



Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy



Co-funded by the Erasmus+ Programme of the European Union

Highlights of MATES Pilot Experiences

Definition of new Occupational Profiles

Layman Report

April 2022



About this Report

This document was developed through the EC-funded Erasmus+ project **MATES: Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy**.

The objective of the MATES project is to develop a skills strategy that addresses the main drivers of change in the maritime industries, in particular shipbuilding and offshore renewable energy. Both sectors are strongly linked and require new capacities to succeed in an increasingly digital, green and knowledge-driven economy.

Duration: January 2018 – April 2022 (52 months)

More information on the project is available at projectmates.eu.

Document information	
Short description	Summary of the Pilot Experience DOP “Definition of new Occupational Profiles”. The main achievements and European added value are clearly outlined to promote further implementation among interested experts and stakeholders.
Next steps	These results present a solid foundation for the Maritime Technologies Skills Strategy and the long-term Action Plan and sustainability.
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Partners involved



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1. Context

MATES: Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy is an EC-funded, ERASMUS+ project with the objective to develop a skills strategy that addresses the main drivers of change in the maritime industries, in particular shipbuilding (SB) and offshore renewable energy (ORE).

The MATES Pilot Experiences are vital components of the strategic design of the project. They consist of a series of activities that fall in line with the priority areas needed to support training and development of the shipbuilding and offshore renewable energy industries. This report summarises the outcomes and learning elements from one of these Pilot Experiences: **Definition of Occupational Profiles (DOP)**.

Results of this Pilot Experience are particularly relevant for the following stakeholder groups:

- ESCO community
- Industry
- Research and Development Centres/ Universities
- Vocational and Educational Training Centres

ESCO, the multilingual classification of European Skills, Competences, Qualifications and Occupations, is part of the Europe 2020 strategy. It was launched by the European Commission services in 2010 by means of an open stakeholder consultation. [ESCO v1](#) is a database available in 28 languages¹. Figure 1 shows how useful it is to have occupations, skills and qualifications listed in a common framework which can match the industry needs with the educational system.



Figure 1: Description of ESCO practical use².

The MATES project provided an opportunity to contribute to the ESCO update, by feeding the database with the expected new profiles in the Shipbuilding (SB) and Offshore Renewable Energy (ORE) sectors and updating the ESCO descriptors for the existing occupations related to those sectors. Within this Pilot Experience the MATES project tested a new Protocol to facilitate the collaborative review of occupational profiles, to obtain insights on sectoral needs from a wider range of technical experts. Contributions to the ESCO community require a broad knowledge base of the ESCO taxonomy and terminology employed, as well as an advanced level of English and the technical expertise related to the occupations that are being defined. The DOP Pilot Experience has tested mechanisms to bridge these barriers, in order to facilitate the involvement of relevant experts in the continuous improvement and updating of the database.

¹ ESCO is available in all EU languages, plus Icelandic, Norwegian and Arabic

² Diagram from the ESCO presentation at the MATES project' Final Conference <https://www.projectmates.eu/wp-content/uploads/2022/04/MATES-Final-Conference-Report.pdf>

2. Overview of the DOP Pilot Experience

The goals for this Pilot Experience are:

1. To update relevant **ESCO** descriptors for the occupations related to the SB and ORE sectors.
2. To define the **new occupations expected to emerge in the next decade**.
3. To develop a protocol to **facilitate the transfer of inputs from external experts to the ESCO** community.
4. To **transfer lessons learnt from the MATES experience and recommendations to the ESCO Board**.

To achieve those goals, a suitable and effective methodology was set up to identify:

- a) the current skills needed in the maritime technologies (SB and ORE sectors),
- b) the expected future skills needs, both for current occupations and the projected future occupations.

Therefore, the MATES partnership set up and developed sector-specific partnerships with relevant educational and scientific communities, industry, society, and administrations. MATES engaged in an open and transparent way with experts chosen from these sector-specific partnerships, in order to gain their feedback and benefit from their experience and advice during the development of the project activities, and in particular regarding the skills intelligence analysis. These experts were a major constituent of the MATES' network of 231 experts which had previously been organized and databased into eight Thematic Groups³. The key reports for the present Pilot Experience are shown in Figure 2.

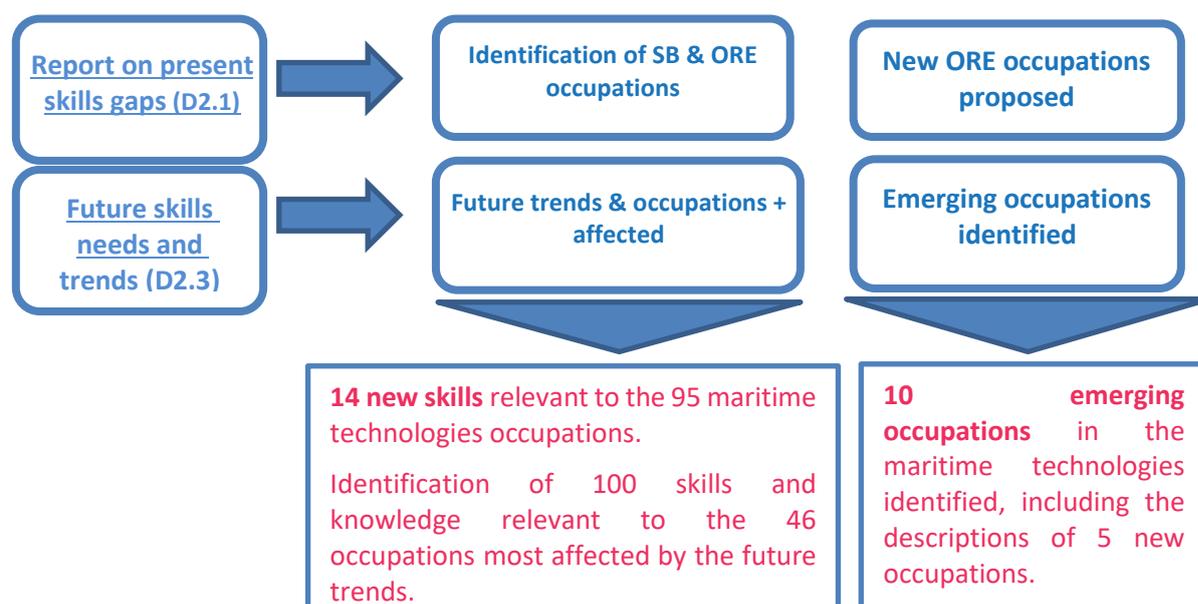


Figure 2: The DOP methodology and key results

³ Offshore Energy, Shipbuilding, Innovation Management, Gender Balance, Ocean Literacy, Green Technologies, Digital Technologies, Vocational Education Training Standards & Governance. List and characterization of experts is available at <http://whowhomates.com/inicio.php>

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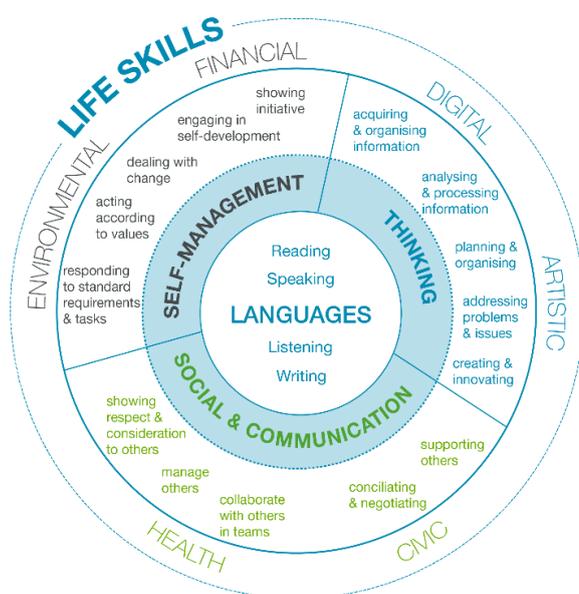
1 - The [MATES Baseline Report on Present Skill Gaps⁴ \(Executive report⁵\)](#) maps the existing occupational profiles that are involved in the main sectors' activities and their corresponding skills and competences, based on ESCO classifications, and identifies skills gaps of the sectors' workforce and skills mismatch between education and training providers and the industries' relevant requirements. This report was the basis for the identification of emerging occupations and the building of future scenarios for forecasting skills requirements in the short, medium and long-term.

2 – The [MATES report entitled “Foresight Scenarios Identifying Future Skills Needs and Trends”⁶](#) deals with the identification and analysis of emerging trends in the Shipbuilding and Offshore Renewable Energy sectors with respect to new technologies, new skills, training programmes and other associated parameters. This report provided a clustering of the key technologies in three time-horizons and a description of future scenarios of skills and competences, as well as gaps in the current and foreseen levels sectors in the short, medium and long term.

Based on this information, during the DOP Pilot Experience a collaborative approach to review **the 95 occupational profiles** involved in the shipbuilding and offshore renewable energy value chain was tested. The associated skills and competences were addressed in detail: **14 new skills** relevant to them were identified and described; **the 46 occupations deemed to be most affected by emerging trends** in the shipbuilding and offshore renewable energy occupations **were matched with the 100 skills** most important for their updating.

In addition, **10 occupations** not included in the previous list and which were **expected to gain relevance in the future** scenarios were also identified. From these, **5 occupations which did not exist in the ESCO database** were described following ESCO taxonomy; and the remaining 5 were updated.

The ESCO secretariat processed all the details from this feedback from MATES, which was then discussed with and accepted by all Member States in January 2021. Thus MATES specific contribution was finally included in the updated ESCO v1.1 classification released in February 2022.



Transversal Skills and Competences (TSC) were first introduced in the ESCO database in 2020 although the structure it followed was not available until 2021. As the MATES skills intelligence analysis was developed in 2019, using P21 framework⁷, all MATES findings addressing TSC will require a deep review for their contextualisation in the present ESCO framework.

As a result, some of the proposed skills and knowledge discussed during the DOP Pilot Experience were not introduced during that review and it is expected that they will be included in the ESCO v1.2 revision by the Large Scale Partnership that launched the Pact for Skills in the ORE. **The most relevant Transversal Skills pending for inclusion were those addressing Ocean Literacy**, which could apply to most of the maritime sectors.

Figure 3 shows the framework for the transversal skills adopted by the ESCO community.

Figure 3: A common framework for transversal skills. Presentation by Dr. Martin Noack 26.11.2020¹

⁴ Sdoukopoulos, E., Tsafonias, G., Perra, V.M., Boile, M., 2020. Baseline Report on present skills needs in shipbuilding and offshore renewables value chains, MATES project results. projectmates.eu/wp-content/uploads/2020/10/MATES_D2.1_Final_Oct-2020.pdf

⁵ projectmates.eu/wp-content/uploads/2021/01/MATES-D2.1-Baseline-Executive-Report-Jan-2021-1.pdf

⁶ Ergas I., Smyrnakis G. (2020). Foresight scenarios identifying future skills needs and trends. Results of the MATES project projectmates.eu/wp-content/uploads/2021/01/MATES-D2.3-Foresight-scenarios-Jan-2020.pdf

⁷ <http://www.battelleforkids.org/networks/p21>

OUTCOMES

- 100 occupational profiles involved in the SB and ORE value chains were reviewed. Building on the insights made by industry experts, 14 new skills and 5 new occupations were identified, described and have now been included in v1.1 of the ESCO database. In addition, 46 occupations (occ) deemed to be the most affected by emerging trends were matched with the 100 skills considered to be the most necessary for their updating.
- A [protocol](#) for the collaborative review occupational profiles and skills in ESCO database.

3 Achievements

This PE contributed to the updating of the ESCO database, specifically with the expected new occupational profiles in the SB and ORE sectors and cataloguing occupations in terms of skills and capacities within the ESCO framework.

Table 1: Quantitative summary of occupational profiles and skills analysed in each targeted sector, distinguishing the primary occupations from the secondary ones. Number of new skills relevant to them identified. Number of emerging occupations as a result of the future trends, distinguishing the new ones from those existing that have been updated. Number of occupations that will require training and the most relevant skills for their adaptation to future scenarios.

	SHIPBUILDING	OFFSHORE RENEWABLE ENERGY	SB+ ORE	TOTAL
Occupations reviewed	28	35	32	95
Primary	27	18		
Supporting	1	17		
New skills identified		11	3	14
Emerging occupations	3	7		10
New	1	3	1	5
Existing updated	2	3		5
Occupations most affected by future trends	19	17	10	46
Future in-demand skills	37	12	51	100

3.1. Results on skills

- A set of 2 skills (s) and knowledge (k) was proposed to be added to all those occupations identified as relevant to the MATES target sectors:

- **marine engineering (k):** applying to all occupations related to SB and ORE
- **marine technology (k):** applying to SB and ORE, but also to other maritime occupations such as those of the oil and gas sector, or maritime transport

- Two new knowledge items (k) were proposed to be added to all those occupations identified as relevant to the ORE sector:

- **offshore renewable energy technologies (k):** applying to primary and supporting occupations in the ORE
- **offshore constructions and facilities (k):** applying to primary and supporting occupations in the ORE

- 10 new skills related to certain new occupations and future trends were identified and described:

- **research locations for offshore energy farms (s):** essential skill for the ORE engineer.
- **design offshore energy systems (s):** essential skill for the ORE engineer.
- **Install offshore renewable energy systems(s):** essential skill for the ORE technician.
- **perform hydrodynamic calculations (s):** optional skill for the ORE engineer, could also apply to occupations from other sectors such as oil and gas.
- **advise on offshore renewable energies subjects (s):** cross-sectoral, optional for the ORE engineer; could also apply to lawyer, corporate lawyer and legal consultant.
- **maritime law (k):** cross-sectoral, essential for the ship planner, ship duty engineer, vessel operations coordinator, marine engineer, naval architect, maritime water transport general manager, vessel assembly inspector; optional for the ORE engineer, lawyer, corporate lawyer, legal consultant, mechanical engineer, shipbroker, fleet commander; marine chief engineer; mechanical engineer, marine surveyor.
- **types of tidal stream generators (k):** essential for the ORE engineer, optional for the ORE plant operator.
- **Inspect tidal stream generators (s):** essential for the ORE technician.
- **types of wave energy converters (k):** essential for the ORE engineer, optional for the ORE plant operator.
- **Inspect wave energy converters (s):** essential for the ORE technician.

3.2. Results concerning occupations

Emerging occupations in the SB sector. The foresight scenarios identified three emerging occupations in the SB sector: These occupations were not identified as primary or supporting occupations for the SB sector in the MATES Baseline report of present skills gaps, but were considered as gaining relevance in the Foresight scenarios identifying future skills needs and trends. One of them was proposed for inclusion as a new occupation, while the other two were proposed as specialisations of existing occupations.

NEW occupation emerging in the SB sector: this occupation which didn't exist in ESCO V1.0 was described for its inclusion in ESCO v1.1

- **Alternative fuels engineer (new):** includes skills and knowledge associated with the design and development of systems, components, motors, and equipment which replaces the use of conventional fossil fuels as the main power source for propulsion and power generation.

Table 2: Description of the new occupational profiles for the shipbuilding sector included in the ESCO v1.1 as a result of the DOP Pilot Experience.

Occupation	Code & Hierarchy	Description
Alternative fuels engineer	2149.9.1 Engineering professionals not elsewhere classified	Alternative fuels engineers design and develop systems, components, motors, and equipment which replace the use of conventional fossil fuels as main power source for propulsion and power generation with the feature of using renewable energies and non-fossil fuels. They strive to optimise energy production from renewable sources and reduce production expenses and environmental strain. The alternative fuels employed mainly include Liquefied Natural Gas (LNG), Liquefied Petroleum Gas (LPG), biodiesel, bio-alcohol as well as electricity (i.e., batteries and fuel cells), hydrogen and fuels produced from biomass.

UPDATED occupations emerging in the SB sector: though these occupations existed in ESCO V1.0, they were not linked to the SB sector. Their descriptors were revised to match the skills that will be required for their specialisation in shipbuilding, and proposed for its inclusion in ESCO v1.1.

- **Automation engineer (updated):** automation engineers research, design, and develop applications and systems for the automation of the production process. An update of the existing profile in the ESCO database was proposed, to include the required specialisation for the shipbuilding sector.
- **Automation engineer technician (updated):** automation engineering technicians collaborate with automation engineers in the development of applications and systems for the automation of the production process. An update of the existing profile in the ESCO database was proposed, to include the required specialisation for the shipbuilding sector.

For these two updated occupations new essential skills and knowledge that are increasing in relevance were proposed, as well as the skills and knowledge required for the specialisation in vessel automation.

Table 3: ESCO descriptors included in the ESCO v1.1 for the updating of the emerging occupations in the SB sector, indicating in bold the new skills and competences.

Occupation	Essential skills	Essential knowledge	Optional skills	Optional knowledge
automation engineer	-assemble mechatronic units assemble sensors -ensure public safety and security -install automation components -install mechatronic equipment -maintain robotic equipment -make use of personal robots for practical support -simulate mechatronic design concepts -test mechatronic units -test sensors	robotic components robotics sensors	-ensure vessel compliance with regulations -ensure vessel security	guidance, navigation and control systems maritime law marine engineering marine technology
automation engineering technician	-assemble mechatronic units assemble sensors -install mechatronic equipment - maintain robotic equipment -make use of personal robots for practical support -test mechatronic units -test sensors	robotic components robotics sensors	-ensure vessel compliance with regulations	guidance, navigation and control systems marine engineering marine technology

Emerging occupations in the ORE sector: The Delphi exercise identified seven emerging occupations in the ORE sector: These occupations were not identified as primary or supporting occupations for the ORE sector in the MATES Baseline report of present skills gaps, but were considered as gaining relevance in the Foresight scenarios identifying future skills needs and trends. Four of them were proposed for inclusion in ESCO as new occupations, while the remaining three were proposed as specialisations of existing occupations:

NEW occupations emerging in the ORE sector: these occupations did not exist in ESCO V1.0 and were described for inclusion in ESCO v1.1

- **Offshore renewable energy engineer (new)**, which includes skills, qualifications and competences associated with offshore constructions and infrastructures, marine geotechnical engineering, marine engineering, offshore renewable energies technologies, combined with electromechanical engineering skills necessary to the sector, such as mechatronics, automation, etc.
- **Offshore renewable energy technician (new)**, which includes expertise in offshore wind energy technology, tidal stream and wave generators and the efficiency and behaviour of offshore energy systems, as well as the necessary skills for working at height and hazardous environments, such as the ocean.
- **Offshore renewable energy plant operator (new)**, with similar skills, qualifications and competences to those of a power production plant operator and solar power plant operator but a specialisation in offshore wind, wave or tidal farms.
- **Drone pilot:** this occupation did not exist in ESCO, and has been included as cross-sectoral, with some specific skills related to ORE.

Table 4: Description of the new occupational profiles for the ORE sector included in the ESCO v1.1 as a result of the DOP Pilot Experience.

Occupation	Code & Hierarchy	Description
ORE engineer	2149.9.5 Engineering professionals not classified elsewhere	Offshore renewable energy engineers design and supervise the installation of offshore energy farms and equipment. They research and test locations to find the most productive location, ensure the successful execution of the design plan and make any necessary modifications or provide targeted advice. Offshore renewable energy engineers test equipment such as wind-turbine blades, tidal stream and wave generators. They develop strategies for more efficient energy production, and environmental sustainability.
ORE technician	3119.11 Physical and Engineering Science Technicians not classified elsewhere	Offshore renewable energy technicians install offshore energy farms and equipment. They ensure the that equipment operates in compliance with regulations and assist the offshore renewable energy engineers in the construction of energy devices such as wind turbine blades, tidal stream and wave generators. They also react to system problems, and repair faults.
ORE Plant Operator	3131.1 Science and engineering associate professionals	Offshore renewable energy plant operators operate and maintain equipment which produces electrical energy from marine renewable sources such as offshore wind power, wave power, or tidal currents. They monitor measuring equipment to ensure the safety of operations, and that production needs are met. They also react to system problems, and repair faults.
Drone Pilot	3153.4 Science and engineering associate professionals	Drone pilots remotely operate unmanned aerial vehicles (UAVs). They navigate the drone as well as activate other equipment such as cameras, sensors as LIDARS to calculate distances, or any other type of instrumentation.

UPDATED occupations emerging in the SB sector: these occupations existed in ESCO V1.0 but were not linked to the ORE sector. Their descriptors were revised to match the skills that will be requested for their specialisation in offshore renewables, and proposed for inclusion in ESCO v1.1.

- **Instrumentation engineer (update)** with a specialisation in MRE devices and qualified in envisioning and designing equipment and systems for remote monitoring of the production sites and processes in order to facilitate the interface between the farm operators, the marine renewables devices and the production systems. This profile was proposed for inclusion in the ESCO database as a specialisation of the existing occupation of instrumentation engineer
- **Instrumentation engineering technician (update)** who assists the MRE control and instrumentation engineer and is responsible for building, testing, monitoring, and maintaining of the technical equipment used in the production process. This profile was proposed for inclusion in the ESCO database as a specialisation of the existing occupation of instrumentation engineering technician.
- **Lawyer, corporate lawyer and legal consultant (update):** the same update is proposed for the three occupations, for their specialisation in ORE.

For these three updated occupations new essential skills and knowledge that are increasing in relevance were proposed, as well as skills and knowledge required for the specialisation in vessel automation.

Table 5: ESCO descriptors included in the ESCO v1.1 for the updating of the emerging occupations in the ORE sector, indicating in bold the new skills and competences.

Occupation	Essential skills	Essential knowledge	Optional skills	Optional knowledge
Instrumentation engineer	-analyse big data -perform data analysis -test sensors -use remote control equipment -use specific data analysis software	automation technology control systems environmental legislation environmental threats	-conduct quality control analysis -inspect offshore constructions -oversee pre-assembly operations -utilise machine learning	marine engineering marine technology offshore constructions and facilities offshore renewable energy technologies
Instrumentation engineering technician			-maintain sensor equipment -test sensors -use remote control equipment -utilise machine learning -write technical reports	cloud technologies data mining data storage marine engineering mechatronics offshore renewable energy technologies renewable energy technologies statistical analysis system software
Lawyer, corporate lawyer and legal consultant				maritime law

MATES Layman Report – Definition of Occupational profiles

As a result of the MATES Delphi exercise, the future scenarios on occupations were projected in three time-horizons related to the emerging trends in the targeted sectors. The type of skills and competences that will be required and the most effective training methods were prioritised. This information provided the basis for matching those occupations deemed to be the most affected by future trends with the more relevant skills and knowledges for their update, presented in Table 6.

Table 6 New skills and Knowledge requested for the updating of the occupations most affected by the paradigm shifters analysed in the [MATES report entitled “Foresight Scenarios Identifying Future Skills Needs and Trends. New skills in ESCO - proposed as a result of this PE- are signaled in bold \(when they were added to ESCOv1.1, and in italics when they weren’t\).](#)

Sector	Paradigm shifter	Occupations most affected	Skills	Knowledge
	<p>Digitalisation</p> <p><i>The use of digital technologies to change the business model and provide new revenue and value-producing opportunities</i></p>	<p>Electromechanical engineer</p> <p>Marine engineer</p> <p>Naval architect</p> <p>Electromechanical drafter</p> <p>Electromechanical engineering technician</p> <p>Electronics engineering technician</p> <p>Marine engineering technician</p> <p>Marine electronics technician</p> <p>Marine engineering drafter</p> <p>Electromechanical equipment assembler</p> <p>Electronic equipment assembler</p>	<p>-analyse big data</p> <p>-analyse test data</p> <p>-gather data</p> <p>-manage data</p> <p>-manage quantitative data</p> <p>-perform data mining</p> <p>-use analytics for decision purposes</p> <p>-use specific data analysis software</p> <p>-utilise machine learning</p>	<p>business intelligence</p> <p>cloud technologies</p> <p>data mining</p> <p>data storage</p> <p>information extraction</p> <p>information structure</p> <p>statistical analysis system software</p> <p>unstructured data</p> <p>visual presentation techniques</p>
	<p>Vessel automation, vessel autonomy and robotics</p>	<p>Automation engineer</p> <p>Electromechanical engineer</p> <p>Marine engineer</p> <p>Naval architect</p> <p>Automation engineering technician</p> <p>Electromechanical engineering technician</p> <p>Electronics engineering technician</p> <p>Marine electronics technician</p> <p>Shipwright</p> <p>Abrasive blasting operator</p> <p>Boilermaker</p>	<p>-assemble mechatronic units</p> <p>-assemble sensors</p> <p>-design automation components</p> <p>-ensure public safety and security</p> <p>-ensure vessel security</p> <p>-install automation components</p> <p>-install mechatronic equipment</p> <p>-maintain mechatronic equipment</p> <p>-maintain robotic equipment</p>	<p>automation technology</p> <p>control engineering</p> <p>guidance, navigation and control systems</p> <p>maritime law</p> <p>mechatronics</p> <p>robotic components</p> <p>robotics</p> <p>sensors</p>

		<p>Electromechanical equipment assembler</p> <p>Electronic equipment assembler</p> <p>Mobile crane operator</p> <p>Pipe welder (pipe fitter)</p> <p>Production plant crane operator</p> <p>Sheet metal worker</p> <p>Surface treatment operator</p> <p>Transport equipment painter</p> <p>Welder</p>	<p>-make use of personal robots for practical support</p> <p>-operate automated process control</p> <p>-simulate mechatronic design concepts</p> <p>-test mechatronic units</p> <p>-test sensors</p>	
SB	Exploitation of alternative fuels	<p>Marine engineer</p> <p>Naval architect</p> <p>Marine engineering drafter</p> <p>Marine engineering technician</p> <p>Vessel engine assembler</p>	<p>-analyse energy consumption</p> <p>-conduct energy audit</p> <p>-develop energy saving concepts</p> <p>-identify energy needs</p> <p>-operate battery test equipment</p> <p>-promote innovative infrastructure design</p> <p>-promote sustainable energy</p>	<p>energy efficiency</p> <p>battery chemistry</p> <p>battery components</p> <p>battery fluids</p> <p>chemical products</p> <p>fuel gas</p> <p>renewable energy technologies</p> <p>solar energy</p> <p>vessel fuels</p>
	Drones	<p>Vessel assembly supervisor</p> <p>Vessel assembly inspector</p> <p>Marine surveyor</p>	<p>-ensure compliance with civil aviation regulations</p> <p>-ensure ongoing compliance with regulations</p> <p>-have spatial awareness</p> <p>-operate a camera</p> <p>-operate control systems</p> <p>-operate radio navigation instruments</p> <p>-use remote control equipment</p> <p>-use meteorological information</p>	<p>aviation meteorology</p> <p>civil aviation regulations</p> <p>comply with air traffic control operations</p> <p>digital camera sensors</p> <p>guidance, navigation and control</p> <p>maritime law</p> <p>unmanned air systems</p>
	Green retrofitting	<p>Marine engineer</p> <p>Naval architect</p> <p>Marine Engineering Technician</p>	<p>-assess environmental impact</p> <p>-develop waste management processes</p> <p>-ensure compliance with environmental legislation</p>	<p>composite materials</p> <p>energy efficiency</p> <p>environmental legislation</p>

			<ul style="list-style-type: none"> -integrate new products in manufacturing -promote innovative infrastructure design -promote sustainable energy 	renewable energy technologies
	3D Printing	<ul style="list-style-type: none"> Shipwright Boilermaker Computer numerical control (CNC) machine operator Electromechanical equipment assembler Pipe welder (pipe fitter) Vessel engine assembler Welder 	<ul style="list-style-type: none"> -design prototypes -determine suitability of materials -operate 3D computer graphics software -operate printing machinery -use CAD software -use technical drawing software 	<ul style="list-style-type: none"> 3D modelling 3D printing process CAD software ICT software specifications maintenance and repair maintenance of printing machines printing materials printing on large scale machines printing techniques
ORE	Smart grid & smart sensors	<ul style="list-style-type: none"> Power distribution engineer Electric power generation engineer Maintenance and repair engineer Power production plant operator Solar power plant operator 	<ul style="list-style-type: none"> -analyse test data -assemble sensors -execute software tests -gather data -maintain sensor equipment -perform data analysis -test sensors -use remote control equipment -use specific data analysis software -use analytics for decision purposes 	<ul style="list-style-type: none"> data mining methods sensors business intelligence
	Big data	<ul style="list-style-type: none"> Electric power generation engineer Energy systems engineer Maintenance and repair engineer Power distribution engineer Solar energy engineer Renewable energy engineer Wind energy engineer 	<ul style="list-style-type: none"> -analyse big data -analyse test data -gather data -manage data -manage quantitative data -perform data mining -use specific data analysis software 	<ul style="list-style-type: none"> business intelligence cloud technologies data mining data storage information extraction information structure statistical analysis system software

			<p>-use analytics for decision purposes</p> <p>-utilise machine learning</p>	<p>unstructured data</p> <p>visual presentation techniques</p>
Energy Storage	<p>Power distribution engineer</p> <p>Electric power generation engineer</p> <p>Maintenance and repair engineer</p> <p>Power production plant operator</p> <p>Solar power plant operator</p>	<p>-install hydraulic systems</p> <p>-operate battery test equipment</p> <p>-operate hydrogen extraction equipment</p> <p>-repair battery components</p> <p>-maintain hydraulic systems</p> <p>-operate hydraulic machinery controls</p> <p>-operate hydraulic pumps</p>	<p>battery chemistry</p> <p>battery components</p> <p>battery fluids</p> <p>chemical products</p> <p>fuel gas</p> <p>hydraulics</p> <p>hydroelectricity</p>	
Automation & advanced robotics	<p>Hydropower technician</p> <p>Solar energy technician</p> <p>Tidal power technician</p> <p>Wave power technician</p> <p>Wind turbine technician</p> <p>Cable installer</p> <p>Construction commercial diver</p> <p>Electromechanical equipment assembler</p> <p>Electronic equipment assembler</p> <p>Welder</p>	<p>-assemble mechatronic units</p> <p>-assemble sensors</p> <p>-design automation components</p> <p>-ensure public safety and security</p> <p>-install automation components</p> <p>-install mechatronic equipment</p> <p>-maintain robotic equipment</p> <p>-make use of personal robots for practical support</p> <p>-operate automated process control</p> <p>-simulate mechatronic design concepts</p> <p>-test mechatronic units</p> <p>-test sensors</p>	<p>automation technology</p> <p>control engineering</p> <p>mechatronics</p> <p>robotics</p> <p>robotic components</p> <p>sensors</p>	
3D printing	<p>Electromechanical engineering technician</p> <p>Hydropower technician</p> <p>Solar energy technician</p> <p>Tidal power technician</p> <p>Wave power technician</p> <p>Wind turbine technician</p>	<p>-design prototypes</p> <p>-determine suitability of materials</p> <p>-operate 3D computer graphics software</p> <p>-operate printing machinery</p>	<p>3D modelling</p> <p>3D printing process</p> <p>CAD software</p> <p>ICT software specifications</p> <p>maintenance and repair</p>	

	Electronic equipment assembler	-use CAD software	maintenance of printing machines
	Electromechanical equipment assembler	-use technical drawing software	printing materials
	Printed circuit board assembler		printing on large scale machines
	Welder		printing techniques

3.3. Results discussed but not included in ESCO

Four skills analysed by the DOP PE and discussed with the ESCO secretariat were in the end not included in the ESCO v1.1 revision, but are to remain available for future reviews:

Two of them addressed Ocean Literacy and may be included as Transversal Skills and Competences:

- **Ocean literacy principles** (k): cross –sectoral, could also apply to most of the maritime sectors.
- **Ocean literacy** (s): the proposed definition is the one that has been agreed by the Ocean Literacy Network.

There are other two ORE occupations that were not included in this ESCO update, but might be considered in future revisions:

- **Work in confined spaces:** at present only skills related with cleaning in confined spaces are considered. But many other tasks developed in confined spaces request this skill (as an example, welding in confined spaces, painting in confined spaces, or repairing surfaces in confined spaces).
- **Use analytics for decision purposes:** This skill was proposed by the MATES project for a group of occupations, but was not retained. In a future review, the occupations for which it had been recommended could include this skill, or it could be replaced by the very similar skill **utilise decision support system**, which was included during the ESCO v1.1 update (as a result of another contribution).

During the analysis of new occupations proposed for inclusion in the ESCO database, there were other occupations which were considered, though they were finally discarded; the most relevant discussions addressed the following:

- **Hydrodynamics engineer or technician**, with a specialisation in hydrodynamics and qualified in designing and evaluating the performance of offshore renewable energies devices as well as their anchoring system. This occupation was not considered for inclusion in the ESCO database, due to the important similarities with the offshore renewable energy engineer occupation.
- Three different Plant Operators were proposed, with the specialisations in the following renewable technologies: Offshore Wind Plant Operator, Wave Plant Operator and Tidal Plant Operator; these three occupations were finally merged into a single **ORE Plant Operator**, which covered all three specialisations.

The supply of training programmes was analysed for each country, as well as for Europe as a whole. The identified training programmes were integrated in the <http://www.marinettraining.eu> database .

3.4. Protocol for satellite experts

Contributions to the ESCO database require a broad knowledge of the ESCO taxonomy and terminology employed, as well as an advanced level of English and the technical expertise related to the occupations that are being defined. MATES has issued a **Protocol** to facilitate any possible contributions from external experts to the ESCO database to bridge the language barriers, and overcome the difficulties inherent in the use of ESCO collaborative tools. The Protocol provides a five-step methodology to facilitate the collaborative review of occupation profiles and skills in the ESCO database, summarising the best practices and lessons learned from the ESCO review process, to make the methodological approach easy to apply, replicable, and useful for other sectoral projects.

The methodology is based in the involvement of two figures: on one hand, there is the “satellite expert” with extensive knowledge of the sector addressed, who only needs to be involved for short periods of time; on the other, the ESCO facilitator, to establish collaboration with the ESCO secretariat and support the involvement of the satellite expert (Figure).

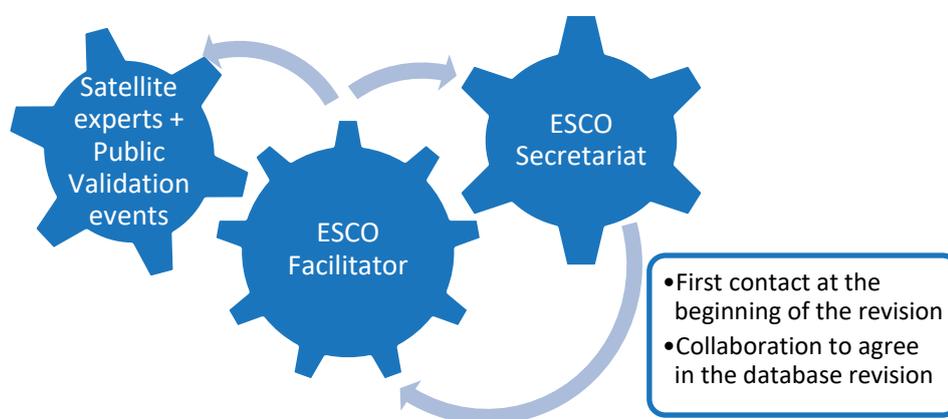


Figure 4: Schema of the proposed organization for undertaking the sectoral ESCO review

ESCO Facilitator/s must have the following characteristics:

- Broad knowledge of the ESCO taxonomy and terminology
- Advanced level of English: ability to write English at a high level and to understand written English being the most relevant.
- Sufficient technical expertise related to the occupations that are being defined
- Ability to coordinate communication within a team
- Good project management
- Reasonable standard of computer literacy

Satellite experts: they must have extensive knowledge of the sector addressed, and only need to be involved for short periods of time.

3.5. Main impact

ESCO is the multilingual classification of European Skills, Competences, Qualifications and Occupations, run by the European Commission and is part of the Europe 2020 strategy. The ESCO classifications identify and categorise skills, competences, qualifications and occupations relevant for the EU labour market and education and training.

For ESCO to remain useful in the labour market and in education and training, it needs to be updated regularly in line with trends of new and changing occupations and skills. **MATES has been an active contributor to this**

process, reviewing 100 occupational profiles in the Shipbuilding and Offshore Renewable Energy value chain with the purpose of identifying changes due to emerging trends in the maritime technologies sector. The impacts of these trends, which were identified by the MATES partnership, have **resulted in 14 new skills and five new occupations being identified, described and included in ESCO v1.1**. MATES has also developed a Protocol to assist the involvement of experts in the review process.

An overview of the DOP PE achievements MATES results transferred to ESCO v1.1 were presented at:

- Two online workshops addressed to the MATES project experts (June and July 2021, 40 participants reached)
- One Careers Working Group meeting of the Pact for Skills in the Offshore Renewable Energies (Sept. 2021), reaching 8 stakeholders from Industrial Associations, Social Partners, and Research.
- The Workshop presenting the MATES Skills Strategy in September 2021, reaching 50 participants.

4. European Added Value

The simultaneous expansion and “greening” of the Blue Economy has led to expansive modernisation and the evolution of new technologies and techniques across many sectors. Two of the sectors undergoing significant changes due to these forces are the offshore renewable energy (ORE) and shipbuilding sectors. ESCO (European Skills, Competences, Qualifications and Occupations) is a common reference terminology that facilitates the integration of the European labour market by clearly describing the occupations and skills needed for industry sectors and how these skills relate between sectors. However the pace of change in ORE and shipbuilding left many of the associated skills outdated and lacking in clarity over how emerging green technologies will interact in the future of these sectors.

The MATES project capitalized its state-of-the-art knowledge of the ESCO and the Blue Skills Economy to develop and showcase new pathways for skills recognition, in line with the revised EQF qualification recommendations.

This PE has had a wide impact because it compiled feedback from stakeholders all across Europe and its result benefits the maritime sector as a whole at that level .ESCO, a European Commission database with an all-European scope, facilitates the exchange of data between employers, education providers and job seekers irrespective of language or country. As such, ESCO has many benefits for various stakeholders including:

- **Jobseekers:** can document and describe their knowledge, skills, and competences to match job openings more accurately and can also support geographical and occupational mobility in Europe
- **Education/training institutions:** can use the terminology to describe the learning outcomes of their qualifications, providing transparency and helping them to adapt their programmes to meet labour market needs
- **Employers:** can more accurately state the skills and qualifications they require from employees
- **Policy makers:** can use ESCO for skills intelligence enabling analyses of skills supply and demand

The ESCO Team is at present undertaking an analysis to restructure the ESCO forum, and is considering the inclusion of ESCO facilitators. The Protocol proposed by the MATES project to integrate contributions of “satellite experts” has served as an inspiration in this process.

All layman reports and education and training materials from all the MATES Pilot Experiences are available on the MATES website and include:

ED2MIT: Education and Training for Data Driven Maritime Industry projectmates.eu/pilotexperience/ed2mit
MOOCs on Industry 4.0 and the naval sector projectmates.eu/pilotexperience/mooc-training-course
Freeboard projectmates.eu/pilotexperience/freeboard
The Magnus Effect projectmates.eu/pilotexperience/the-magnus-effect
Innovation Manager in Shipbuilding Course projectmates.eu/pilotexperience/innovation-manager-course
Additive Manufacturing and Risk Management in the Shipbuilding and Ship Repairs Sectors projectmates.eu/pilotexperience/training-seminar
MOL² Maritime on the Loop of Ocean Literacy projectmates.eu/pilotexperience/mol2
Offshore Renewable Energy Courses projectmates.eu/pilotexperience/renewable-energies-crash-courses
Ocean Pro.Tec Lab projectmates.eu/pilotexperience/ocean-pro-tec-lab
Green Move projectmates.eu/pilotexperience/green-move
Definition of New Occupational Profiles projectmates.eu/pilotexperience/dop-definition-of-new-occupational-profiles





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