European Commission

SET PLAN TASK FORCE RECOMMENDATIONS

Task Force 4: Skills

Cross-cutting recommendations to better align SET Plan technological developments with skills needs

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ABBREVIATIONS

Abbreviation	Definition
AI	Artificial Intelligence
AR	Augmented Reality
BMWE	German Federal Ministry for Economic Affairs and Energy
CEDEFOP	European Centre for the Development of Vocational Training
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CET	Clean Energy Transition
CETP	Clean Energy Transition Partnership
DG EAC	Directorate-General for Education and Culture (European Commission)
DG EMPL	Directorate-General for Employment, Social Affairs and Inclusion (European Commission)
DG ENER	Directorate-General for Energy (European Commission)
DG GROW	Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (European Commission)
DG RTD	Directorate-General for Research and Innovation (European Commission)
DUT	Driving Urban Transition Partnership
ECIU	European Consortium of Innovative Universities
EDDIE	Education for Digitalisation in Energy (project)
EERA	European Energy Research Alliance
EFP	Energy Research Programme (German)
EIT	European Institute of Innovation and Technology
EQF	European Qualifications Framework
ESCO	European Skills, Competences, and Occupations (framework)
ESQF	European Sectoral Qualifications Framework
ETF	European Training Foundation
ETIP	European Technology and Innovation Platform
ETIP BAT	Batteries
ETIP BIO	Bioenergy
ETIP ECTP	European Construction and Technology Plat
ETIP GEO	Geothermal
ETIP HYDRO	Hydropower
ETIP OCEAN	Ocean Energy
ETIP PV	European Technology and Innovation Platform for Photovoltaics
ETIP RHC	European Technology and Innovation Platform on Renewable Heating and Cooling
ETIP SNET	European Technology and Innovation Platform for Smart Networks for Energy Transition
ETIP SNETP	European Sustainable Nuclear Energy Technology Platform
ETIP WIND	European Technology and Innovation Platform for Wind Energy

Abbreviation	Definition
ETIP ZEP	Zero Emission Platform
EU	European Union
EUROPASS	Personal tool for learning and working in Europe
EV	Electric Vehicle
ICT	Information and Communications Technology
IoT	Internet of Things
IT	Information Technologies
IWG	Implementation Working Group
IWG CCS-U	Carbon Capture, Storage, and Utilisation
IWG CST	Concentrated Solar Thermal
IWG DCT	Direct Current Technologies
IWG EEB	Energy and Resource Efficiency in Buildings
IWG ES	Energy Systems
IWG GEO	Geothermal Energy
IWG H2	Hydrogen
IWG IND	Sustainable and Efficient Energy Use in Industry
IWG NS	Nuclear safety
IWG OCEAN	Ocean energy
IWG PEDs	Positive Energy Districts
IWG PV	Solar Photovoltaics
IWG RFB	Renewable fuels and bioenergy
IWG WIND	Wind energy
JP	Joint Programme
JRC	Joint Research Centre
KPI	Key Performance Indicator
LCT	Low-Carbon Technology
LERU	League of European Research Universities
LPO	Lead Policy Officer
NECP	National Energy and Climate Plan
NZIA	Net-Zero Industry Act
O&M	Operations and Maintenance
RES	Renewable Energy Sources
SCADA	Supervisory Control and Data Acquisition
SDG	Sustainable Development Goal
SET	Strategic Energy Technology
SME	Small and Medium-Sized Enterprise

SMR	Small Modular Reactor
SRIA	Strategic Research and Innovation Agenda
STEM	Science, Technology, Engineering, and Mathematics
TES	Thermal Energy Storage
TF	Task Force
TRANSIT	Transition to a Sustainable Future through Training and Education
TWEED	Training Wind Energy Experts on Digitalisation
UN	United Nations
VET	Vocational Education and Training
VR	Virtual Reality

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1. EXECUTIVE SUMMARY

The Task Force on 'Skills' developed recommendations for skills development in the energy sector. Recommendations are directly linked to the Commission's policies and funding mechanisms. They are targeted at key SET Plan stakeholders of Implementation Working Groups (IWGs), European Technology and Innovation Platforms (ETIPs), and the wider SET Plan community. Recommendations were created by 14 Task Force members and four Independent experts, supported by a Task Force Leader and Facilitator. European Commission Policy Officers had an observer role in the development of the recommendations.

Recommendations focus on innovative teaching, learning and training, digital skills, upskilling and reskilling, harmonising and refining recognition frameworks, and enhancing inclusion and attracting talent. They specify the action needed, potential solutions to the challenges, specific action points, and who could be directly involved in implementing them.

The recommendations specify **why** action is needed, **what** solutions could address the identified challenges, and how they could be implemented. These elements are synthesised below for each recommendation. The recommendations also identify the target audience (**who**), the proposed timing for implementation (**when**), and the Key Performance Indicators (**KPI**) that could be used to track progress.

The recommendations target key SET Plan stakeholders: primarily the Implementation Working Groups (IWGs), and the European Technology and Innovation Platforms (ETIPs), but also the European Energy Research Alliance (EERA), and the Clean Energy Transition Partnership (CETP). The recommendations are also relevant to funding agencies of Member States. The Task Force members, representing the IWGs, ETIPs, EERA and CETP, have expressed strong interest in implementing the recommendations. Implementation is encouraged to commence in 2026 and continue throughout 2027-2030. Progress will be monitored using the proposed KPIs

Recommendation 1: Strengthen education-industry links in the energy sector and update curricula

Why: Education pathways remain misaligned with the evolving needs of the energy sector, leading to skills shortages, uneven training standards and limited labour mobility. Weak collaboration between education providers and industry creates barriers for graduates and reduces the availability of job ready professionals.

What: The recommendation focuses on modernising higher education, vocational education and training and lifelong learning curricula, to reflect clean energy technologies, interdisciplinarity and systems thinking. It calls for a stronger and more systematic involvement of industry in curriculum design and delivery.

How: IWGs, ETIPs, EERA and CETP are recommended to: (1) further coordinate modernisation of curricula at all levels, and establish structured collaboration between the EC, national education ministries, industry bodies and academic institutions to deliver targeted reforms, apprenticeships and new programmes; (2) leverage on European initiatives including the Pact for Skills, the Data Union Strategy and the BUILD Up Skills initiative; and (3) facilitate transnational cooperation through the Clean Energy Transition Partnership to connect skills programmes across Member States.

Recommendation 2: Integrate digital and cross-disciplinary skills in all energy training

Why: Digitalisation of the energy system is outpacing workforce capabilities, creating gaps in AI, data, cybersecurity and system integration. Energy jobs increasingly require hybrid technical and digital skills, yet training remains fragmented and siloed.

What: This recommendation aims to embed digital literacy, AI, data management and system-level thinking into all energy education and training pathways. It promotes cross-disciplinary learning across technical, environmental and social domains.

How: IWGs, ETIPs, EERA and CETP are recommended to: (1) systematically incorporate digital competences on energy sector training across all levels and disciplines (e.g. data analytics, simulation software, IoT and AI) and support communities of practice that enable continuous upskilling of the workforce; (2) share digital resources and map existing initiatives to develop modular and personalised training programmes, building on academia and industry collaboration and the EERA Smart Grids Joint Programme; (3) mobilise Pillar 2 of the Affordable Energy Action Plan to accelerate the development of the full range of digital skills required across the energy system throughout its transition.

Recommendation 3: Scale-up upskilling and reskilling programmes for the current workforce in the energy sector

Why: Many workers in fossil fuel and related sectors have transferable skills but lack clean energy and digital competences. Training new entrants is too slow to meet immediate labour demand on its own.

What: The recommendation calls for expanding targeted upskilling and reskilling programmes for the existing workforce, especially in declining sectors. It prioritises work- and simulation-based learning to ensure rapid, job-ready outcomes.

How: IWGs, ETIPs, EERA and CETP are recommended to: (1) launch targeted reskilling initiatives to retrain workers transitioning from fossil fuel industries, and equipping them with clean energy competences through apprenticeships, internships and simulation-based training; (2) engage all relevant stakeholders in capacity building, leveraging existing structures such as the Net Zero Industrial Academies, the InnoEnergy Skills Institute, the Energy Poverty Advisory Hub and a dedicated Smart Grid Academy to address immediate shortages arising from grid digitalisation; (3) develop innovative learning and training schemes in energy skills in the short term (2026-2027); and (4) establish structured links with national territorial just transition plans in the medium term (2027-2030).

Recommendation 4: Harmonise European certification, qualification frameworks and skill standards

Why: Fragmented certification systems limit labour mobility and slow SET Plan technology deployment across the Single Market. Employers often lack trust in qualifications issued in other Member States.

What: This recommendation seeks to establish common European definitions, certifications and qualification standards for key energy sector occupations. It promotes mutual recognition through EU frameworks such as the European Qualifications Framework and European Skills, Competences, Qualifications and Occupations.

How: IWGs, ETIPs, EERA and CETP are recommended to: (1) set up working groups to identify priority occupations and drive technical standardisation to contribute to the development of a common European competency standards for the energy sector in collaboration with the European Centre for the Development of Vocational Training, the European Training Foundation, the Joint Research Centre (JRC), and the European Committee for (Electrotechnical) Standardization; (2) promote mutual recognition of national certification schemes, with Member States encouraged to test, model or adopt proven frameworks, quality assurance practices and microcredentials; and (3) develop a European Sectoral Qualification Framework for energy, enhancing cross-b

Recommendation 5: Promote inclusion and awareness of SET Plan technologies to attract talent

Why: SET Plan technologies suffer from low visibility, gender imbalance and persistent perception challenges. Underrepresentation reduces the available talent pool and limits innovation.

What: This recommendation calls for EU-wide and national campaigns presenting SET Plan energy careers as inclusive, innovative and purpose-driven. It emphasises diversity, gender equality and equal access to skills development.

How: IWGs, ETIPs, EERA and CETP are recommended to: (1) launch EU-wide awareness campaign to enhance the attractiveness of clean energy careers, and tailored national and regional outreach campaigns supported by employment agencies, large-scale partnerships, and relevant EC directorates; (2) mobilise support, identify appropriate communication channels and expand reach across Member States at national, sectoral and regional levels; and (3) systematically promote gender balance through clear KPIs and targeted outreach, building on the Gender Equality Strategy 2026-2030 and ensuring that training and reskilling programmes embed gender equality as a structural objective.

2. INTRODUCTION

The Task Force on 'Skills' has developed recommendations for skills development in the energy sector.

The recommendations are targeted at key SET Plan stakeholders[1] (Implementation Working Groups, IWGs, and European Technology and Innovation Platforms, ETIPs), and the wider SET Plan community. The annexes include an overview of the Task Force participants, the methodology, and the conceptual framework for this cross-cutting topic.

The green and digital transitions are transforming economic activities and job requirements, posing a risk of skills obsolescence for workers unless these changes are proactively addressed. It is estimated that some million additional jobs in clean energy will be needed by 2030 in the EU, many of which require advanced digital and cross-disciplinary skills[2] [ETIP SNET 2023].

Building skills across the energy and related sectors and overcoming capacity gaps involves:

- **Skillsets that address wide-ranging needs:** innovation management [H2 IWG]; impact assessments; life cycle analysis [ETIP SNETP] and circularity [ETIP ECTP]; environmental knowledge [ETIP RHC]; project management [ETIP OCEAN]; health and safety; community engagement [ETIP GEO]; business skills; energy system modellers [IWG OCEAN]; industrial symbiosis facilitation, energy efficient analysis [IWG INDUSTRY]; logistics [H2]; circular economy innovations [EERA].
- **Technical skillset gaps within and across sectors:** engineering [ETIP SNETP] [DCT]; manufacturing [IWG NS]; nuclear [ETIP SNETP]; wind farms [ETIP WIND]; [IWG EEB]; renovation [IWG EEB][ETIP ECTP]; system integration [SNET] customisation [IWG PV], and optimisation [ETIP RHC]; geoscience [IWG GEO]; hybridisation [ETIP RHC]; climate resilience [IWG EEB], long-term sustainability and efficiency in used resources (e.g. nuclear waste management).
- **Building certification [ETIP SNETP] and recognition systems** that facilitate the filling of skills gaps [IWG EEB] and enable seamless mobility across SET Plan countries and beyond; a need to define and redefine skills and qualifications [IWG EEB].
- **Improving training availability and quality including following examples** [IWG EEB]: Improving and aligning training offers to current and future skills demands of the energy; training in specialist skills for district heating and cooling in regions and different countries [IWG IND]; reducing the variability of training programmes and standards across borders [ETIP SNETP]; barriers to entry exist for graduates [ETIP ZEP], for example where higher education curricula are not sufficiently aligned with the requirements of industry; a lack of aligned educational programmes and curricula for nuclear professionals across different regulatory environments, affecting cross-border workforce mobility [ETIP SNETP]; policymakers and public administration require knowledge and expertise [ETIP ZEP, IWG H2]; enhancing interdisciplinary education and increasing system-thinking approaches [EERA].
- **Improving the attractiveness of energy-related jobs and improving equity and equality** [IWG EEB]; a lack of women in the clean energy transition business and specific sectors [ETIP SNETP], [IWG CST].
- **Building knowledge:** Challenges in identifying skills shortages [IWG EEB].

1 The recommendations should: i) facilitate cooperation between the IWGs and ETIPs on crucial cross-cutting topics designed to drive clean energy transition; ii) indicate to IWGs and ETIPs how to incorporate these cross-cutting topics in their respective SRIAs, IICs and Thematic Visions, and consequently make the SET Plan more effective and impactful.

2 https://energy.ec.europa.eu/system/files/2021-06/education_and_skills_task_force_-_position_paper__0_0.pdf

3. KEY EU POLICIES AND INITIATIVES

The recommendations explicitly focus on meeting the expectations of the **Strategic Energy Technology (SET) Plan**[3]. The SET Plan **Implementation Working Groups**[4] **(IWGs)** address the need for expertise in clean energy, with digital and data skills being essential. Skill sets are strongly interdisciplinary, collaborative, and cross-sectoral, encompassing policy and regulatory development. Working alongside the IWGs, the **European Technology and Innovation Platforms**[5] **(ETIPs)** have particularly identified the digital skills needs in AI, analytics, and the pan-sector development of structures such as the **Clean Energy Transition Partnership**[6].

The recommendations aim to contribute to the goals of the **Energy Union**[7], to meet the skills needs across the energy sector, and respond flexibly to emerging sector needs and trends across the EU and globally. They aim to develop human capital to successfully deliver the Green and Digital transitions across the European Union, address and bridge skills gaps, meet market needs, and support collaboration and knowledge development among all stakeholders (policy, industry, academia, research institutions, and associations).

The recommendations link to EU energy-related policies, including the **Clean Industrial Deal**[8]: the **Affordable Energy Action Plan**[9] **Tripartite contracts** (Action 6); the **Energy Efficiency Directive**[10]; the **Citizen Energy Package**[11]; the **Grid Package** (December 2025[12]); the **Electrification Action Plan**[13]; the **Heating and Cooling Strategy**[14]; and the **Action Plan for Digitalising the Energy System**[15].

The **Industrial Accelerator Act**[16] is relevant through its focus on competitiveness and industrial capacity. It will introduce Industrial Acceleration Areas involving clean manufacturing clusters and "projects in these areas will avail of profiling with investors and support with skills development". The **Construction Service Act**[17] (under public consultation until 28 April 2026) and the **Affordable Housing Plan**[18] are particularly relevant given concerns about building quality, energy performance and the need for high-quality construction aligned with environmental objectives.

The recommendations acknowledge that the **Commission 2026 Work Plan**[19] aims to strengthen energy security, set up an **Energy Efficiency Framework**, and launch a **Skills Portability Initiative**[20] and, within an Education Package, develop a **2030 Roadmap on the future of digital education and skills**. **The Skills Portability initiative** is expected to modernise mutual recognition, digitise qualification documents and facilitate mobility of certified professionals.

3 https://energy.ec.europa.eu/topics/research-and-technology/strategic-energy-technology-plan_en
4 https://setis.ec.europa.eu/working-groups_en
5 https://smart-networks-energy-transition.ec.europa.eu/
6 https://cetpartnership.eu/
7 https://energy.ec.europa.eu/strategy/energy-union_en
8 https://commission.europa.eu/topics/eu-competitiveness/clean-industrial-deal_en
9 https://energy.ec.europa.eu/publications/action-plan-affordable-energy-unlocking-true-value-our-energy-union-secure-affordable-efficient-and_en
10 https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-directive_en
11 https://errin.eu/calls/support-services-energy-communities
12 https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2945
13 https://commission.europa.eu/news/new-action-plan-save-eu260-billion-annually-energy-2040-2025-02-26_en
14 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1757551754568&uri=CELEX:52016DC0051
15 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0552&qid=1666369684560
16 https://ec.europa.eu/commission/presscorner/detail/en/qanda_26_516 and https://ec.europa.eu/commission/presscorner/detail/en/ip_26_515 and https://single-market-economy.ec.europa.eu/publications/industrial-accelerator-act_en
17 https://ec.europa.eu/newsroom/neb/items/919400/en
18 https://housing.ec.europa.eu/european-affordable-housing-plan_en
19 https://commission.europa.eu/strategy-and-policy/strategy-documents/commission-work-programme/commission-work-programme-2026_en
20 https://employment-social-affairs.ec.europa.eu/news/commission-seeks-views-skills-portability-initiative-2025-12-05_en And see also https://employment-social-affairs.ec.europa.eu/document/63569573-8ddf-42ca-836a-1743e9f58fb1_en

Recommendations link to policies and instruments in the Directorates General for Employment (DG EMPL) and Education (DG EAC). The March 2025 Communication on a **Union of Skills**[21] includes the **Skills Guarantee Pilot**[22] and is becoming a central policy tool for facilitating reskilling, especially from declining sectors (such as automotive and fossil-fuel-related industries) toward clean energy sectors. The Union of Skills will further "reinforce the ***Pact for Skills***[23] to help more workers gain new skills in strategic sectors", and where *"the Commission invites public and private organisations to join forces and take concrete action to upskill and reskill people in Europe"*.

Other actions within the Union of Skills include: the launch of the **EU Talent Pool**[24] platform; pilot a **European VET diploma** [2025-2026]; pilot a **Skills Guarantee for workers** [2025]; roll-out of targeted **EU Skills Academies**, after a review of existing ones [2026]; pilot **transnational university-business partnerships** for sectors with severe skills gaps [2026]; **European Strategy for vocational education and training** (VET) [2026]; and, establish a **European Skills Intelligence Observatory**.

21 https://commission.europa.eu/topics/eu-competitiveness/union-skills_en
22 https://ec.europa.eu/commission/presscorner/detail/en/ip_25_2828
23 https://employment-social-affairs.ec.europa.eu/policies-and-activities/skills-and-qualifications/working-together/pact-skills_en
24 https://home-affairs.ec.europa.eu/policies/migration-and-asylum/legal-migration-and-resettlement/work/eu-talent-pool_en

4. RECOMMENDATIONS

RECOMMENDATION 1: STRENGTHEN EDUCATION-INDUSTRY LINKS AND UPDATE CURRICULA

Recommendation summary:

Education pathways remain misaligned with the evolving needs of the energy sector, leading to skills shortages, uneven training standards and limited labour mobility. Weak collaboration between education providers and industry creates barriers for graduates and reduces the availability of job ready professionals.

The recommendation focuses on modernising higher education, VET and lifelong learning curricula to reflect clean energy technologies, interdisciplinarity and systems thinking. It calls for stronger and more systematic involvement of industry in curriculum design and delivery.

IWGs, ETIPs, and CETP are recommended to: (1) further coordinated modernisation of curricula at all levels, structured collaboration between the Commission, national education ministries, industry bodies and academic institutions to deliver targeted reforms, apprenticeships and new programmes; (2) leverage on European initiatives including the Pact for Skills, the Data Union Strategy to close persistent skills gaps, drawing on the experience of the BUILD Up Skills initiative and relevant national projects; (3) facilitate transnational cooperation through the Clean Energy Transition Partnership supported by the foresight roadmap to connect skills programmes across Member States.

WHY

Challenges identified by TF members and literature review

As underlined in the *'Competitiveness of Clean Energy Technologies: Annual Report' (2025), "a skilled workforce is at the base of the EU's capacity to design, manufacture, construct, connect and maintain clean energy technologies and infrastructure"*[25].

Better alignment of education with current and future skills demands of the energy sector can reduce cross-border variability in training standards and improve workforce mobility.

Updating curricula through close collaboration between education and industry will help overcome entry barriers for graduates, support interdisciplinarity and systems thinking, and ensure policymakers and professionals are equipped with the necessary expertise

Expected outcomes and contribution to EU priorities

Ensuring that there is a flow of knowledgeable, competent and skilled learners who can fulfil the skills needs of the energy sector (especially across the SET Plan research and innovation actions) in achieving the Green Deal goal of climate neutrality by 2050, and as the 10th report of the Energy Union emphasises, to "enhance innovation, secure supply chains, and maintain global competitiveness".[26]

25 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52025DC0074
26 https://energy.ec.europa.eu/strategy/energy-union/10th-report-state-energy-union_en

WHAT

A concerted effort is needed to revise and expand **higher education programmes, technical college courses, and vocational training** in fields relevant to the SET Plan actions. Updating programmes should include the latest advances in clean energy science and technology, such as courses on battery storage, hydrogen technologies, and power electronics for DC grids. The **European Energy Research Alliance** (EERA[27] and universities should work together on curricular reform, leveraging EU tools such as the **Blueprint for Sectoral Cooperation on Skills**[28]. Networks of universities with links to industry and research should be reinforced.

This could include **Master's** programmes (e.g. Smart Grids and Energy Systems Engineering) **and Doctoral programmes** (e.g. doctoral training centres for green hydrogen). EU support could be through **Erasmus Mundus**[29] programmes or **Marie Sklodowska-Curie** doctoral networks focusing on energy transition technologies, and by supporting best practices[30].

At the vocational level, the **dual education system** (combining classroom learning and apprenticeships) should be expanded for energy jobs. Companies should be informed of the benefits of offering more apprenticeship opportunities in fields such as solar installation, energy-efficient construction, smart grid technicians or electric vehicle maintenance. This can be done through awareness-raising workshops or campaigns. Companies should be incentivised to offer more apprenticeships through initiatives at the EU and national levels.

ETIPs (industry platforms) are encouraged to identify specific skill needs and coordinate with education providers to address them. For instance, if offshore wind companies forecast a need for more cable installation experts, they could partner with maritime training institutes to create and deliver courses.

Involving industry experts in teaching as adjunct lecturers or trainers gives students real-world experience. Academia can involve students in research with practical applications, preparing them for careers in industry or entrepreneurship within the energy sector. That experience can be expanded to include students, teachers and trainers through train-the-trainer sessions focused on real-world situations. There should be consideration of mandatory periods for trainers and VET teachers to undertake in energy companies and research infrastructures.

Education initiatives should aim to attract a **diverse pool of talent** – especially women, who are underrepresented in many STEM fields, and individuals from regions or communities that are not traditionally engaged in energy careers. Outreach programmes, scholarships, and inclusive marketing of clean energy careers can widen the range of entrants. A key goal is to develop a modern curriculum that imparts updated technical knowledge and nurtures essential soft skills, such as leadership, teamwork, and critical thinking, that employers value.

Centres of excellence across Europe should be established or strengthened to serve as hubs for specific skill sets (as suggested in the ETIP skills report). For example, a centre for wind energy education in a coastal country, or for solar energy in a sunny region, could serve students and workers across the EU, and the students should be provided with hands-on infrastructure-based (for example, living labs, pilot plants, digital twins, operational testbeds) learning experiences. By aligning teaching and learning with the needs of the clean energy industry, graduates can contribute to SET Plan objectives without lengthy on-the-job training.

27 https://www.eera-set.eu/
28 https://employment-social-affairs.ec.europa.eu/policies-and-activities/skills-and-qualifications/working-together/blueprint-sectoral-cooperation-skills_en
29 https://erasmus-plus.ec.europa.eu/opportunities/opportunities-for-individuals/students/erasmus-mundus-joint-masters
30 The EUREC European Master programmes on renewable energy and sustainable energy system management: https://master.eurec.be/ and https://sesym.eurec.be/ and the TU Delft programme: https://www.tudelft.nl/onderwijs/opleidingen/masters/set/msc-sustainable-energy-technology/track-heating-and-cooling/programme

WHO

- Collaboration between the European Commission, national education ministries, industry bodies, and academic institutions to execute curriculum reforms and new programme launches over the coming years. There are mutual responsibilities between industry and education providers, including tertiary, vocational and school-level actors: for example, ensuring that education institutions maintain active collaboration with industry and embed practical exposure throughout programmes.
- Industry (ETIPs) can commit to providing apprenticeships, instructors, equipment, or internships for training programmes, and can survey and confirm the skills needs.
- Member States (IWGs) can align national funding to support partnership projects. Member States can also collaborate to create double-degree programmes that enable qualifications to be recognised in different countries, or even across the entire EU. For example, developing a double-degree programme with a qualification recognised in both countries.
- The Clean Energy Transition Partnership can facilitate transnational cooperation by connecting skill programmes across different countries.

HOW

Immediate action: **Develop a detailed foresight of future developments in energy skills.**

- Build on the **strategic roadmap**[31] for skills in the energy sector, and through **Pillar 2 of the Affordable Energy Action Plan, Energy Union Task Force**[32], and a simplified governance regime for the Energy Union.
- Build on the experience of the **BUILD Up Skills**[33] initiative in addressing skills development that are noted in the **Revised Energy Efficiency Directive**[34] and the development of **National Platforms on Energy Efficiency Skills**[35].
- Engage with the **Data Union Strategy**[36] in building coherent and robust data through the creation of **"Common European Data Spaces** in … energy … skills … and the Green Deal"[37].
- Link to the **Pact for Skills partnership in Renewable Energy**[38], **Pact for Skills partnership in Offshore Renewable Energy**[39], and to the **Pact for Skills partnerships in Digitalisation of the Energy System**[40] (and potentially the planned Pact for Skills partnership in Energy Efficiency) to benefit from its work in basic digital skills, skills in analytics, knowledge transfer, equity and equality, and creating synergies with relevant projects and initiatives.
- Synthesise and share good practices about EU-funded and other National projects (such as the **MATCH** programme[41] in France or the EU-wide reskilling projects BUILD UP Skills and RESkill4NetZero; the Irish Climate Action Plan 2025[42] and Impact 2030[43]) that involve developing energy skills of the future.
- Leverage Horizon Europe projects such as **TRANSIT**[44] as case studies for integrating innovative teaching methods into curricula. TRANSIT has demonstrated the use of gamification and interactive tools to engage learners in renewable energy topics, and these approaches can be adapted for vocational and higher education programmes. Embedding gamified simulations (e.g., energy market games, system optimisation challenges) in technical courses fosters practical problem-solving and system-thinking skills while increasing student motivation and retention.
- Map and categorise existing educational infrastructures to make visible the existing hands-on training assets and identify regional and sectoral gaps regarding availability. Maintain and enhance the map and link it to the foresight activity.

31 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0552&qid=1666369684560
32 https://energy.ec.europa.eu/strategy/energy-union/energy-union-task-force_en
33 https://build-up.ec.europa.eu/en/bup-skills
34 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AJOL_2023_231_R_0001&qid=1695186598766
35 https://www2.fundsforngos.org/latest-funds-for-ngos/build-up-skills-national-platforms-on-energy-efficiency-skills-for-the-clean-energy-transition-program/
36 https://digital-strategy.ec.europa.eu/en/policies/data-union
37 https://digital-strategy.ec.europa.eu/en/policies/data-spaces
38 https://pact-for-skills.ec.europa.eu/document/download/060eb886-87d8-4721-a504-28c621ee1e96_en?filename=20230321%20-%20RE%20Skills%20partnership-%20Declaration%20%282%29.pdf
39 https://marineboard.eu/pact-skills-offshore-renewable-energy
40 https://pact-for-skills.ec.europa.eu/about/news-and-factsheets/pact-skills-launches-large-scale-skills-partnership-digitalisation-energy-system-2023-12-20_en
41 https://www.gifen.fr/api/content/assets/cd091706-ae5a-4e61-be2b-0e834d451898
42 Action JT/25/3: Establish Offshore Wind Skills Development Programme
43 Impact 2030: Pillar 4: Talent at the Heart of the R&I Ecosystem, e.g. Action 22: Strengthen connectivity between R&I and skills development
44 https://transitproject.eu/

Medium-term: **Reinforce collaborative developments across industry, research, citizens and policy related to energy skills:**

- Under Action 5 of the Affordable Energy Action Plan, tackle **investment gaps and mobilise private capital**.
- Under Action 6 of the Affordable Energy Action Plan, facilitate **tripartite contracts**.
- Link to the collaborative groups in the **Citizen Energy Package**[45].
- Ensure the creation of new **EU Skills Academies** in the energy sector. Activities should include hands-on, practical training across the energy sector. Training programmes should clearly reflect the need for experimental facilities, including pilot production lines and spaces enabling learners and workers to gain practical experience without interrupting industrial operations.

WHEN

- Short-term (2026-2027): Develop detailed foresight of future developments in energy skills, building on existing initiatives (*see description above, and proposed KPIs below*).
- Medium-term (2027-2030): Reinforce collaborative developments across industry, research, citizens and policy related to energy skills (*see description above*).

KEY PERFORMANCE INDICATORS (KPIS)

- Number of EU project calls encouraging academia/industry cooperation in energy.
- Number of accredited training programmes focused on low-carbon energy.
  - **Target:** 50+ new accredited programmes by the end of 2027. For example, from basic science to advanced engineering and smart systems, or higher education courses referencing a UN SDG contribution.
  - **Expected Outcome:** High-quality, standardised training offerings across SET Plan countries.
- Number of trainees involved in new programmes, considering geographic and gender inclusiveness.
- Number of Low-Carbon Energy Academies/Training Centres of Excellence established.
  - **Target:** 20–30 centres by the end of 2027.
  - **Expected Outcome:** A decentralised and industry-responsive infrastructure for training.
- Annual publication of renewable energy skills gap analysis. The SET Plan Secretariat could coordinate production.
  - **Target:** One per year starting 2026. ETIPs could contribute to the report by providing their specific gap analysis.
  - **Expected Outcome:** Informed, agile policymaking and workforce planning.

45 https://energy.ec.europa.eu/news/work-begins-citizens-energy-package-ensure-fair-and-inclusive-energy-transition-2024-12-19_en

RECOMMENDATION 2: INTEGRATE DIGITAL AND CROSS-DISCIPLINARY SKILLS IN ALL ENERGY TRAINING

Recommendation summary:

Digitalisation of the energy system is outpacing workforce capabilities, creating gaps in AI, data, cybersecurity and system integration. Energy jobs increasingly require hybrid technical-digital skills, yet training remains fragmented and siloed.

What: This recommendation aims to embed digital literacy, AI, data management and system-level thinking into all energy education and training pathways. It promotes cross-disciplinary learning across technical, environmental and social domains.

IWGs, ETIPs, and CETP are recommended to: (1) systematically incorporate digital competences on energy sector training across all levels and disciplines, including data analytics, simulation software, IoT and AI, alongside a systems-thinking approach, supported by communities of practice that enable continuous upskilling of the workforce; (2) develop modular and personalised training programmes through academia and industry collaboration, with IWGs and ETIPs tasked with sharing digital resources and mapping existing initiatives, drawing on EERA joint programmes such as the Smart Grids JP to inform curriculum development; (3) mobilise Pillar 2 of the Affordable Energy Action Plan to accelerate the development of the full range of digital skills required across the energy system throughout its transition.

WHY

The energy and construction workforce lacks sufficient and highly needed digitalisation skills [IWG EEB]. To help address the needs, there is a **Large Partnership** for **Skills in the digitalisation of the energy system**[46] launched in December 2023 [ETIP SNET], forming part of the strategy for energy system digitalisation[47].

Telecommunications[48] are a core enabling technology for digitalisation of the energy system. The power outage events in Spain and Portugal in April 2025[49] reinforced the view of the stakeholders that there is an importance of resilience[50] and cybersecurity[51] within broader system skills[52]. As energy infrastructure becomes increasingly digitalised to efficiently integrate renewables and LCTs (Low-Carbon Technologies) more broadly, the exposure to cyber threats has been highlighted.

Digital Skills involve:

- Digital tools for training and education, such as virtual reality and simulation-based learning.
- Digital skills for tasks that are required for engineers, technicians, and managers working in energy system operations (e.g., Internet of Things, integration, and remote monitoring).
- Digital skills for streamlining permitting energy developments. Facilitate authorities' use of digital platforms, data management tools, and geospatial systems to streamline application reviews, ensure transparency, and accelerate decision-making in energy project approvals.
- Digital skills are required across organisations, developers, engineers, contractors [IWG DCT], and users [IWG ES, EEB]. These skills are relevant to energy communities and active consumers who can bring flexibility through demand management and cybersecurity to distributed RES (renewable energy sources) generation assets.

46 https://energy.ec.europa.eu/news/commission-promotes-strategic-partnership-skills-advance-digitalisation-energy-system-2023-12-14_en
47 https://energy.ec.europa.eu/topics/eus-energy-system/digitalisation-energy-system_en
48 Part of the Digital Ecosystem https://pact-for-skills.ec.europa.eu/about/industrial-ecosystems-and-partnerships/digital_en and see also https://connecteurope.org/insights/position-papers/future-proofed-telecom-workforce-education-and-skills-competitive-europe
49 https://windeurope.org/newsroom/news/iberian-peninsula-blackout-proves-the-need-for-grid-resilience/
50 https://blogs.worldbank.org/en/energy/building-resilient-power-grids--integrating-climate-and-disaster
51 https://www.eurelectric.org/in-detail/cybersecurity-in-the-power-sector/
52 https://www.eurelectric.org/news/five-recommendations-for-future-proofing-europes-grids-grids-for-speed-2024/

A portfolio of specific digital skillsets was identified, covering areas such as:

- Information security skills and data engineering [ETIP SNET].
- Security and intellectual property [IWG DCT].
- AI and machine-learning skills (e.g. grid operators) [ETIP SNET]; automation, data analytics, artificial intelligence, machine learning and cybersecurity to support digital transformation in nuclear operations [ETIP SNETP] and large-scale, extensive renovation of buildings (energy efficiency first principle) [ETIP ECTP]. Digital and AI training programmes are needed for smart buildings and smart grids, cybersecurity and predictive maintenance in energy systems[53].
- Drive the transition from analogue processes to digital systems for monitoring, maintenance, grid integration and permitting, such as deploying sensor networks, digital twins, and real-time data platforms to improve efficiency and predictability [ETIP WIND, ETIP ECTP].
- Digital tools integrated in CS thermal applicator and link ICT with thermal energy solutions [IWG CST]. Lack of shared 'data' [IWG CST]. AI, big data, and predictive maintenance training programmes to modernise plant operations and optimise efficiency [ETIP SNETP].
- Digital education tools (e.g. simulation-based learning, remote labs, digitally-enabled learning infrastructures, and augmented reality) should link to lifelong learning tools such as micro-credentials and hybrid education platforms, to support continuous skilling and upskilling across Europe. Such tools can be scalable to support the widest possible community of learners.
- Digital tools for life-cycle assessment (IWG EEB), and whole-life carbon in buildings
- Robotics, data security, automation, virtual and augmented reality (AR), remote monitoring and diagnostics.

Given the speed of innovation and technology developments in the energy sectors, there is a need for:

- Cross-sectoral upskilling to align professionals with evolving technologies and safety requirements [ETIP SNETP].
- Industrial symbiosis facilitation, energy-efficient analysts [IWG INDUSTRY].
- Continuous upskilling to stay ahead of emerging trends such as blockchain for energy trading, digital twins, and automated control systems and proficiency in human-machine interfaces, especially as automation increases in generation, transmission, and distribution.

Expected outcomes and contribution to EU priorities

- Providing the skills needed to achieve the **Green Deal** goal of climate neutrality by 2050[54].
- Contributing skills to the **Clean Industrial Deal**[55] and the dimensions of the Energy Union: energy security, energy efficiency, and research and innovation, especially via Horizon Europe (€95.5 billion allocated for energy research and innovation from 2021–2027 [56]).
- Supporting SET Plan research and innovation actions[57]: integrating renewable technologies in the energy systems; new technologies and services for consumers; resilience and security of energy systems; competitiveness in the global battery sector, e-mobility, and the overall European Smart Grids sector[58].

WHAT

Energy jobs increasingly have a significant digital component by default, so digital skills can no longer be siloed. All energy sector training programmes (whether a vocational course for solar installers or an engineering degree in power systems) should include modules on digital tools (such as data analytics, simulation software, and IoT sensors) and encourage a systems-thinking approach.

53 https://www.iea.org/reports/world-energy-employment-2024
54 https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en
55 https://commission.europa.eu/topics/competitiveness/clean-industrial-deal_en
56 https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/cluster-5-climate-energy-and-mobility_en
57 https://energy.ec.europa.eu/topics/research-and-technology/strategic-energy-technology-plan_en#key-action-areas
58 https://energy.ec.europa.eu/topics/markets-and-consumers/smart-grids-and-meters_en

This means developing **energy-specific digital curricula**: for example, courses on energy management should teach how to utilise data platforms for monitoring and optimisation; wind and solar PV technicians should learn to operate remotely via diagnostics; and grid engineers should be proficient in cybersecurity for Supervisory Control and Data Acquisition (SCADA) systems. Energy companies and training providers should utilise the **Digital Decade** policy programme[59] and initiatives (e.g., the **Digital Skills and Jobs Coalition**[60]) to keep their content up to date.

Cross-disciplinarity is key. Training should break down silos between electrical, IT, mechanical, chemical, and civil engineering, and incorporate environmental and social dimensions. One approach is to adopt a **modular training structure** that covers cross-cutting competences applicable across multiple energy fields (e.g., project management, energy economics, life-cycle assessment), followed by specialised modules for each technology.

A modular approach makes reskilling easier and allows for the recognition of overlapping skills. It shortens training time when people move fields, as they do not have to relearn common basics. Cross-disciplinarity can be reinforced by promoting interdisciplinary project-based learning.

Building communities of practice (for instance, an online community for energy data analysts) can help update digital skill sets. By ensuring every new electrician, engineer, scientist, or technician in the energy sector is also "a bit of a data analyst and systems thinker", the workforce will be more adaptable and innovation-ready. SET Plan stakeholders can share digital training resources. Ultimately, this integrated skill approach addresses not only current gaps but also the evolving nature of jobs, mitigating future skill obsolescence.

WHO

- **Academia and energy sector:** Develop modular training, with IT-specific training programs to provide insights for testing new technologies and data developments.
- **IWGs and ETIPs:** Share digital resources and map existing initiatives.
- **EERA:** Inform education programmes about the needs in digital training via its joint programmes, such as the **Smart Grid JP**[61].

HOW

Through Pillar 2 of the **Affordable Energy Action Plan**[62], accelerate the development of all digital skills needed by the Energy system in its transition, including AI and machine learning across the energy sector.

a. Promote the development of **core digital competences for everyone** in the energy and related sectors through the **Digital Competence Framework**[63], its certification framework, and communities of practice[64]. The TRANSIT[65] project is an example of how gamified online learning environments are utilised to enhance the adoption of AI, IoT, and data analytics concepts in energy contexts. Such approaches, ranging from competitive leaderboards for micro-credentials to immersive VR/AR problem-solving tasks, can accelerate the acquisition of digital competencies and increase participation from underrepresented groups.

b. Participate in the **Digital Skills and Jobs Coalition Platform**[66] to ensure that all energy and energy-related employers become part of a community of practice[67].

c. Link employers to the **European Digital Innovation Hubs**[68] related to energy so that they can assess digital readiness[69] and find training opportunities[70], particularly for SMEs[71].

59 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en
60 https://digital-skills-jobs.europa.eu/en/about/digital-skills-and-jobs-coalition
61 https://eera-smartgrids.eu/
62 https://energy.ec.europa.eu/strategy/affordable-energy_en#affordable-energy-action-plan
63 https://joint-research-centre.ec.europa.eu/projects-and-activities/education-and-training/digital-transformation-education/digital-competence-framework-citizens-digcomp_en
64 https://all-digital.org/communities-of-practice/
65 https://transitproject.eu/
66 https://digital-skills-jobs.europa.eu/en/about/digital-skills-and-jobs-coalition
67 https://digital-skills-jobs.europa.eu/en/community/networking
68 https://european-digital-innovation-hubs.ec.europa.eu/home
69 https://european-digital-innovation-hubs.ec.europa.eu/digital-speed-test
70 https://european-digital-innovation-hubs.ec.europa.eu/knowledge-hub/edih-academy
71 https://european-digital-innovation-hubs.ec.europa.eu/smes-list

d. Build on experience and best practices from **Erasmus+ projects** such as Skills4EII[72], Renew the Energy, Save the Future![73], Digital and Vocational Synergy for Future Careers[74], the EDDIE project (Education for Digitalisation in Energy)[75], and on the Horizon Europe Marie Skłodowska-Curie Actions Training Wind Energy Experts on Digitalisation (TWEED)[76].

e. Promote cross-disciplinary skills by integrating, alongside digital competences, early **awareness of sustainability principles and emerging clean-energy technologies**.

WHEN

- Immediate action (2026) or short-term (2026-2027): Develop energy-specific digital curricula.
- Medium-term (2027-2030): Assess participation and review developments according to the proposed KPIs (***see below***).

KEY PERFORMANCE INDICATORS (KPIS)

- Number of VET graduates certified in digital energy skills by 2030.
- Number of new workers trained in clean energy technologies annually.
  - **Target:** 150,000 new workers/year by 2030.
  - **Expected Outcome:** A robust, skilled labour force to meet EU clean energy deployment targets.
- Increase in the percentage of trained personnel in priority sectors (solar PV, wind, heat pumps, hydrogen).
  - **Target:** 20–30% increase by 2027.
  - **Expected Outcome:** Timely sectoral workforce scaling aligned with industrial growth.
- Share of women in technical roles.
  - **Target:** 40% by 2030 (baseline ~25%).
  - **Expected Outcome:** Gender-balanced workforce across the clean energy value chain.
- Participation of underrepresented groups in training programmes.
  - **Target:** 50% increase by 2027.
  - **Expected Outcome:** Broader societal access to green job opportunities.
- Percentage of clean energy projects reporting adequately skilled labour availability.
  - **Target:** ≥90% by 2030.
  - **Expected Outcome:** Minimised project delays due to workforce constraints.

72 Skills Alliance for the Green, Digital and Social Transformation of the Energy Intensive Industries: https://erasmus-plus.ec.europa.eu/projects/search/details/101184954
73 https://erasmus-plus.ec.europa.eu/projects/search/details/2024-2-ES01-KA210-VET-000284451
74 https://erasmus-plus.ec.europa.eu/projects/search/details/2024-2-R001-KA210-VET-000273929
75 https://www.cedefop.europa.eu/en/project-fiches/education-digitalisation-energy-eddie
76 https://cordis.europa.eu/project/id/101168673

RECOMMENDATION 3. SCALE-UP UPSKILLING AND RESKILLING PROGRAMMES FOR THE CURRENT WORKFORCE

Recommendation summary:

Many workers in fossil-fuel and related sectors have transferable skills but lack clean-energy-specific and digital competences. Training new entrants alone is too slow to meet immediate labour demand.

The recommendation calls for expanding targeted upskilling and reskilling programmes for the existing workforce, especially in declining sectors. It prioritises work-based and simulation-based learning to ensure rapid, job-ready outcomes.

IWGs, ETIPs, and CETP are recommended to: (1) launch targeted reskilling initiatives to retrain workers transitioning from fossil fuel industries, equipping them with clean energy competences through work-based learning modalities including apprenticeships, internships and simulation-based training; (2) engage all relevant stakeholders in capacity building, leveraging existing structures such as the Net Zero Industrial Academies, the InnoEnergy Skills Institute, the Energy Poverty Advisory Hub and a dedicated Smart Grid Academy to address immediate shortages arising from grid digitalisation; (3) in the short term (2026-2027), develop innovative learning and training in energy skills and implement them building on existing initiatives; (4) in medium-term (2027-2030), establish structured links with national territorial just transition plans.

WHY

Many skills in the fossil fuel industry (e.g., engineering, project management, heavy machinery operation) are highly transferable to the clean energy sector. However, there is a need for digital upskilling (particularly in Artificial Intelligence) of the entire existing workforce in the energy sector to ensure compliance with technological standards.

The **Shorewinner**[77] project highlights persistent skills gaps in digital, safety, and offshore-specific competences, noting that current training provision in several countries remains too general and insufficiently aligned with industry standards and real offshore operating conditions[78].

Reskilling can be more cost-effective and faster than training entirely new entrants. It would enable fossil fuel workers to avoid being left behind in the clean energy transition and help meet immediate workforce demand in certain sectors.

Expected outcomes and contribution to EU priorities

- The **Just Transition Mechanism**[79] which supports all Member States, with a focus on the most carbon-intensive regions or those with the highest number of people employed in the fossil fuel sector.
- Providing the skills needed to achieve the **Green Deal** goal of climate neutrality by 2050.
- Scaling up reskilling programmes fits directly into the **Union of Skills** mission.
- Contributing skills to **the Clean Industrial Deal** and the dimensions of the **Energy Union**.
- Ensuring that the competences and knowledge of existing workers in the energy sector can be refined and enhanced to provide the skilled labour force needed to support all of the **SET Plan research and innovation actions**.
- Targeted reskilling in **offshore renewables** supports EU objectives by accelerating project deployment timelines, addressing regional labour shortages in coastal and island regions, and strengthening European industrial leadership in offshore wind and related clean technologies.

77 https://shorewinner.eu/meet-shorewinner-project/
78 https://shorewinner.eu/wp-content/uploads/2025/06/SHOREWINNER_D2.2_PT_Final_V2.pdf
79 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en

WHAT

The energy transition can only succeed if the current workforce is closely involved. SET Plan countries and industries should implement large-scale reskilling programmes, learning from successful models across Europe: for example, the **coal regions in transition**[80] and the **COALition project**[81]. There are programmes to retrain coal miners as solar panel installers or geothermal technicians; these efforts should be intensified and replicated for oil and gas workers and automotive workers (transitioning to EV and battery manufacturing).

Workforce development can be informed by **a Strategic Roadmap for Skills in the European Energy Sector**[82]. This would require dedicated leadership, endorsement, and resources. The **ReSkill4NetZero**[83] project has produced a skills strategy[84] which could contribute as a basis for a strategy. It was agreed that the recommendation should frame this as an action for the Commission to lead, with support from the SET Plan community.

The **Just Transition Mechanism**[85] and other funds can finance retraining. A key target group is tradespeople, such as electricians, metalworkers, plumbers, and construction workers – many of their skills are transferable with additional training. A plumber can become a heat pump installer with targeted courses; a steel welder can work on wind turbine towers or hydrogen pipelines after reskilling. Workers in fossil-fuel-related industries could transfer their skills to renewables, geothermal energy, hydrogen, and other emerging sectors.

The Shorewinner analysis stresses the importance of **upgrading VET curricula** with offshore-specific modules (e.g. working at heights, marine safety, electrical systems for offshore wind), **co-designed with employers** to ensure immediate labour market relevance[86]. The project highlights simulation-based training and mobile training units as effective solutions for regions with limited access to offshore infrastructure, particularly in island and peripheral coastal areas[87].

Government incentives are crucial: providing stipends, free courses, or tax breaks encourages workers (and their employers) to pursue further training. Because many tradespeople work in small firms or are self-employed, making training accessible (through evening classes or online modules) and affordable is crucial.

The **8. Energy Research Programme (8.EFP)**[88] **of the German Federal Ministry for Economic Affairs and Energy (BMWE)** addresses skills and qualifications. Within the Mission Transfer framework and associated capacity-building, the BMWE highlights the need to expand the pool of qualified personnel and strengthen competencies by engaging young researchers and fostering cooperation between science and industry.

The German Federal Environmental Foundation's **'Qualification for the energy transition' (Qualifizierung für die Energiewende)** funding initiative[89] targets projects which aim to strengthen skills development across the energy workforce. This initiative supports workforce qualification in skilled trades and renewable technologies, promotes innovative training formats, advances gender inclusion and the participation of underrepresented groups, and enhances career guidance and vocational training in energy technologies.

The EU should also support exchanges of best practices: for instance, one country's programme to certify oil refinery technicians as petrochemical process controllers for biofuel plants could guide another country. **Shorewinner** findings underline the need for stronger industry-training provider partnerships, including structured apprenticeships and paid internships, to lower entry barriers for SMEs and self-employed workers in coastal regions[90].

The **Skills4EII alliance**[91] (Skills Alliance for the Green, Digital and Social Transformation of the Energy Intensive Industries), funded by the Erasmus+ programme, focuses on mapping and addressing skills gaps in energy-intensive industries in support of the green transition. It aims to create a common framework that integrates the specificities of all industries to continuously and proactively adjust skill demands.

80 https://energy.ec.europa.eu/topics/clean-energy-transition/eu-coal-regions-transition_en
81 https://www.coalitionhubs.eu/
82 Some specific roadmaps are noted https://cinea.ec.europa.eu/news-events/news/eu-life-programme-new-skills-roadmaps-delivered-15-countries-meet-buildings-climate-and-energy-goals-2025-06-24_en and https://cdn.digitaleurope.org/uploads/2023/06/DIGITALEUROPEs-roadmap-for-Europes-energy-ecosystem-digital-transformation.pdf
83 https://reskill4net-zero.eu/
84 https://reskill4net-zero.eu/wp-content/uploads/2025/12/Renewable-Energy-Skills-Strategy-for-Europe.pdf
85 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en
86 https://shorewinner.eu/wp-content/uploads/2025/06/SHOREWINNER_D2.2_PT_Final_V2.pdf
87 https://shorewinner.eu/wp-content/uploads/2025/06/SHOREWINNER_D2.2_PT_Final_V2.pdf
88 https://www.bundeswirtschaftsministerium.de/Redaktion/DE/Publikationen/Energie/8-energieforschungsprogramm-zur-angewandten-energieforschung.html
89 https://www.dbu.de/en/topics/funding-initiatives/qualification-for-the-energy-transition/
90 https://shorewinner.eu/wp-content/uploads/2025/06/SHOREWINNER_D2.2_PT_Final_V2.pdf
91 https://www.aspire2050.eu/skills4eii

Additionally, these upskilling efforts should not neglect **older workers**, where continuous professional development can keep mid-career engineers and technicians up to date with new tools and methods, extending their productive careers. Companies can institute requirements or incentives for a certain number of training hours per year (some forward-looking firms already tie skill development to career progression).

This recommendation also encompasses **addressing skill obsolescence:** sectors undergoing automation (such as conventional power plants) may see some jobs decline, so proactive retraining into growth areas (such as renewables operations and maintenance and grid upgrade projects) prevents unemployment and fills vacancies in new fields. The developed upskilling and reskilling programmes would support the general need to increase STEM output levels in the EU.

Upskilling at scale will also require expanding training capacity – including more trainers (with upskilling of existing trainers), additional training centres, mobile training units for remote areas, and modern training equipment (such as VR simulators for high-risk tasks).

On-the-job training is also essential, with skills development tailored to workers, such as IT support, distance learning, or dedicated training hours. By mobilising resources, Europe can transform workers from past sectors into the workforce, drive the clean technologies of the future, and ensure that no one is left behind in the transition.

WHO

- National governments can provide incentives (e.g. tax breaks, free courses) and establish links with national territorial just transition plans that cover the period up to 2030[92].
- Companies can provide incentives (e.g. career development pathways, number of training hours per year).
- Employer engagement in co-designing curricula and offering work-based learning placements (internships and apprenticeships) is essential to ensure training content matches real operational needs in offshore wind and related sectors[93].
- The Implementation Working Groups and ETIPs can assist by identifying which upcoming projects (e.g. a big wind farm or building retrofit program) might face labour shortages, so that reskilling can be focused accordingly.
- The Joint Research Centre (JRC) can help with skills intelligence by collecting and analysing supply and demand data of the workforce.
- ETIP SNET can collaborate in the observatory of reskilling and upskilling needs, taking into account the European Qualifications Framework (EQF).

HOW

Encourage and support **innovative learning and training in energy skills**.

- Build capacity in public administrations, such as through the **Energy Poverty Advisory Hub**[94]. Develop instruments to help national authorities achieve a uniform understanding of tasks related to permitting, siting and defining sensitive areas, policy planning, policy communication, and coping with disinformation, which is increasingly hindering the development of energy infrastructure. Embed KPIs into these instruments.
- Collaborate with the existing and future **Net Zero Industrial Academies**[95] (battery, solar, wind, nuclear, and grid), and the **InnoEnergy Skills Institute**[96] which develops "tailored upskilling solutions to help you build a future-ready workforce", to explore how that Institute can support collaborative energy skills developments.

92 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en
93 https://shorewinner.eu/wp-content/uploads/2025/06/SHOREWINNER_D2.2_PT_Final_V2.pdf
94 https://energy-poverty.ec.europa.eu/
95 https://ec.europa.eu/newsroom/growth/items/823315/en
96 https://innoenergy.com/skillsinstitute

- Embedding offshore-specific modules (e.g. marine safety, working at heights, offshore electrical systems) **into academy programmes**[97], co-developed with industry to ensure immediate applicability[98]. There is an urgency to establish a **Smart Grid Academy** to address immediate skills shortages arising from the digitalisation of electricity grids.
- Through the **ReSkill4NetZero**[99] project with "a VET training programme of modular and flexible training courses" and working on recognised skills certification.
- Through the Coordination and Support Action "HORIZON-EURATOM-2024-NRT-01-02: **European Nuclear Skills Initiative"**[100].
- Through the "**Coal Regions in Transition" Platform**[101].
- Though national initiatives like the French **'Mon avenir dans le nucléaire'**[102].
- Collaborate with the Strategic Alliance for skills development under the **Pact for Skills for the Construction sector**[103] and other Pact for Skills energy-skills **partnerships**.
- Collaborate with the **AI Skills Academy**[104] ("train-the-trainer trainings" in **Pillar 1: Knowledge, education, and training), EIT Education**[105], EIT **Digital Education**[106], and the **Euratom Research and Training Programme**[107] to develop innovative skills training and learning resources targeted to industry and research. Promote the resources through schemes such as the **Young Energy Ambassadors** programme[108].
- Apply **gamification principles from projects like TRANSIT**[109] to adult learning and reskilling programmes. Interactive scenario-based challenges can simulate decision-making in renewable energy project planning, grid operation, or maintenance. These boost engagement among mid-career professionals and provide measurable performance data to track learning progress and tailor future training.
- Collaborate with **European Schoolnet**[110] to develop innovative multi-national energy-related content for school curricula[111].
- Consult with the **European Universities Association**[112] and other higher education research groupings (such as the Coimbra Group[113], ECIU[114] and LERU[115]) to better align curricula and research with the developing energy skills needs.
- Link to the publicity potential of the **European Youth Energy Day**[116] and the **European Researchers' Night**[117] and to lifelong learning initiatives.
- Stimulate **regional lifelong learning initiatives** at the vocational, applied, and academic levels through linkage to regional development funds, the social climate fund, or the competitiveness fund, with a focus on digitalisation, industrialisation, and robotisation.

97 https://ec.europa.eu/newsroom/growth/items/823315/en
98 https://shorewinner.eu/wp-content/uploads/2025/06/SHOREWINNER_D2.2_PT_Final_V2.pdf
99 https://www.ehpa.org/projects/reskill4netzero/
100 https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/HORIZON-EURATOM-2024-NRT-01-02?isExactMatch=true&status=31094501,31094502,31094503&callIdentifier=HORIZON-EURATOM-2024-NRT-01&order=DESC&pageNumber=1&pageSize=50&sortBy=startDate
101 https://energy.ec.europa.eu/topics/clean-energy-transition/eu-coal-regions-transition_en
102 https://www.monavenirdanslenucleaire.fr/
103 https://erasmus-plus.ec.europa.eu/de/projects/search/details/101187470
104 https://www.eitdeeptechtalent.eu/calls-and-opportunities/ai-skills-academy/
105 https://www.eit.europa.eu/community-activities/eit-community-education
106 https://www.eitdigital.eu/online-education/
107 https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/euratom-research-and-training-programme_en
108 https://sustainable-energy-week.ec.europa.eu/young-energy-ambassadors_en
109 Transit Web https://transitproject.eu/
110 http://www.eun.org/
111 https://catalogue.europeanschoolnetacademy.eu/
112 https://www.eua.eu/
113 https://www.coimbra-group.eu/
114 https://www.eciu.eu/
115 https://www.leru.org/
116 https://youth.europa.eu/year-of-youth/activities/1222_en
117 https://marie-sklodowska-curie-actions.ec.europa.eu/actions/msca-citizens/join-a-celebration-of-science

- Develop dedicated skill profiles for **concentrated solar thermal (CST) and thermal energy storage (TES) technologies**. Establish targeted reskilling pathways for workers from conventional thermal power plants. Integrate CST, TES, and hybrid-system competencies into national and EU-level curricula, qualification standards, and certification frameworks. Leverage the strong overlap with existing thermal engineering competencies to enable low-cost, rapid workforce transition and accelerate deployment.

WHEN

- Short-term (2026-2027): Develop and implement innovative learning and training in energy skills, building on existing initiatives (see description above).
- Medium-term (2027-2030): Establish links with national territorial just transition plans[118].

KEY PERFORMANCE INDICATORS (KPIS)

- Number of training centres, companies and education providers involved in the initiatives.
- Number of workers re/upskilled from fossil sectors to clean energy.
  - **Target:** 100,000 by 2030.
  - **Expected Outcome:** A just transition for fossil-fuel-reliant communities.
- Share of industrial regions with formal green skills strategies.
  - **Target:** 100% of NZIA-priority regions by 2027.
  - **Expected Outcome:** Regionally tailored upskilling strategies integrated into industrial plans.

118 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en

RECOMMENDATION 4: HARMONISE CERTIFICATION, QUALIFICATION FRAMEWORKS AND SKILL STANDARDS

Recommendation summary:

Fragmented certification systems limit labour mobility and slow clean-energy deployment across the Single Market. Employers often lack trust in qualifications issued in other Member States.

This recommendation seeks to establish common European definitions, certifications and qualification standards for key energy-sector occupations. It promotes mutual recognition through EU frameworks such as the EQF and ESCO.

IWGs, ETIPs, and CETP are recommended to: (1) develop Common European competency standards for the energy sector in collaboration with Cedefop, ETF, JRC, CEN and CENELEC, with the SET Plan community tasked with identifying priority occupations and driving technical standardisation through dedicated task forces and working groups; (2) promote mutual recognition of national certification schemes, with Member States encouraged to adopt or model proven frameworks, sharing content, testing methodologies, quality assurance practices and microcredentials; (3) develop a European Sectoral Qualification Framework for energy, enhancing cross-border recognition, comparability and labour mobility across the SET Plan community.

WHY

Harmonisation is essential for aligning skills, certifications, and qualifications across borders. It supports labour mobility, efficient upskilling, and the development of trustworthy certification systems, all of which are key to closing skills gaps in the clean energy sector

Expected outcomes and contribution to EU priorities

- Providing the skills mobility needed to achieve the **Green Deal** goal of climate neutrality by 2050.
- Contributing to skills mobility needs across **the Clean Industrial Deal** and the dimensions of the **Energy Union**: energy security, energy efficiency, and research and innovation.
- Contributing to the aim of the **Union of Skills** to increase the mobility of workers and make skills portable across EU countries. For example, the **Skills Portability Initiative**[119], including its pillars related to modernising recognition frameworks and digitalising qualification documentation. The **Construction Service Act**[120] (public consultation until 28 April 2026) is an additional legislative vehicle relevant to recognition processes, particularly for building renovation and construction skills.
- Supporting the **SET Plan research and innovation actions**, especially: new technologies and services for consumers; resilience and security of energy systems; new materials and technologies for buildings; energy efficiency for the industry

WHAT

An EU-wide effort is needed to standardise the definition and certification of key clean energy skills. Different countries have their own certifications for solar installers and energy auditors, which can vary in rigour and are not always mutually recognised. Aligning these under a common framework (building on the **European Qualifications Framework**[121]) will help employers trust the qualifications from any Member State and allow workers to move more easily to where jobs are.

Harmonised certification programmes should be created for critical roles, such as a European solar PV installer certification, a European heat pump technician licence, or a standardised course and exam for a wind turbine service technician. The objective would be for workers certified to this common standard to be able to work on projects across the EU, helping to address regional skill shortages.

119 https://employment-social-affairs.ec.europa.eu/news/commission-seeks-views-skills-portability-initiative-2025-12-05_en And see also https://employment-social-affairs.ec.europa.eu/document/63569573-8ddf-42ca-836a-1743e9f58fb1_en

120 https://ec.europa.eu/newsroom/neb/items/919400/en

121 https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework

The **European Sectoral Qualification Framework** should be further developed to cover qualifications and jobs at all levels (from plumbers in construction to energy plant technicians and energy network managers). National sectoral qualifications frameworks could be mapped efficiently against the European sectoral frameworks.

The SET Plan community, through its Task Forces and working groups, can identify priority skill sets that need standardisation and work with bodies such as CEN (European Committee for Standardisation) and CENELEC (European Committee for Electrotechnical Standardisation) to develop technical training standards. This involves mutual recognition, and where good national certification schemes exist, others should accept them or model their own schemes after them.

Structured cooperation between higher education institutions, research alliances, and companies can help. Establish contacts to gather and disseminate educational tools, curricula, and training materials developed under Horizon Europe and Erasmus+ projects focused on energy skills. Train-the-trainer programmes could be developed via EU-funded projects.

Common standards enable the **sharing of training content and testing methods**. For example, an online theoretical course for battery system installers could be used EU-wide if everyone agrees on the competencies it covers. Harmonisation should also extend to emerging areas by defining skill benchmarks for new roles, such as "hydrogen safety engineer" or "building energy systems integrator", to guide training programmes across all countries.

Quality assurance is a key requirement. Standardised certifications typically require passing exams or assessments, ensuring a baseline skill level that improves safety and consumer confidence (by confirming that a certified technician has EU-level safety training).

Recognition of skills for informal learning or on-the-job experience can be achieved through frameworks that validate workers' skills. Many workers possess valuable skills without formal qualifications, and they should be able to obtain accreditation through assessment. The EU's work on a **Europass skills passport**[122] and micro-credentials for lifelong learning can support this portability and recognition of skills. Harmonisation will support companies (especially SMEs) in expanding across borders, as staff credentials will be valid in multiple countries.

Creating a common skills language and certification system in Europe, such as the European Sectoral Qualifications Framework, will raise the competency and flexibility of the energy workforce, directly contributing to faster and safer deployment of SET Plan technologies.

WHO

- To implement this recommendation, the **European Commission**, in collaboration with professional associations and **standardisation bodies** (e.g. CEN/CENELEC), should convene experts to develop these skill standards as part of a new **European Sectoral Qualification Framework** in the energy sector.
- Over time, **funding programmes** could make adherence to these standards a condition (for example, requiring that installations funded by EU programmes use certified installers).

122 https://europass.europa.eu/en/what-europass-skills-passport

HOW

Explore and contribute to the Clean Industrial Deal **European Fair Transition Observatory**[123] to **build and share knowledge** across the energy sector, to commission research, and to share developments in **certification and recognition of energy skills.**

- Through the Union of Skills and the **Skills Portability Initiative**.
- Collaborate with other relevant Commission bodies and activities such as **Cedefop**[124] (for example, through Cedefop's work on skills and jobs for the Green Transition[125], VET and reskilling[126], and the Cedefop green observatory[127]), the European Training Foundation[128], and the **Joint Research Centre Skills Intelligence Hub**[129]. This can help to build and share knowledge of certification and recognition, such as through the **National Energy and Climate plans 2021-2030**[130] and Article 28(6)[131] of the **2023 Directive on Energy Efficiency**[132], which requires Member States to conduct national assessments of energy efficiency skills and gaps and to submit the information via a common online platform.
- EU-funded projects on skills should follow clearly defined Commission recommendations on the use of micro-credentials.
- Promote micro-credentials and portable certifications.
- Build on national projects such as the **Nuclear Skills Passport**[133].
- Link to relevant communication and information campaigns, such as the **European Cluster Collaboration Platform** campaign on energy awareness[134].

WHEN

- Medium-term (2027-2030): National Energy and Climate Progress Reporting (every 2 years).
- Long-term (post-2030): Inclusion of quantified skills needs in post-2030 national reporting frameworks[135].

KEY PERFORMANCE INDICATORS (KPIS)

- Number of SET Plan countries implementing recognition of cross-border certifications.
- Inclusion of quantified skills needs in National Energy and Climate Plans (NECPs).
  - **Target:** Each country to submit a progress report every 2 years, according to the structure, format, technical details and process as set out in the Implementing Regulation.
  - NECPs as a governance tool will be reviewed for the post-2030 period as part of the forthcoming revision of the Governance of the Energy Union and Climate Action Regulation[136].
  - **Expected Outcome:** Skills integrated into core national policy frameworks.
- Percentage of certifications mapped to EQF (European Qualifications Framework) or ESCO (European Skills, Competences, and Occupations).
- Increase in cross-border job placements or mobility in certified roles.

123 https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/tender-details/6c4ffb2a-b629-4d00-ae2d-9c475fa9c466-PIN?isExactMatch=true&order=DESC&pageNumber=1&pageSize=50&sortBy=startDate
124 https://www.cedefop.europa.eu/en
125 https://www.cedefop.europa.eu/en/projects/skills-and-jobs-green-transition
126 https://www.cedefop.europa.eu/en/tools/timeline-vet-policies-europe/search/43323
127 https://www.cedefop.europa.eu/en/themes/green-observatory
128 https://www.etf.europa.eu/en
129 https://joint-research-centre.ec.europa.eu/projects-and-activities/skills-and-competences-0/skills-intelligence_en
130 https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-energy-and-climate-plans_en
131 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AJOL_2023_231_R_0001&qid=1695186598766
132 https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-directive_en
133 https://www.csfn-nucleaire.org/fr/actualites/passeport-nucleaire
134 https://www.clustercollaboration.eu/content/energy-awareness-campaign-small-actions-big-energy-savings. Example national programmes related to lifelong learning and energy skills in Germany include: https://www.bmas.de/DE/Arbeit/Aus-und-Weiterbildung/Berufliche-Weiterbildung/Nationale-Weiterbildungsstrategie/nationale-weiterbildungsstrategie.html; https://www.zdh.de/presse/veroeffentlichungen/reden-und-namensbeitraege/energiewende-ist-nur-mit-dem-handwerk-zu-bewaeltigen/; https://www.bibb.de/de/738.php
135 NECPs as a governance tool will be reviewed for the post-2030 period as part of the forthcoming revision of the Governance of the Energy Union and Climate Action Regulation.
136 https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-energy-and-climate-plans_en

RECOMMENDATION 5. PROMOTE INCLUSION AND AWARENESS TO ATTRACT TALENT

Recommendation summary:

The clean-energy sector suffers from low visibility, gender imbalance and persistent perception challenges. Underrepresentation reduces the available talent pool and limits innovation.

This recommendation calls for EU-wide and national campaigns presenting clean-energy careers as inclusive, innovative and purpose-driven. It emphasises diversity, gender equality and equal access to skills development.

IWGs, ETIPs, and CETP are recommended to: (1) launch an EU-wide awareness campaign to enhance the attractiveness of clean energy careers, emphasising diversity, inclusion and purpose-driven work, with SET Plan countries encouraged to complement this through tailored national and regional outreach supported by employment agencies, Large-Scale Partnerships, and relevant Commission directorates; (2) mobilise support, identify appropriate communication channels and expand reach across Member States at national, sectoral and regional levels; (3) systematically promoted gender balance through clear KPIs and targeted outreach, building on the Gender Equality Strategy 2026-2030 and ensuring that training and reskilling programmes embed gender equality as a structural objective.

WHY

The clean energy sector faces labour shortages due to a skills gap and a negative image. It is often perceived as primarily technical and male dominated. The sector must become more inclusive, appealing, and visible. Improving job appeal will boost recruitment, retention, and sector growth. It suffers from gender imbalance and social inequality; inclusive, diverse teams perform better and foster innovation. An improved gender balance and inclusiveness would align with the EU values and Green Deal objectives.

Expected outcomes and contribution to EU priorities

- This will widen the understanding of the range of skills needed to achieve the **Green Deal** goal of climate neutrality by 2050.
- Awareness of the number of quality career paths available would positively influence the choice of STEM studies in initial education.
- Through maximising the size of the European energy skills pool, the actions will contribute to achieving **the Clean Industrial Deal** and the dimensions of the **Energy Union**. The **SET Plan's research and innovation actions will have optimal access to the skills needed** to achieve their goals.
- Attracting more women in the clean energy sector contributes to the **EU Gender Equality Strategy**[137].

137 https://commission.europa.eu/strategy-and-policy/policies/justice-and-fundamental-rights/gender-equality/gender-equality-strategy_en

WHAT

While the other recommendations focus on training existing and new workers, a crucial underpinning action is to **attract a broad, diverse talent pool** into the clean energy sector. **Campaigns and policies aimed at raising awareness of energy careers can help** ensure that training is accessible to all segments of society. This includes encouraging more women and girls to pursue STEM education and energy jobs, as diversity will alleviate skill shortages by empowering a wider population and increasing female representation in engineering and leadership roles

Awareness campaigns can also incorporate gamified online challenges, such as virtual energy transition missions or community-based competitions, to engage young people and career changers. The TRANSIT[138] project demonstrates that gamification can make energy topics more relatable and engaging, thereby lowering barriers to entry and increasing the diversity of participants in clean energy careers.

Within the framework of the **Geotherm Fora project**[139], ETIP Geothermal and IWG Geothermal published a report on education, training, and mobility, including gender aspects[140].

It also means reaching students early. For instance, incorporating climate and energy topics into school curricula can inspire the next generation of engineers and technicians, and also reach their parents, given the importance of parental involvement in educational decisions. Messages conveyed should showcase the diversity of possible careers in the sector and appeal to younger generations' **environmental concerns**. It should broaden awareness of the breadth of roles in the sector (e.g., digital, managerial, social, legal, entrepreneurial).

Changes in perceptions are needed, and participation should be encouraged in VET courses and reskilling programmes to qualify for a job in the clean energy sector.

WHO

- The **Large-Scale Partnerships**[141] could help create content and act as amplifiers of the messages conveyed.
- The **European Commission** (DG ENER, DG EMPL and DG GROW), the **IWGs** and **ETIPs** can mobilise support and expand the outreach by engaging SET Plan countries and identifying the right channels and contacts to engage with.
- **Employment agencies** can promote green industry prospects.

HOW

Involve education ministries to promote gender diversity in the future energy workforce by strengthening early-stage interventions in schools and universities.

Specific campaigns could target people transitioning from other industries or regions. Communications delivered in regional languages would appeal to a variety of groups. **Awareness campaigns at national, sectoral, and regional levels (supported by EU frameworks and tools)** can help build a high-tech, purpose-driven, and dynamic sector at the forefront of digitalisation and climate action. Campaigns should reach a wide audience and could be carried out with social media support, as well as spots on national TV and radio, in collaboration with the SET Plan countries' ministries of education (and other relevant public authorities).

The existing mobility scheme of the **EERA (European Energy Research Alliance) Joint Programme Geothermal Energy**[142] highlights the importance of the "Women in Geothermal" initiative in empowering women and advancing their education, professional development, and careers in the geothermal community. Promote a gender-balanced workforce by setting clear KPIs, building on the Gender Equality Strategy 2026-2030[143], and ensuring that training, reskilling programmes and outreach initiatives systematically support gender equality.

138 https://transitproject.eu/
139 https://www.egec.org/research-projects/geotherm-fora/
140 https://etip-geothermal.eu/publications/
141 See for example: https://pact-for-skills.ec.europa.eu/document/download/200cbf53-78bf-4cbc-8a13-c9552a21e981_en?filename=11.%20Renewable%20Energy.pdf
142 https://www.eera-set.eu/activities/joint-programmes.html
143 https://commission.europa.eu/strategy-and-policy/policies/justice-and-fundamental-rights/gender-equality/gender-equality-strategy_en

WHEN

- Short-term (2026-2027): Launch of EU-wide awareness campaign, involving SET Plan countries and establishing links with existing initiatives (*see description above*).
- Medium-term (2027-2030): Review of campaign according to KPIs (*see below*).

KEY PERFORMANCE INDICATORS (KPIS)

- Share of women in technical energy roles.
  - **Target:** 40% by 2030 (baseline ~25%).
  - **Expected Outcome:** Gender-balanced workforce across the clean energy value chain.
- Number of SET Plan countries involved in communications campaigns.
- Reach of EU-wide campaign (views, impressions, downloads, media mentions, and engagement rates on social media).
- Percentage of actioned recommendations deemed effective by stakeholders.
  - **Target:** >80% satisfaction in annual SET Plan Community review.
  - **Expected Outcome:** High-impact, stakeholder-responsive policy implementation.
- Use of ETIP/IWG reports in regulatory or funding decisions.
  - **Target:** Referenced in 75%+ of relevant EU/national programmes.
  - **Expected Outcome:** Evidence-based programme design and deployment.

ANNEXES

ANNEX 1: TASK FORCE PARTICIPANTS

The table below provides an overview of the participants of the Task Force 'Skills'.

Table A1: Participants of the Task Force 'Skills'

Name (Role/Organisation)
Task Force members
• Albannie Cagnac (ETIP SNETP) • Ann Jessica Johnson (ETIP SNETP) • Axel Thielmann (ETIP BAT) • Hande Eryilmaz (IWG CST) • Huub Keizers (IWG EEB) • Igor Krupenski (IWG IND) • Luca Xodo (IWG Geothermal) • Luis Coelho (ETIP RHC) • Mariya Trifonova (ETIP WIND) • Miguel Angel Sanchez Fornie (ETIP SNET) • Miklos Antics (ETIP Geothermal) • Nabih Cherradi (ETIP PV) • Nicolaos Cutululis (IWG DCT) • Peter Eecen (EERA) • Silvia Bodoardo (EERA)
Support Office (including experts)
• Michael Blakemore (Task Force Lead, Support Office) • Jasminka Michalcakova and Luis Vega (Task Force Facilitator, Support Office) • Nathalie Richet (Lead Expert) • Emilienne Tingwey (Support Expert) • Stefan Humpl (Support Expert) • Marielle Feenstra (Support Expert) • Brian Azzopardi (Support Expert)
European Commission (Observers)
• Mathieu Fromentin (Lead Policy Officer, DG RTD) • Bence Marmarosi (DG RTD) • Paul Grandeau (DG RTD) • Endre Gyorgy (DG EMPL) • Sonia De Melo Xavier (DG EMPL) • Remi Mayet (DG ENER) • Cristina Marchitelli (DG ENER) • Victor Charbonnier (DG ENER) • Laia Delgado Callico (JRC) • Ingrida Murauskaite-Bull (JRC)

ANNEX 2: METHODOLOGY OF THE TASK FORCE

This section describes the main elements of the approach for developing the recommendations:

1. Nomination of Task Force members
2. Task Force meetings
3. Literature Review
4. Conceptual Framework
5. Consultation with wider SET Plan community

1. Nomination of Task Force members

The following 'stakeholder groups' of the SET Plan were invited to nominate representatives to participate in the Task Forces:

- Implementation Working Groups (IWGs).
- European Technology and Innovation Platforms (ETIPs).
- European Energy Research Alliance (EERA).
- Clean Energy Transition (CET) Partnership.
- Driving Urban Transition (DUT) Partnership

Each SET Plan stakeholder group (i.e., a specific ETIP or IWG) could nominate one primary representative for each cross-cutting Task Force. A call for expressions of interest was launched in Q3 2024 to gather nominations and establish the members of each Task Force.

There were specific roles within the Task Force to facilitate the co-creation of recommendations.

Table A2: Overview of roles for each Task Force

Role	Description
Support Office (7+)	The Support Office operates the Task Forces and comprises: • A coordination team overseeing the operation of the five Task Forces. • One Task Force Lead and one Task Force Facilitator to coordinate the meetings (incl. logistics and minutes) and outputs of the Task Forces. • Five Independent Experts who provide knowledge and guidance in their specialised fields and write up (specific aspects of) the recommendations. They are 'independent' in the sense that they were not previously involved in the SET Plan.
Members of the Task Forces (10 – 20)	Representatives were nominated by the SET Plan stakeholder groups (ETIPs, IWGs). Specific responsibilities for Task Force members included: • Attend meetings of the Task Force (three online meetings during 2025). • In between meetings: Gather feedback from the SET Plan stakeholder group they represent and provide written inputs (e.g. survey). • During meetings: Make verbal contributions (e.g. rank and decide on priorities and solutions). Inputs from Task Force members contributed to the development of the Conceptual Framework.

European Commission (2+)	• European Commission Policy Officers had an observer role in the recommendation policy process. • 'Lead' Policy Officers: Ensured that the work of the Task Force was aligned with the policy priorities of the Commission. They reviewed and approved recommendations from the Task Force. They did not directly influence the process of the recommendations. • Other Policy Officers: Provide oral and written inputs on an as-needed basis (e.g. for a specific policy area).

The Support Office served as a facilitator, drawing on the knowledge of SET Plan stakeholder groups.

Figure A1: Roles of the Task Force and Support Office

2. Task Force meetings

For the Skills Task Force, the following meetings have been held to facilitate the development of the draft recommendations:

- 1st Task Force Meeting (11 March 2025): The top priorities and related barriers/gaps were discussed and refined. Within the Task Force, priorities for future work were agreed upon.
- 2nd Task Force Meeting (June 2025): Preliminary concepts for recommendations were discussed.
- 3rd Task Force Meeting (February 2026): Finalisation of the recommendations was discussed.
- Several meetings and online interaction followed with the Task Force Lead, Facilitator, and the experts to discuss input, develop the recommendations and support preparation for Task Force Meetings.

3. Literature review

Between October 2024 and April 2026, literature was reviewed by the Support Office and the Independent Experts. The literature review serves as supporting evidence.

4. Developing the Conceptual Framework

A preliminary Conceptual Framework was developed for each cross-cutting topic ahead of the 1st Task Force meeting. It facilitated the process of developing recommendations by supporting the identification of:

- **Barriers and gaps:** A barrier is something that acts as a hindrance or obstacle. A gap signifies a lack of separation. Both need to be addressed to progress in line with a cross-cutting topic.
- **Solutions:** Practical approaches which address a specific barrier or gap.
- **Recommendations:** Solutions were refined to be effective, feasible, and appropriate in the context of the SET Plan.

The initial Conceptual Framework included input from:

- The survey used to collect Expressions of Interest (EoI) and recruit Task Force members (launched in Summer 2024).
- A Cluster Workshop (November 2024) brought together the Secretariats of the Implementation Working Groups (IWGs) and the European Technology & Innovation Platforms (ETIPs) of the SET Plan. The objective of the workshop was to identify priorities for five cross-cutting topics to inform the future work of the respective Task Forces.
- Research conducted by the Support Office on the EU Policy landscape relevant for the cross-cutting topics.
- Feedback received by Independent Experts of the Task Force.

A revised Conceptual Framework is included in Annex 3.

5. Consultation with the wider SET Plan community

Following the development of the draft recommendations, a consultation has been launched to collect feedback from the IWG and ETIP Secretariats and (Co-)Chairs, the European Commission members, and Steering Group members. The consultation took place between 25 August and 12 September 2025. A second consultation took place between the 9th of February and the beginning of March. Feedback from the consultation was used to revise recommendations on cross-cutting topics to be addressed by/within the SET Plan.

ANNEX 3: CONCEPTUAL FRAMEWORK

A Conceptual Framework was prepared to facilitate the Task Force's development of recommendations.

1. Typologies for the conceptual framework

The Conceptual Framework distinguished between different types of gaps/barriers:

- **Barriers and gaps:** A barrier is something that acts as a hindrance or obstacle. A gap signifies a lack of separation. Both need to be addressed to progress in line with a cross-cutting topic.
- **Solutions:** Practical approaches which address a specific barrier or gap.
- **Recommendations:** In the context of the SET Plan, solutions should be refined to be:
  - Effective (it successfully resolves the barrier/gap),
  - Feasible (SET Plan actors can implement it), and
  - Appropriate (it is something that should be addressed by/within the SET Plan).

The Conceptual Framework also distinguishes between different types of gaps/barriers:

- **Political and regulatory:** for example, inconsistent policies and regulatory standards, protectionist policies, geopolitical tensions, and dependency on foreign suppliers for critical digital components and raw materials, policy incentives for decarbonisation and resilience, harmonisation of regulatory frameworks, and alignment with EU climate targets.
- **Economic and financial:** for example, high investment costs and limited availability of funding, hindering private engagement and large-scale adoption, Single Market enhancement, cost reductions through digitalisation, and consumer savings from improved efficiency.
- **Social:** for example, digital inequalities, lack of skilled workforce, low awareness of cybersecurity, and data privacy concerns. Organisational resistance and limited capacity to integrate digital solutions. Job creation in new professions, digital literacy programmes, and consumer empowerment through digital solutions.
- **Technical:** for example, integration challenges with existing infrastructure, insufficient digital infrastructure in rural areas, high energy consumption, interoperability issues, and cybersecurity threats. Energy efficiency through AI and IoT, better integration of renewables, optimisation of electric vehicles, and digital platforms supporting decentralised energy communities.

2. Input to the conceptual framework

Preliminary content of the Country Framework includes input from:

- The survey used to collect Expressions of Interest (EoI) and recruit Task Force members (launched in Summer 2024).
- This Cluster Workshop (November 2024) brought together the Secretariats of the Implementation Working Groups (IWGs) and the European Technology & Innovation Platforms (ETIPs) of the SET Plan. The objective of the workshop was to identify priorities for five cross-cutting topics to inform the future work of the respective Task Forces.
- Research conducted by the Support Office on the EU Policy landscape relevant for the cross-cutting topics.

Task Force meetings took place (online) in 2025 to refine the conceptual framework. The focus of these meetings has been:

- **1st Task Force meeting:** To discuss and refine the top priorities and related barriers/gaps. Within each Task Force, there is an agreement on which priorities to focus future work on.
- **2nd Task Force meeting:** To identify and refine solutions (from long-list to short-list of solutions) and test them, i.e. make sure that they are 'Task Force/SET Plan compatible'.
- **3rd Task Force meeting:** To agree on final recommendations.
- **Potential ad-hoc meeting:** The Task Force can determine if an additional meeting is needed, and the objectives of such a meeting will be determined accordingly (e.g. to discuss priorities which were not selected in the 1st Task Force meeting).

Task Force members had the opportunity to comment (in writing) on the conceptual framework in between Task Force meetings.

Table A3: Over view of roles for each Task Force

Priorities	Gaps/barriers (per priority)	Solutions	Recommendations (specific to the SET Plan)

1. Identifying gaps and anticipating future skill needs: Non-technological skills	**Skill & Capacity Gaps**
	• There is a need for skillsets covering:
	  • Impact assessments, life cycle analysis [SNETP]; environmental knowledge [ETIP RHC]; project development skills such as environmental assessment and project management [ETIP OCEAN].
	  • Innovation management [H2]; problem definition applied to the energy transition (disruptive innovation) [H2 IWG]; business skills [ETIP RHC], soft skills [ETIP RHC], project management and community engagement [ETIP GEO].
		• Develop programmes in environmental impact assessment, energy systems integration, and life-cycle analysis to support the transition to low-carbon energy [SNETP].	Recommendation 1

2. Identifying gaps and anticipating future skill needs: Blue-collar skills	**Skill & Capacity Gaps**
	• There is a need for skillsets covering:
	  • Engineering, civil, mechanical, in all energy sectors [ETIP SNETP].
	  • Skilled engineers [IWG DCT].
	  • Weld training [ETIP SNETP].
	  • Technology manufacturing skills (e.g. welder, lathe operator, crane operator, etc.) [IWG NS].
	  • Reactor operation, safety protocols, and maintenance, requiring significant on-the-job experience and certifications [ETIP SNETP].
	  • Operating and maintaining (O&M) wind farms [ETIP WIND].
		• Focus on flexible training programmes for new skills, along with a strong focus on up-skilling and re-skilling.	Recommendation 1

	Awareness and Acceptance Gaps
	• Difficulty in attracting workers in the construction sector [IWG EEB]:
	  • Hard working conditions (often low salaries) [IWG EEB].
	  • Bad image of the sector [IWG EEB].
	  • Difficulty in attracting women [IWG EEB].
	  • Bad image of low/medium-skilled professionals and associated degrees/certificates [IWG EEB].
	  • Difficulties in providing the right training modules for the blue-collar workforce [IWG EEB].
	• Renovation wave and clean energy transition: need for a huge workforce [IWG EEB].
		• More effective collaboration between energy and construction actors, stronger focus on inclusion and enhancing the attractiveness of energy careers.	Recommendations 1, 5

Priorities	Gaps/barriers (per priority)	Solutions	Recommendations (specific to the SET Plan)

3. Identifying gaps and anticipating future skill needs: Skills for energy systems	**Skill & Capacity Barriers**
	• There is a need for skillsets covering:
	  • Energy system modellers (who must understand specific characteristics of energy systems) [IWG OCEAN].
	  • System integration skills [ETIP SNETP].
	  • System customisation [IWG PV], and system optimisation [ETIP RHC].
	  • Advanced nuclear technologies such as Small Modular Reactors (SMRs), Generation IV reactors, and fusion, requiring retraining in additive manufacturing, new materials, and digitalisation [ETIP SNETP].
	• Increasing demand for skilled workers in clean technology sectors highlights skill gaps in key areas[144] .
	• Digital and AI-driven training programmes are increasingly needed to support smart grids, cybersecurity and predictive maintenance in energy systems[145].
		• Develop specialised training programmes for SMRs, hybrid energy systems, and next-generation reactor technologies to support integration with renewables [ETIP SNETP].
		• Focus on upskilling trade workers such as plumbers and electricians to in-demand clean energy occupations, e.g. heat pump technicians. Government incentives for retraining can support this, as many trade workers are self-employed or in micro-enterprises, meaning training must be self-financed. However, this pathway is only viable if there is a sufficient supply of workers to qualify for upskilling; therefore, continuing to expand the general pool of trade workers is essential to avoid simply shifting shortages from one part of the economy to another[146].
			Recommendation 1

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Priorities	Gaps/barriers (per priority)	Solutions	Recommendations (specific to the SET Plan)

4. Identifying gaps and anticipating future skill needs: Digital skills	**Skill & Capacity Barriers**
	• There is a need for skillsets covering:
	  • AI-related skills (e.g. grid operators) [ETIP SNETP]; automation, data analytics, artificial intelligence, and cybersecurity to support digital transformation in nuclear operations [ETIP SNETP].
	  • Equip developers and users with digital skills [IWG ES].
	  • Industrial symbiosis facilitation, energy-efficient analyst [IWG INDUSTRY].
	  • Digital knowledge for contractors [IWG DCT].
	  • Drive transition from analogue to digital [ETIP wind].
	  • Digital tools integrated in CS thermal applicator and link ICT with thermal energy solutions [IWG CST]. Lack of shared 'data' [IWG CST].
	• The green and digital transitions are transforming economic activities and job requirements, posing a risk of skills obsolescence for workers unless proactively addressed.
	• Low level of digitalisation in the sector (compared to other sectors) [IWG EEB].
		• Implement AI, big data, and predictive maintenance training programmes to modernise nuclear plant operations and optimise efficiency [ETIP SNETP].
		• Large Partnership for Skills in the Digitalisation of the energy system launched. [ETIP SNETP].
			Recommendation 2

5. Identifying gaps and anticipating future skill needs: Data and security skills	**Skill & Capacity Barriers**
	• There is a need for skillsets covering:
	  • Information security skills and data engineering [ETIP SNET].
	  • Security and intellectual property [IWG DCT].
	  • Skills in geoscience (collaboration with CCS) and skills in surface engineering (collaboration with ETIP-RHC) [IWG GEO].
	  • Cross-sectoral upskilling to align professionals with evolving nuclear technologies and safety requirements [ETIP SNETP].
		As above	Recommendation 2

Priorities	Gaps/barriers (per priority)	Solutions	Recommendations (specific to the SET Plan)

6. Identifying gaps and anticipating future skill needs: Other	**Skill and Capacity Barriers**
	• There is a need for skillsets covering:
	  • Operational [ETIP OCEAN].
	  • Transport logistics (from ports to safety pipelines to trucks) [IWG H2].
	  • Technical to build and operate plants [IWG BIO].
	  • Installers [ETIP RHC].
	  • Hybridisation [ETIP RHC].
	  • Need to train the next generation of engineers and scientists who can lead the energy transition and embed sustainability and circular economy principles in future innovations [EERA].
		• Skill development for the net-zero economy is embedded in the Net-Zero Industry Act [ETIP Wind].
		• Incorporating sustainability and circular economy into curricula will ensure that future leaders have the necessary knowledge and expertise to meet Europe's energy goals [EERA].
			Recommendation 1

	Information and knowledge gaps • Lack of structured interdisciplinary cooperation between engineering, social sciences, and industry for skills development [IWG PED]. • Barrier in balancing research and industry skill gaps [CST]. • Barrier in connecting skills needs of the industry with the training providers' institutions [ETIP SNETP].	• Collaboration between academia and industry, but also other already running initiatives, will strengthen practical learning and drive innovation [EERA].	Recommendations 1, 5

Priorities	Gaps/barriers (per priority)	Solutions	Recommendations (specific to the SET Plan)
7. Re-skilling and transferring existing knowledge	**Skills and Capacity Barriers** • Need to find a faster way to skill people; focus on life-long-learning, working, and training should be learned together [IWG EEB]	• Aim to transfer skilled workers from other sectors [ETIP GEO], keeping the knowledge and experience of the transitioning oil and gas workforce to match the future demand of skilled personnel: knowledge of the subsurface, for example, drilling, reservoir engineering, piping, geochemistry, geology for the role of geothermal energy [ETIP GEO]; knowledge of CO2 transport and storage [ETIP ZEP]. • Map transferable resources and identify new and similar jobs in other industries [ETIP Wind]. • Implement continuous education programmes to ensure professionals remain up-to-date with regulatory changes and evolving safety standards [ETIP SNETP]. • Lifelong learning programmes for upskilling and reskilling to adapt the current workforce to new energy technologies and practices [EERA].	Recommendation 3
	Information and knowledge gaps: • Challenges in Identifying Skills Shortages [IWG EEB].		Recommendations 3, 5

Priorities	Gaps/barriers (per priority)	Solutions	Recommendations (specific to the SET Plan)

8. Recognition of skills	**Regulatory Barriers**
	• The lack of recognition of qualifications of third-country nationals and across EU SET Plan countries is a barrier to skills and talent mobility.
	  • Teaching the needed skills to specialists of DHC in different regions and different countries [IWG IND].
	• The use of skilled workers from third countries remains largely limited.
	• The concept of green skills, which is intrinsically linked to the concept of green jobs, lacks common and standardised definitions, resulting in fragmented data and skills intelligence.
	• While new sources of information and methodologies have been progressively developed (see drivers' section later in this report), skills intelligence remains underused by policy makers.
	• Need to define and redefine skills [IWG EEB]:
	  • Skills for sustainable and resilient buildings, including durability aspects and climate resilience [IWG EEB].
	  • Skills exist, but new pathways should be designed to find new skills where they are needed [IWG EEB].
	• Variability of training programmes and standards across borders, leading to inconsistencies in certifications and mobility challenges for nuclear professionals [ETIP SNETP].
	• Getting skills recognised for the value they bring – ensuring all recognise that skills have a currency [IWG EEB].
		• Certification and accreditation processes in the EU for workers [DCT, ETIP GEO] could support a competencies passport [ETIP SNETP].
		• Standardising or harmonising skills [IWG PV] (e.g. through a taxonomy of competences [ETIP SNETP]).
		• The complex landscape of initiatives, combined with the lack of a unified approach and definition of green skills across SET Plan countries, highlights the need for strategic coordination and cooperation across countries and stakeholders.
		• Good knowledge and good practices in some regions [IWG IND]
			Recommendation 4

Priorities	Gaps/barriers (per priority)	Solutions	Recommendations (specific to the SET Plan)
9. Education and training programmes	**Education & Training Barriers** • Participation in education and training remains low and below targets set at the EU level. • Technical education and training pathways specific to the clean energy and technologies sectors remain insufficient. • Lack of women in the CET business and specific sectors [ETIP SNETP], [IWG CST]. • Barriers to entry exist for graduates [ETIP ZEP]. • Deterioration of basic skills among the European pupils, together with persistent teacher shortages[147]. • Limited progress in the rate of adult participation in learning (39.5% in 2022), which remains far from the 60% EU headline target[148].	• Encouraging universities, training centres, and industry to develop education and training programmes [ETIP WIND]. • Establish a community to foster exchange on skills needs for hydrogen [IWG H2]. • Need for close collaboration between academia and industry [ETIP ZEP]; industry should better express skill needs in regular exchange with universities [Hydro]; Need to harmonise education from school (including university) with employment needs of companies [IWG H2]. • Cross-sectional training programmes should be interdisciplinary [ETIP SNETP] and have a broad vision of different technologies [IWG CST, PV, BAT]. • Bridging programmes are needed to encourage STEM graduates [ETIP ZEP, IWG CST, IWG GEO]. • Develop pan-European training programmes that align with emerging technologies, safety requirements, and cross-sector applications [ETIP SNETP]. • Increasing the number of women entering vocational occupations will support narrowing the gender imbalance, especially in the energy workforce[149]. • Expanding STEM education mentorship and targeted hiring policies could help bridge the gender gap in the clean energy sectors. For example, women already represent 40% of the solar PV workforce, compared to only 15% in oil and gas [150].	Recommendation 1

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Priorities	Gaps/barriers (per priority)	Solutions	Recommendations (specific to the SET Plan)
	Other Barriers • Insufficient targeted policies to foster women and other underrepresented groups' participation in the labour market limit the talent pool and reduce the availability of skilled workers needed for the transition. • Lack of aligned educational programmes and curricula for nuclear professionals across different regulatory environments, affecting cross-border workforce mobility [ETIP SNETP]. • The fragmented approach to skills hinders the potential to grasp all opportunities related to skills development.	• Stronger focus on inclusion and enhancing the attractiveness of energy careers with explicit focus on further enhancing gender equality across energy careers.	Recommendation 1
10. Expertise of authorities and policymakers	**Education & Training Barriers** • Policymakers and public administration require education for expertise [ETIP ZEP, IWG H2]; at the city level, further skills development, capacity building, and human resources are needed [IWG PED]; ensuring the right competence for planning [ETIP RHC]. • Staff responsible for undertaking permitting need to be equipped with the necessary knowledge to better understand the project development cycle, the current state of the art of the technology, the environmental effects and supply-chain bottlenecks [ETIP WIND].	• Need to upskill authorities to understand technologies for permitting decisions [IWG GEO, DCT]; • Enhance coordination between EU energy agencies and SET Plan countries to ensure regulatory consistency and policy alignment in education and workforce planning [ETIP SNETP].	Recommendation 1, 5