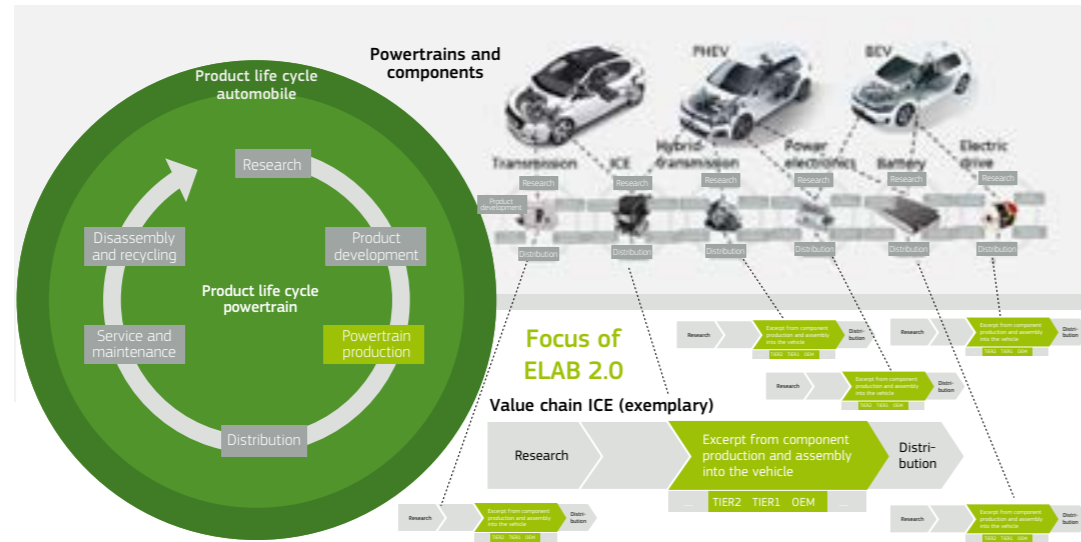


Figure 1: ELAB 2.0's scope and bottom-up approach. Sources: BMW, Bosch, Daimler, Peugeot, Volkswagen, ZF.



**DANIEL BORRMANN**

Daniel Borrmann obtained his degree in Mechanical Engineering in 2010. Since then, he has been a research associate at the Fraunhofer Institute for Industrial Engineering IAO in the area of Mobility Innovation. His current research work focuses on the analysis of the technical, economic and social challenges and opportunities caused by electric mobility. One concrete example of his work is the identification of technical specifications as well as

an evaluation of costs and employment for the production of future powertrains in the Structure Study BWe mobile 2015. The objective of this research project was to estimate the economic and social impact of electric vehicles in Baden-Württemberg. He was also responsible for the development of the ELAB 1.0 and ELAB 2.0 forecasting model to calculate the impact of a strong dissemination of electric powertrains on employment in the automotive industry.



**FLORIAN HERRMANN**

Florian Herrmann obtained his master's degree in Industrial Engineering from the Karlsruhe Institute of Technology (KIT) and his doctoral degree in Technology Management from the University of Stuttgart. From 2011 to 2015, he worked as a research associate in the area of Mobility Innovation at the Fraunhofer Institute for Industrial Engineering IAO in Stuttgart, Germany. In 2015, he became Head of the Competence Centre Mobility

Innovation, and since April 2018, he has been Head of the Research Unit Mobility and Innovation Systems at the same institution. The focus of his research work has been the analysis of value creation structures and their evolution in the automotive industry.

The ELAB 2.0 project<sup>3</sup> mainly aims at a scenario-based, quantitative evaluation of the effects of vehicle electrification on employment. The analysis ranges from the production of important powertrain components by Tier 1 and Tier 2 suppliers<sup>4</sup>, through the assembly of complete powertrain systems and up to their final assembly in the vehicle at the automotive manufacturers' (OEMs) premises. A qualitative estimation of the effects on other stakeholders has also been carried out. The results achieved with ELAB 2.0's forecasting model are used to provide recommendations to deal with these effects at strategic level.

Each phase of the automobile's lifecycle will, in one way or another, be influenced by the electrification of powertrains. Phase-specific repercussions on personnel requirements, especially quantitatively speaking, follow particular patterns and are driven by different factors. Hence the decision to limit the project's scope to the production of powertrains for passenger cars.

ELAB 2.0 distinguishes itself from other research projects by following a bottom-up approach. Numerical data regarding the personnel requirements for the manufacturing of single powertrain components, e.g. pistons and piston rods, are aggregated in order to

<sup>3</sup> The research project ELAB 2.0 was a joint initiative comprising partners from German automobile manufacturers and suppliers, automotive association and union representatives and scientific organisations. We want to thank all partners for their contribution.

<sup>4</sup> Tier 1 suppliers deliver their products directly to the automotive manufacturers. They work very closely with OEMs and are responsible for the development and manufacturing of complex systems. Tier 2 suppliers are located at a minor sub-assembly phase. They sell less complex components to Tier 1 suppliers (Heneric, O., Licht, G., Sofka, W., *Europe's Automotive Industry on the Move – Competitiveness in a Changing World*. Zentrum für Europäische Wirtschaftsforschung GmbH. Physica-Verlag Heidelberg, 2005, p. 19.)



**CAROLINA SACHS**

Carolina Sachs obtained her bachelor's degree in Industrial and Systems Engineering at the Monterrey Institute of Technology and Higher Education in Mexico. She obtained her master's degree in Industrial Engineering from the Kiel University of Applied Sciences in Germany. She worked from 2005 until 2010 as Quality and Project Engineer for several European and North American vehicle producers and suppliers. Since 2010, she has been a research associate in the area of Mobility Innovation / Mobility Ecosystems at the Fraunhofer Institute for Industrial Engineering IAO / Institute of Human Factors and Technology Management (IAT) at the University of Stuttgart in Germany. Her research work focuses on the analysis of the evolution of automotive supply chains and production systems in the context of vehicle electrification and digitalisation, market potentials of micro mobility and the assessment of the implications of powertrain electrification on skills and labour.

calculate personnel requirements for complete systems, such as the electric motor and traction battery. These, in turn, can be allocated to different representative powertrains. A set of assumptions applied throughout the entire ELAB forecasting model simplifies the data collection process and ensures accuracy and comparability among all data (see Table 1). The selected components and production processes mainly encompass the share of value creation that, in general terms, is representative of the OEMs, Tier 1 and Tier 2 suppliers. Due to compliance rules, the evaluation carried out with the ELAB model purposely does not differentiate between the workforces required by each project partner, but rather aggregates the data provided and handles them anonymously.

The results obtained during the course of ELAB 2.0 have shown that the effects of powertrain electrification on employment will indeed be significant. Even in a scenario that assumes a production mix with a rather moderate share of PHEVs and BEVs in 2030 (Scenario

1), a reduction in personnel requirements can be expected. An extreme scenario that assumes an almost maximum penetration of electric vehicles (Scenario 3), and considers the effects of productivity rates in its calculations, concludes that by 2030, electric mobility could have a direct or indirect impact on every second job related to drive technologies. Additional factors, such as higher productivity rates, a more acute market stagnation over time or the relocation of value-chain processes outside Europe could even aggravate this situation. Regions where industry has so far profited from focusing on a single technology, mostly one related to ICEs, could face particular difficulties in securing employment and the region's economic attractiveness. However, the timely implementation of a forward-looking strategy can lead to a socially, environmentally and economically successful structural change. Political decision makers are called upon to develop strategies to drive innovation and support stakeholders along and around the automotive value chain on their transition process towards sustainable mobility.

Parameter	Assumption
Market / region	Continental Europe
Market segment	C-Segment for front-wheel drive passenger cars
Production volume	One million powertrains
Representative powertrains	<ul style="list-style-type: none"> <li>• ICE including Mild Hybrid (MHEV)</li> <li>• Plug-In Hybrid (PHEV)</li> <li>• BEV</li> </ul>
BEV production share in 2017 / 2025 / 2030	<ul style="list-style-type: none"> <li>• Scenario 1: 1% / 15% / 25%</li> <li>• Scenario 2: 1% / 20% / 40%</li> <li>• Scenario 3: 1% / 40% / 80%</li> </ul>
Productivity rates	<ul style="list-style-type: none"> <li>• 2% p.a. for conventional components</li> <li>• 3% p.a. for new components for electric cars</li> </ul>
Employee types	<ul style="list-style-type: none"> <li>• Direct employees</li> <li>• Indirect employees</li> <li>• Employees indirectly related to production</li> </ul>

Table 1: Assumptions in ELAB 2.0's forecasting model. Source: ELAB 2.0



## European Commission

Joint Research Centre

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## SETIS Magazine

SETIS launches a new magazine quarterly, each issue is dedicated to a different low-carbon energy technology or relevant aspects of the sector. It covers the latest developments in the subject in question. Relevant personalities are invited to write articles outlining the main challenges and priorities facing their sectors, and interviews are conducted with key representatives from the related topic.

The magazines also include a SET Plan news section detailing the last developments to achieve the Integrated SET Plan objectives, and European Commission services and/or relevant organizations/institutions are invited to provide a foreword that highlights the main policy developments on the subject.

## Jobs and skills in the energy transition

This edition of SETIS Magazine takes a closer look at the jobs- and skills-related aspects of the clean energy transition. It examines the monitoring and projection of changes in employment, as well as efforts to identify and resolve skills needs. Renowned experts from the wider international research and policy community assess the state of the art and present the latest findings of the clean energy employment assessment field.

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Europe Direct is a service that answers your questions about the European Union. You can contact this service:  
– by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),  
– at the following standard number: +32 22999696 or  
– by email via: [https://europa.eu/european-union/contact\\_en/](https://europa.eu/european-union/contact_en/)

## Finding information about the EU

### Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: [https://europa.eu/european-union/index\\_en/](https://europa.eu/european-union/index_en/)

### EU publications

You can download or order free and priced EU publications at: <https://publications.europa.eu/en/publications>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see [https://europa.eu/european-union/contact\\_en/](https://europa.eu/european-union/contact_en/))

### EU law and related documents

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: <http://eur-lex.europa.eu>

### Open data from the EU

The EU Open Data Portal (<http://data.europa.eu/euodp/en>) provides access to datasets from the EU. Data can be downloaded and reused for free, both for commercial and non-commercial purposes.

