

# Explanatory Note- Twin Transition Skills Dashboard

## Introduction

This dashboard displays the evolution of skills demand in the EU member states. Using online job vacancy data developed by [Lightcast](#), a leading global company on labour market analytics, the dashboard provides information on the developments and composition of AI and GREEN skills demand.

This dashboard is part of the Future of Work and Inclusive Growth in Europe project at Bruegel, which aims to develop multiple dashboards on labour market topics. It has been produced with the financial support of the Mastercard Center for Inclusive Growth. The rest of the note will explain the data sources employed in the dashboard.

## Data

### Lightcast data and definition of AI and GREEN jobs

The data employed in the dashboard are provided by Lightcast, a global labour market data company. Lightcast scrapes the content of online job vacancies from the web, extracts and organises the information into an online job vacancy (OJV) database.

This dashboard displays three main indicators constructed from this database; i) the required skills ii) the required education level and iii) the occupation listed in an OJV post.

Using information on required skills, a bottom-up approach is applied to identify the GREEN and AI jobs. If a vacancy lists at least one skill that is classified as AI (GREEN) according to the skills taxonomy developed by Lightcast, then that vacancy is classified as AI (GREEN). The Lightcast taxonomy for AI and GREEN skills is provided in the Appendix.

### Data availability

For most of the EU countries, the data are available starting January 2019, the exceptions are Cyprus, Latvia, Malta, and Slovenia.

COUNTRY	Start date	End date	COUNTRY	Start date	End date
AT	01/01/2019	31/09/2023	IE	01/01/2019	31/09/2023
BE	01/01/2019	31/09/2023	IT	01/01/2019	31/09/2023
BG	01/01/2019	31/09/2023	LT	01/01/2019	31/09/2023
CY	01/04/2021	31/09/2023	LU	01/01/2019	31/09/2023
CZ	01/01/2019	31/09/2023	LV	01/01/2021	31/09/2023
DE	01/01/2019	31/09/2023	MT	01/01/2021	31/09/2023
DK	01/01/2019	31/09/2023	NL	01/01/2019	31/09/2023
EE	01/01/2019	31/09/2023	PL	01/01/2019	31/09/2023
EL	01/01/2019	31/09/2023	PT	01/01/2019	31/09/2023
ES	01/01/2019	31/09/2023	RO	01/01/2019	31/09/2023
FI	01/01/2019	31/09/2023	SE	01/01/2019	31/09/2023
FR	01/01/2019	31/09/2023	SI	01/01/2021	31/09/2023
HR	01/01/2019	31/09/2023	SK	01/01/2019	31/09/2023
HU	01/01/2019	31/09/2023			

## Bruegel calculations

**EU averages** are calculated using the sum of all job posts across all member states, rather than the average of country values.

**Indexation** of monthly number of AI (GREEN) jobs series is done by equalizing the mean of 2021 monthly number of AI (GREEN) jobs to 100.

Some OJVs do not explicitly list an **occupation**. The graph showing the occupational distribution of AI and GREEN skills demand does exclude these posts while calculating the relative shares of each occupation. In 2022, 18.11% of AI jobs did not list an occupation, while the same number is 12.54% for GREEN jobs. The 2019 figures were 3.78% and 5.39% respectively.

## Other data sources

The country education levels, shown in graph *Share of AI and GREEN jobs across education levels and occupations*, are calculated using the micro data of Labour Force Surveys ([LFS](#)). Education levels are calculated for working age population (ages 25 to 64).

## Appendix

### Skills taxonomy

The lists below report all the AI and GREEN skills as classified in the most recent version of the Lightcast skill taxonomy. The skills are grouped into clusters based on their domain.

#### AI skills

##### Expert systems

AI/ML Inference, AIOps (Artificial Intelligence For IT Operations), Applications Of Artificial Intelligence, Artificial General Intelligence, Artificial Intelligence, Artificial Intelligence Development, Artificial Intelligence Markup Language (AIML), Artificial Intelligence Systems, Azure Cognitive Services, Baidu, Cognitive Automation, Cognitive Computing, Computational Intelligence, Cortana, Ethical AI, Expert Systems, Explainable AI (XAI), Generative Artificial Intelligence, Intelligent Control, Intelligent Systems, Interactive Kiosk, IPSoft Amelia, Knowledge Engineering, Knowledge-Based Configuration, Knowledge-Based Systems, Multi-Agent Systems, Open Neural Network Exchange (ONNX), OpenAI Gym, Operationalizing AI, Reasoning Systems, Soft Computing, Swarm Intelligence, Watson Conversation, Watson Studio, Weka

##### Autonomous Driving

Advanced Driver Assistance Systems, Autonomous Cruise Control Systems, Autonomous System, Autonomous Vehicles, Guidance Navigation And Control Systems, Light Detection And Ranging (LiDAR), OpenCV, Path Analysis, Path Finding, Remote Sensing, Unmanned Aerial Systems (UAS)

##### Machine Learning

AdaBoost (Adaptive Boosting), Adversarial Machine Learning, Apache MADlib, Apache Mahout, Apache SINGA, Apache Spark, Association Rule Learning, Attention Mechanisms, Automated Machine Learning, Autonomic Computing, AWS SageMaker, Azure Machine Learning, Boltzmann Machine, Boosting, Bot Framework, CHi-Squared Automatic Interaction Detection (CHAID), Cluster Analysis, Collaborative Filtering, Confusion Matrix, Cyber-Physical Systems, Dask (Software), Data Classification, Dbscan, Decision Models, Decision Tree Learning, Dimensionality Reduction, Dlib (C++ Library), Embedded Intelligence, Ensemble Methods, Evolutionary Programming, Expectation Maximization Algorithm, Fast ai, Feature Engineering, Feature Extraction, Feature Learning, Feature Selection, Game Ai, Gaussian Process, Genetic Algorithm, Google AutoML, Google Cloud ML Engine, Gradient Boosting, H2O ai, Hidden Markov Model, Hyperparameter Optimization, Inference Engine, K-Means Clustering, Kernel Methods, Kubeflow, LIBSVM, Loss Functions, Machine Learning, Machine Learning Algorithms, Machine Learning Methods, Machine Learning Model Monitoring And Evaluation, Machine Learning Model Training, Markov Chain, Matrix Factorization, Meta Learning, Microsoft Cognitive Toolkit (CNTK), MLflow, MLOps (Machine Learning Operations), mlpack (C++ Library), ModelOps, Naive Bayes Classifier, Objective Function, Oracle Autonomous Database, Perceptron, Predictionio, Programmatic Media Buying, Pydata, PyTorch (Machine Learning Library), Random Forest Algorithm, Recommender Systems, Reinforcement Learning, Scikit-Learn (Python Package), Semi-Supervised Learning, Sorting Algorithm, Supervised Learning, Support Vector Machine, Test Datasets, Torch (Machine Learning), Training Datasets, Transfer Learning, Unsupervised Learning, Variational Autoencoders, Vowpal Wabbit, Xgboost

##### Natural Language Processing

Amazon Alexa, Amazon Textract, ANTLR, Apache OpenNLP, BERT (NLP Model), Chatbot, ChatGPT, Computational Linguistics, DeepSpeech, Dialog Systems, fastText, Fuzzy Logic, Handwriting Recognition, Hugging Face (NLP Framework), Hugging Face Transformers, Intelligent Agent, Intelligent Virtual Assistant, Kaldi, Language Model, Large Language Modeling, Latent Dirichlet Allocation, Lexalytics, Machine Translation, Microsoft LUIS, Natural Language Generation, Natural Language Processing, Natural Language Processing Systems, Natural Language Programming, Natural Language Toolkits, Natural Language Understanding, Natural Language User Interface, Nearest Neighbour Algorithm, Nuance Mix, Optical Character Recognition (OCR), Prompt Engineering, Screen Reader, Semantic Analysis, Semantic Interpretation For Speech Recognition, Semantic Parsing, Semantic Search, Sentiment Analysis, Seq2Seq, Shogun, Speech Recognition, Speech Recognition Software, Speech Synthesis, Statistical Language Acquisition, Text Mining, Text-To-Speech, Theano (Software), Tokenization, Transformer (Machine Learning Model), Voice Assistant Technology, Voice Interaction, Voice User Interface, Word Embedding, Word2Vec Models

### **Neural Networks**

Apache MXNet, Artificial Neural Networks, Autoencoders, Chainer (Deep Learning Framework), Convolutional Neural Networks, Cudnn, Deep Learning, Deep Learning Methods, Deeplearning4j, Evolutionary Acquisition Of Neural Topologies, Generative Adversarial Networks, Keras (Neural Network Library), Long Short-Term Memory (LSTM), OpenVINO, PaddlePaddle, Pybrain, PyTorch Lightning, Recurrent Neural Network (RNN), TensorFlow

### **Robotics**

Advanced Robotics, Cognitive Robotics, Motion Planning, Nvidia Jetson, Robot Framework, Robot Operating Systems, Robotic Automation Software, Robotic Liquid Handling Systems, Robotic Programming, Robotic Systems, Servomotor, SLAM Algorithms (Simultaneous Localization And Mapping)

### **Visual Image Recognition**

3D Reconstruction, Activity Recognition, Computer Vision, Contextual Image Classification, Deck gl, Digital Image Processing, Eye Tracking, Face Detection, Facial Recognition, General-Purpose Computing On Graphics Processing Units, Gesture Recognition, Image Analysis, Image Matching, Image Recognition, Image Segmentation, Image Sensor, Imagenet, Machine Vision, Mnist, Motion Analysis, Object Recognition, OmniPage, Pose Estimation, Realsense

## **GREEN skills**

### **Air Quality and Emissions**

Air Permitting, Air Pollution Control, Air Quality, Air Quality Control, Air Sampling, Atmospheric Dispersion Modeling, Carbon Accounting, Carbon Footprint Reduction, Carbon Management, Carbon Monoxide Detectors, Continuous Emissions Monitoring Systems, Emission Calculations, Emission Reduction Projects, Emission Standards, Emission Testing, Emissions Controls, Emissions Inventory, Fugitive Emissions, Greenhouse Gas, Low Carbon Solutions, MACT Standards, National Emissions Standards For Hazardous Air Pollutants, Stack Emission Measurements, Vapor Recovery

### **Clean Energy**

Alternative Energy, Alternative Fuels, Biodiesel, Biodiesel Production, Biofuel Production, Biofuels, Biomass, Clean Technology, Geothermal Energy, Geothermal Heating, Methanol, Renewable Energy,

Renewable Energy Development, Renewable Energy Markets, Renewable Energy Systems, Renewable Fuels

### **Climate Change**

Climate Analysis, Climate Change Adaptation, Climate Change Mitigation, Climate Change Programs, Climate Information, Climate Modeling, Climate Policy, Climate Resilience, Climate Variability And Change

### **Conservation**

Conservation Biology, Conservation Planning, Environmental Impact Statements, Environmental Literacy, Environmental Protection, Environmental Risk Assessment, Environmentalism, Fish Conservation, Forest Conservation, Habitat Conservation, Habitat Conservation Plan, Low Impact Development, Marine Conservation, Rainwater Harvesting, Soil Conservation, Soil Genesis, Sustainability Planning, Threatened And Endangered Species Surveys, Water Conservation, Watershed Management, Wetland Conservation, Wetland Delineation, Wildlife Conservation, Wildlife Monitoring

### **Energy Efficiency**

Cooling Efficiency, Energy Analysis, Energy Conservation, Energy Conservation Measures, Energy Efficiency Analysis, Energy Efficiency Assessment, Energy Efficiency Improvement, Energy Efficiency Research, Energy Efficiency Services, Energy Efficiency Technologies, Energy Efficient Lighting, Energy Efficient Operations, Energy Modeling, Energy Saving Products, Energy-Efficient Buildings, Heat Recovery Steam Generators, Home Energy Assessment, LED Lamps, Renewable Portfolio Standard, Residential Energy Conservation, Residential Energy Efficiency

### **Energy Management**

Advanced Distribution Automation, Automatic Meter Reading, Biomass Conversion, Biorefinery, Electric Meters, Electric Utility, Energy Analysis System, Energy Audits, Energy Consumption, Energy Conversion, Energy Demand Management, Energy Forecasting, Energy Management, Energy Management Planning, Energy Management Systems, Energy Market, Energy Policy, Energy Production, Energy Project Management, Energy Supply, Energy Transformation, Energy Transport, Flow Assurance, Fuel Metering, Gas Meter Systems, Hydraulic Accumulators, Leadership in Energy and Environmental Design (LEED) Rating System, Load Shedding, Meter Reading, One-Line Diagram, Power System Simulator For Engineering, Public Utility, Resource Distribution, Smart Meter Installation, Smart Meter Systems, Sustainability Procedures, Transmission System Operator, Underground Utilities, Utility Cooperative

### **Environmental Engineering and Restoration**

Biological Systems Engineering, Bioremediation, Ecological Engineering, Environmental Analysis, Environmental Contamination, Environmental Economics, Environmental Emergency, Environmental Field Services, Environmental Pollutants, Environmental Problem Solving, Environmental Program Management, Environmental Remediation, Environmental Technology, Environmental Toxicology, Geotextile, Land Reclamation, Landfill Design, Oil Containment Booms, Oil Skimmer, Oil Spill Contingency Plans, Pollution Control Systems, Reforestation, Remediation Systems, Restoration Ecology, Sanitary Engineering, Sediment Controls, Soil Contamination, Stream Restoration, Underground Storage Tanks (UST), Water Pollution, Wetland Restoration

### **Environmental Regulations**

Best Available Control Technology, California Environmental Quality Act (CEQA), Categorical Exclusions, Clean Water Act, Comprehensive Environmental Response Compensation and Liability Act (CERCLA), Emergency Planning And Community Right-To-Know Act, Endangered Species Act, Environmental Auditing, Environmental Compliance, Environmental Compliance Assessment, Environmental Due Diligence, Environmental Laws, Environmental Permitting, Environmental Protocols, EPA Regulations, Federal Insecticide Fungicide And Rodenticide Act, ISO 14000, ISO 14000 Series, ISO 14064, Marine Mammal Protection Act, Massachusetts Environmental Policy Act, National Environmental Policy Act, Natural Resources Law, Pollution Regulations, Resource Conservation And Recovery Act (RCRA), Restriction Of Hazardous Substances Directive, Safe Drinking Water Act, Spill Prevention Control And Countermeasure (SPCC), Total Maximum Daily Load, Water Law, Water Regulations Advisory Scheme

### **Nuclear Energy**

ANSI/ANS Standards, Monte Carlo N-Particle Transport Codes, Nuclear Core Design, Nuclear Criticality Safety, Nuclear Design, Nuclear Fuel, Nuclear Fuel Cycle, Nuclear Instrumentation Module, Nuclear Navy, Nuclear Plant Design, Nuclear Power, Nuclear Reactor, Nuclear Safety, Nuclear Technology, RELAP5-3D, Roentgen, Scintillator

### **Solar Energy**

Commercial Solar Projects, Concentrix Solar, Passive Solar Building Design, Photodetector, Photovoltaic Systems, Photovoltaics, PVsyst, Solar Application, Solar Cell Manufacturing, Solar Cells, Solar Consulting, Solar Design, Solar Development, Solar Energy, Solar Energy Systems Installation, Solar Engineering, Solar Equipment, Solar Inverter, Solar Manufacturing, Solar Panel Assembly, Solar Panels, Solar Photovoltaic Design, Solar Products, Solar Roofs, Solar Systems, Solar Thermal Installation, Solar Thermal Systems, Solar Water Heating

### **Waste Management**

E-Waste, Electrocoagulation, Landfill, Landfill Gas Collection, Leachate Management, Municipal Waste Management, Plastic Recycling, Recycling, Sludge, Sludge Disposal, Solid Waste Management, Tire Recycling, Transfer Station, Trash Pickup, Waste Characterization, Waste Collection, Waste Disposal Systems, Waste Management, Waste Packaging, Waste Removal, Waste Sorting, Waste Tracking System, Waste Transport, Waste Treatment, Wastewater Treatment Plant Design

### **Water Energy**

Dam Construction, Hydraulic Structure, Hydroelectricity, Hydropower, WaterCAD

### **Wind Energy**

Wind Engineering, Wind Farm Construction, Wind Farm Design, Wind Farm Development, Wind Farming, Wind Power, Wind Turbine Maintenance, Wind Turbine Technology, Wind Turbines