Energy Data Scientist Curriculum

Course Catalogue Overview

The energy transition is increasing demand for professionals with strong quantitative and commercial skills. This curriculum helps members build the modelling, analytical and economic skills needed for modern energy roles.

Industry-based
Courses in the full catalogue

Full Access & Personalized Curriculum
Subscribers have full access to every course in the catalogue below. They also receive a personalised step-by-step curriculum built from these courses and tailored to their background, goals, and current skill level

Course Catalogue

Course 1: Basic Python for Energy Analysis

- This course teaches beginner Python skills for energy analysis, including topics like interaction with external sources (Excel files, CSV files, text files etc), key dataframe operations, multi-level dataframes, practical data-cleaning topics, and more
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 11 hours and 25 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 2: Electricity Demand: Power versus Energy

- This course explains the difference between power (W) and energy (Wh) in electricity systems, using electricity demand as the practical context
- It shows how electricity demand should be visualized correctly, focusing on when to use line plots versus scatter plots and how data granularity affects what a chart communicates
- Learners implement the same demand-visualization workflow in both Python and Excel, including an example of plotting a country’s demand across a full year in Python
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 25 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 3: Connecting Offshore Wind Farms to Onshore

- This course explains how offshore wind farms are developed and physically connected to the onshore grid, covering both HVAC and HVDC electricity transmission options and when each is used
- It emphasizes technoeconomic decision making, including practical challenges in offshore projects and the tradeoffs between one versus multiple export lines
- It also introduces different offshore wind turbine technologies and contrasts offshore and onshore wind projects
- You build a hands-on Python model that implements the offshore-to-onshore connection concepts and explores alternative connection configurations
- **Level:** Introductory
- **Prerequisites:** None
- **Video duration:** 68 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 4: Drafting electricity grid schematics

- This course teaches you how to draft a basic electricity grid schematic, covering substations, loads, and transmission lines, using both MATLAB and Python
- It introduces core network design ideas such as redundancy, the N-X security criterion, and the differences between meshed and radial grid architectures
- You start with fundamental design principles, then build the grid topology step by step first in MATLAB and then across three Python segments
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 67 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)
- **Note:** Included with subscription
- **Note:** Learner support via Skool community

Course 5: Energy Storage Data Analytics

- This course introduces energy storage systems and shows how to compute key storage metrics and work with storage datasets using Python
- It covers the core technical concepts behind storage duration, power capability, state of charge, and energy capacity, including step-by-step energy capacity calculations
- It also bridges spreadsheet workflows to Python by recreating common Excel operations used in storage analysis, such as VLOOKUP, SUMIFS, and AVERAGEIFS
- **Prerequisites:** None
- **Video duration:** 47 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 6: Power Station Data Analytics

- This course teaches beginner-friendly data analytics for power stations, focusing on thermal, wind, and hydro assets using Python and Excel
- It shows how to clean electricity generation datasets (MWh), filter and display specific generation categories, and convert or replace units consistently within datasets
- You also learn to analyse installed generation capacity data and extract generation patterns, including wind pattern calculations
- For hydro, it covers computing hourly energy input in both Excel and Python, then building weekly profiles to understand operational behaviour over time
- **Prerequisites:** None
- **Video duration:** 110 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 7: Geopolitical Mapping of Military Alliances

- This course teaches you how to use Python to visualise military geopolitics by mapping military alliances and territorial changes over time
- You learn practical geospatial workflows such as installing Python and key packages, working with GeoPandas and GeoDataFrames, plotting maps of any region, and drawing connections like pipelines or interconnectors
- It then applies these tools to build clear alliance visualisations for NATO, CSTO, and SCO, including styling and design choices for readable maps
- A dedicated section shows how to map NATO's expansion across regions (Europe, the Middle East, and Eurasia) as a time-evolving geographic story
- **Level:** Intermediate
- **Prerequisites:** None
- **Video duration:** 180 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 8: Comparing Datasets with Python and Excel

- This course teaches beginners how to compare datasets using two practical tools: Excel and Python

- You will see an end-to-end workflow implemented first in Excel and then replicated in Python, making it easy to understand the parallels and differences
- **Prerequisites:** None
- **Video duration:** 33 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 9: Preparing Excel Data for Pivot-Table Analysis

- This course shows how to restructure an Excel dataset so it becomes pivot-table friendly, using Python to perform the required data transformation
- It is aimed at beginners and focuses on a practical, implementation-first workflow
- **Prerequisites:** None
- **Video duration:** 26 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 10: Mapping Energy Infrastructure with Python

- This course teaches you how to use Python to map and visualize energy infrastructure, focusing on natural gas pipelines and electricity interconnectors on geographic maps
- It starts from fundamentals (installing Python and packages) and builds up to practical geospatial workflows using tools like GeoPandas, including working with GeoDataFrames, drawing routes between points, and customizing country or regional boundaries
- The material is delivered through hands-on case studies across multiple regions (Eastern Mediterranean, North-West Europe, North-East Europe, and Asia), where you implement real assets such as TurkStream, EastMed, Nord Stream, and several European interconnectors
- It also includes contextual technical and geopolitical analysis alongside the coding exercises, including topics like North-West Europe interconnector systems and the Belt and Road initiative
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 4 hours and 37 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 11: Net Electricity Demand and Wind Share

- This course teaches you how to compute net electricity demand and how to express wind generation output as a percentage share in Python
- **Prerequisites:** None
- **Video duration:** 24 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 12: Levelised Cost of Energy (LCOE)

- This course explains what the Levelized Cost of Energy (LCOE) is and how it is used to compare the cost of different electricity generation technologies
- It teaches the core LCOE formula and walks through two practical, real world style use cases to show how LCOE is applied in decision making
- You then implement the analysis in Python, with an explanation of the code and a plot that shows minimum and maximum LCOE values by technology
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 17 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 13: Reducing the dimensions of Electricity Data

- This course teaches you how to shrink large electricity-demand datasets into a much smaller representation while keeping information loss low, using a practical dimensionality-reduction style workflow
- It explains how high-volume demand data is typically structured and why big-data approaches can introduce challenges and risks if handled poorly

- You implement a step-by-step methodology in both Excel and Python, moving from seasonal demand statistics to daily average load-factor time series, then quantifying errors relative to seasonal patterns
- You then identify the minimum-load-factor error and the specific day when that minimum occurs, ending by constructing a compact dataset built around representative 'typical days'
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 2 hours and 29 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 14: Upsampling daily to hourly electricity data

- This course teaches how to convert an annual daily electricity time series (365 values for demand or generation) into an hourly time series (8760 values, one per hour of the year) using Python
- It focuses on practical upsampling logic, showing both a basic daily-to-hourly conversion and a more realistic version that applies an intraday (daily) shape
- The material covers two common use cases: electricity demand datasets and electricity generation profiles, with dedicated implementations for each
- The course is instructed and developed by Dr. Giannelos (PhD, Imperial College London)
- **Level:** Intermediate
- **Prerequisites:** None
- **Video duration:** 46 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 15: Calculating Zone-Level Electricity Demand

- This course explains how electricity grids are divided into zones and shows how to use Python to compute electricity demand at the zone level
- **Prerequisites:** None
- **Video duration:** 28 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 16: Modelling Flat and Peaky Load Profile

- This course shows how to create electricity demand (load) profiles that are either peaky or flat, and how to quantify and compare their 'peakiness'
- It uses both Excel and Python to normalise a load profile, calculate load-factor style metrics, and then modify the shape to achieve flatter or peakier behaviour
- You will also build simple visualisations to clearly illustrate the differences between profile shapes
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 31 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 17: Big Data for Electricity Grid Reinforcements

- This course shows how data science can be applied to utility datasets that describe candidate power-grid reinforcement investments, with a focus on reducing a large list of options down to a small set of credible alternatives
- It walks through a practical workflow: identifying mutually exclusive investments, grouping them, filtering investment strategies, and comparing resulting reinforcement solutions
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 57 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 18: Comparing Countries' Generation Capacity

- This course teaches you how to compare countries' installed electricity generation capacity by technology (such as solar photovoltaics and wind) across multiple years (for example, 2010 to 2020)
- **Level:** Beginner

- **Prerequisites:** None
- **Video duration:** 34 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 19: Comparing Electricity Access across Countries

- This course teaches how to analyze electricity access data and compare access levels across countries and over time
- You will learn how to turn that data into clear visualizations that show differences and trends by country and year
- **Prerequisites:** None
- **Video duration:** 31 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 20: Comparing CO2 Emissions Intensity

- This course teaches beginners how to use data science to calculate and plot CO_2 emissions intensity trends over time, comparing different years and countries
- It focuses on visualizing changes across roughly two decades in Europe and then translating those plots into clear sustainability insights
- You will learn both the underlying theory and a practical implementation workflow, followed by guided interpretation of results
- It is a 46-minute video course at a beginner level
- **Level:** Beginner
- **Prerequisites:** None
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 21: Comparing Countries' Population in Python

- This course teaches you, in Python, how to compare the populations of different countries across multiple years using official World Bank data
- The core activity is a practical workflow that takes you from obtaining the data to making meaningful comparisons across countries and years
- **Prerequisites:** None
- **Video duration:** 10 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 22: Comparing the Electricity Generation Mix

- This course shows how to use Python data analysis together with the GeoPandas package to visualize and compare the electricity generation mix of different countries across years
- By the end, learners should be able to produce map-based visualizations that highlight how national generation mixes change over time
- **Prerequisites:** None
- **Video duration:** 12 minutes
- **Instructor:** Dr. Giannelos

Course 23: Calculating the Installed Generation Capacity

- This course teaches how to calculate the installed generation capacity of power stations using Python
- The content is structured into a short introduction followed by an implementation section that includes analysis
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 16 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 24: Comparing Countries' Electricity Consumption

- This course teaches you how to build a Python model that visualises and compares electricity consumption (demand) across multiple countries and across multiple years
- It uses official World Bank data as the underlying dataset
- It is aimed at beginners and focuses on a clear, practical workflow for downloading, processing, and plotting the data in Python
- The course is instructed by Dr. Giannelos (PhD, Imperial College London)

- **Prerequisites:** None
- **Video duration:** 30 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 25: Total and Residual Load – Duration Curves

- This course teaches you how to develop and interpret load-duration curves using Python, focusing on both total load and residual load
- You will generate the residual load duration curve and the total load duration curve step by step, and finish with key conclusions
- The course is 27 minutes long and is designed for beginners
- **Prerequisites:** None
- **Video duration:** 27 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 26: Baseload and Intermediate-Load Levels

- This course explains how to break a load duration curve into base-load, intermediate-load, and peak-load segments, and why this breakdown matters when thinking about the right mix of base-load power plants and flexible resources in an electricity grid
- It focuses on the practical steps needed to perform the decomposition, including generating a duration curve for the residual load
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 30 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 27: Hourly Electricity Demand in Busbar Level

- This course teaches you how to calculate the hourly electricity demand of a busbar using Python
- It starts by introducing the initial dataset, then shows how to compute the total demand per bus for every hour
- It also explains how to calculate the annual load pattern for each bus
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 10 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 28: Hourly Electricity Demand for all Grid Buses

- This course explains how to calculate the hourly electricity demand for each bus in a power system, and then how to combine all buses to get the total system demand for every hour
- It starts by introducing the initial dataset you will work with
- It then walks through the main calculations: first finding total demand per bus for each hour, and then summing across buses to compute the total demand per hour for the whole system
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 14 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 29: Rolling Average of Electricity Demand

- This course teaches you how to calculate a rolling average (also called a moving average) for electricity demand data, using Python
- It explains what a rolling average is and how it helps you see underlying trends in electricity demand by smoothing short-term fluctuations
- You will implement the method step by step, using an energy dataset, including how to compute a rolling average with overlaps and how to calculate it without overlaps
- The course also applies the rolling-average approach to an 8760-hour load profile, which represents a full year of hourly demand data
- **Level:** Beginner
- **Prerequisites:** None

- **Video duration:** 50 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 30: Aggregating and Summarizing Electricity Data

- This course teaches Python techniques for aggregating and summarising electricity system data
- You learn how to compute simple summary metrics such as peak demand and installed generation capacity
- The course also shows how to organise these summaries across different buses in an electricity network model
- It includes a short introduction followed by an implementation section where you apply the analysis in Python
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 14 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 31: Renewables-Ninja in Python

- This course teaches you how to use Renewables Ninja in Python to estimate the electricity output a wind farm or a solar PV unit would produce if it were built at any location on Earth
- It starts with a short introduction to what Renewables Ninja is and what you will calculate
- It then moves into an implementation section where you run the analysis in Python to generate renewable output estimates
- The course also includes a final step where you download the code so you can reuse it for your own locations and projects
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 38 minutes
- **Note:** Includes downloadable code

Course 32: Accessing and Processing ENTSOE Data in Python

- This course shows you how to access the ENTSO-E data platform in Python and download energy data for different European countries
- ENTSO-E is the European Network of Transmission System Operators for Electricity, and its Transparency Platform publishes core electricity information such as generation, load, transmission, and balancing data
- It starts with a short introduction and then covers data examples, the EU map of electricity grids, and a simple Python implementation
- By the end, you should understand the basic workflow to connect, retrieve datasets, and do processing so the data is ready to use in Python
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 10 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 33: Big-Excel Processing Techniques in Python

- This course teaches how to process extremely large Excel files in Python, especially when the data is too big for Excel to handle
- It highlights why this matters by pointing to Excel's built-in worksheet limits, for example an .xlsx sheet can hold up to 1,048,576 rows
- The course includes an implementation section showing a practical workflow for working with these oversized Excel datasets in Python
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 13 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 34: The global installed capacity of renewables

- This course shows you how to use official data from IRENA (International Renewable Energy Agency) to create clear plots that compare global installed capacity across renewable technologies such as offshore wind and solar PV (photovoltaics)
- It also clarifies what 'installed capacity' represents in these statistics

- In the implementation section, you first plot installed capacity for key renewables and then expand the same approach to include more technologies
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 18 minutes
- **Instructor:** Dr. Giannelos (PhD Imperial College London)

Course 35: Data Analysis on Installed-Capacity datasets

- This course teaches you how to work with the International Renewable Energy Agency (IRENA) installed-capacity dataset, so you can extract, process, and visualize data on electricity generation technologies such as onshore and offshore wind, solar photovoltaic (PV), geothermal, marine energy, concentrated solar, storage, and hydropower
- It starts with a short introduction and an explanation of the investment quantities used in the dataset
- In the implementation section, you create pie charts for clean energy investment share and bar plots for investments in the power sector
- The focus is on practical, step-by-step data handling and clear visual summaries
- The course ends with brief conclusions and provides the code used for the examples
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 18 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)
- **Note:** Includes downloadable code

Course 36: Efficient Processing of Smart Meter data

- This course shows how to process very large smart meter datasets in Python when the files are too big to fit in your computer's memory (RAM)
- It explains what smart meters record (hourly electricity consumption) and why storing this data in CSV files can create millions of rows that can cause a memory error if you try to load everything at once
- You start by creating a dummy dataset and then you recreate the memory challenge to see the problem directly
- Next, you learn Python iterators, which let you read and process the dataset piece by piece (instead of all at once), making big data processing practical on a normal machine
- The course also includes a full code download so you can reuse the approach on real smart meter files
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 22 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)
- **Note:** Includes downloadable code

Course 37: Intermediate Python for Energy Analysis

- This course teaches intermediate Python skills that you can use for energy data analysis
- You learn core data structures and workflows such as sets, pandas Series, NumPy arrays, and writing better functions with default arguments, nested functions, and keyword arguments
- You also practice working with dates, checking and converting data types, and using dictionaries with practical energy examples
- Finally, the course covers essential math operations, error handling with try and except, randomness and reproducibility and code organisation via modules and packages
- **Level:** Intermediate
- **Prerequisites:** Basic Python for Energy Analysis
- **Video duration:** 6 hours and 52 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 38: Battery Trading and Arbitrage with Optimisation

- This course teaches how to build a profit-maximizing battery trading (arbitrage) strategy in Python using linear and mixed-integer programming
- Learn how energy storage (battery) arbitrage trading relates to battery operation, how it connects to financial arbitrage, how to model the arbitrage profit function, and generate the necessary plots for interpreting the strategy

- **Prerequisites:** None
- **Video duration:** 1 hour and 15 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 39: Build a model to get electricity data via API

- This course teaches you how to use Python to automate the retrieval of Great Britain electricity market data by connecting directly to an API and saving the outputs into an Excel file
- The model you will build will ask the user to choose a start and an end date, and to select a balancing mechanism unit (i.e. power plant, energy storage unit etc), and download data, relevant to the selected unit and the period between the selected dates, such as imbalance electricity prices, spot wholesale electricity prices, the complete list of all balancing mechanism units in Great Britain, the level of electricity produced by the selected unit etc, all nicely formatted in an Excel file
- **Level:** Intermediate
- **Prerequisites:** Day-Ahead & Balancing Market in Python
- **Video duration:** 2 hours and 43 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 40: Univariate Linear Regression for CO2 Forecasts

- This course teaches you how to build, in Python, a machine learning model (univariate linear regression) to forecast CO2 emissions, using real World Bank time series, for several countries and regions such as India, China, France, the USA, and the UK
- It follows a 10-step workflow, starting from downloading the raw data and doing data preprocessing
- You then split the dataset into training and test sets, and train linear regression models
- The course shows how to generate predictions, measure training and test errors, run various tests (overfitting test, naive benchmark test etc), perform sensitivity analysis and hyperparameter tuning
- Finally, you learn the methodology for selecting the final model
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 3 hours and 12 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 41: Univariate ARIMA for CO2 Forecasts

- This course teaches you how to build a machine learning model (univariate ARIMA) in Python to forecast CO2 emissions, using real World Bank time series, for countries and regions such as India, China, France, the USA, and the UK
- You will learn a 10-step methodology, including data preprocessing, splitting the data into training and test sets, model training and evaluation, error analysis, overfitting checks, naïve baseline comparisons, and sensitivity analysis for hyperparameter tuning
- It also teaches how to choose ARIMA orders using stationarity concepts and tests, differencing, autocorrelation function plots, and diagnostic checks before producing the final CO2 forecasts
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 5 hours
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 42: Univariate Shallow Neural Nets for CO2 Forecasts

- This course teaches you, in Python, how to build a machine learning model (univariate shallow neural network) to forecast CO2 emissions, using real World Bank time series, for countries such as India, China, the USA, the UK and the EU
- It follows a ten-step workflow that covers preprocessing, dataset splitting, polynomial feature creation, scaling, and then compiling and fitting shallow neural networks
- You also learn how to generate predictions, compute training and test errors, check for overfitting, compare against a naive benchmark, and do sensitivity analysis plus hyperparameter tuning before producing final forecasts
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 4 hours and 30 minutes
- **Instructor:** Dr. Giannelos, PhD (Imperial College London)

Course 43: Univariate Deep Learning for CO2 Forecasts

- This course teaches you how to build a machine learning model (univariate deep neural network) in Python to forecast CO2 emissions, using real World Bank time series, for different countries such as India, China, France, the USA, and the UK
- You will learn the full workflow, including the difference between multivariate and univariate models and a clear 10-step methodology
- The course covers practical data work like downloading the dataset, preprocessing, creating polynomial features, splitting into training and test sets, and scaling inputs
- It then walks through compiling, fitting, and visualizing neural network models, making predictions, calculating training and test errors, checking for overfitting, and improving models through sensitivity analysis and hyperparameter tuning, before generating forecasts and selecting final models
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 4 hours and 30 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 44: Comparing Machine Learning Forecasts

- This course teaches, in Python, how to compare the forecasting performance of various machine learning models in Python, including univariate linear regression, univariate ARIMA, univariate shallow neural networks, and univariate deep neural networks
- To perform this comparison you build a model in Python from scratch
- You learn the difference between univariate and multivariate models and follow a structured methodology for model comparison
- The course walks through fitting all models on a training set, generating and plotting predictions, and evaluating test and training errors
- It also covers practical checks such as overfitting analysis, sensitivity analysis, and a naïve baseline test, before producing forecasts and selecting the final models
- **Prerequisites:** prior completion of the courses on univariate linear regression, ARIMA, shallow learning and deep learning
- **Video duration:** 2 hours and 27 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 45: Multivariate Machine Learning for Forecasts

- This course teaches you how to build multivariate machine learning models in Python to forecast CO2 emissions
- This includes multivariate Linear Regression, Vector Autoregression (VAR), and both multivariate shallow and deep neural networks
- You begin with a correlation tutorial, including stationarity concepts and correlation significance testing
- You then go through the full workflow: data preprocessing, handling non-stationarity with KPSS and differencing, finding significant correlations, creating the right data structures and features, training and rolling predictions, inverting differencing, plotting results, measuring train and test errors, benchmarking against naïve models, and analyzing overfitting to select good models before producing final forecasts
- **Level:** Intermediate
- **Prerequisites:** Completion of courses on univariate linear regression, univariate ARIMA, univariate shallow neural networks, and univariate deep neural networks
- **Video duration:** 8 hours and 50 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 46: Object-Oriented Programming for Energy Models

- This course teaches intermediate object-oriented programming (OOP) in Python, with examples geared toward building models in energy and economics
- It starts from core Python concepts that matter for OOP, like object identity, mutability vs immutability, and scope, then moves into designing classes with constructors, encapsulation, properties, class methods, and static methods
- It also covers higher-level Python features used in real model code, including closures, decorators, iterators and generators, dataclasses and special methods, and working with collections of custom objects

- Finally, it goes deeper into software design tools such as inheritance, multiple forms of polymorphism (overloading, overriding, operator overloading, duck typing), abstraction (abstract classes and interfaces), and metaclasses
- **Prerequisites:** The level is intermediate, and the prerequisite is completing the course 'Basic Python for Energy Analysis'
- **Video duration:** 15 hours and 53 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 47: Introduction to Visual Studio Code for Python

- This course introduces how to use Visual Studio Code (VS Code) to write Python code, focusing on the essential features a beginner needs to get started
- It explains what VS Code is and why it is useful as a free IDE developed by Microsoft
- The course then covers practical operations such as replacing code, and using an autoformatter to clean up code automatically
- It also introduces debugging and basic workspace settings to help you work more efficiently on Python projects
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 25 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 48: Readable Python with Logging and Type Annotation

- This course teaches you how to make Python code easier to read and less error-prone by adding logging and type annotations
- You will learn why loggers are useful, how to create and configure a logger, and how to organize your project's folder structure to support logging
- You will also learn practical type annotation patterns, including annotations for dictionaries, lists, and tuples, plus Optional, Union, generics, and when to prefer generics over Any
- The course includes code walkthroughs to explain how these ideas work in real scripts, and it ends with a concise overview of the main takeaways
- **Prerequisites:** The level is intermediate, and the prerequisite is completing the course 'Basic Python for Energy Analysis'
- **Video duration:** 1 hour and 19 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 49: Software Design for Energy Modelling

- This course introduces software design principles for building energy and economics models in Python, focusing on writing code that is clear, modular, and easier to maintain
- The course starts by explaining the divide and conquer principle, using a smart energy system example
- It then covers cohesion and coupling, outlining key types of each and how they influence code quality and model development
- Finally, it discusses reusability and the SOLID principles
- **Prerequisites:** The level is intermediate, and the prerequisite is completing the course 'Basic Python for Energy Analysis'
- **Video duration:** 4 hours and 41 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 50: Multithreading essentials for Energy Modelling

- This course teaches the essentials of multithreading in Python and explains how threading ideas connect to energy modelling, energy trading, and algorithmic energy trading
- It covers core background concepts such as compilers and interpreters, dynamic typing in Python, and the differences between threads and processes
- You will learn practical Python threading skills including creating threads in CPython, adding delays, checking thread names and counts, and synchronizing with locks or mutexes
- It also explains common pitfalls like deadlocks and how to avoid them, including good practices such as joining threads at the end of an imported file
- **Prerequisites:** The level is intermediate, and the prerequisite is completing the course 'Basic Python for Energy Analysis'
- **Video duration:** 2 hours and 8 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 51: Per Unit System for Power System Analysis

- This course explains the per-unit system for power-system analysis, a method that makes electricity grid calculations simpler

- You will learn how to convert values from actual units (such as MW and MWh) into per-unit values and back again
- The course includes practical, hands-on examples using both Python and Excel
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 23 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 52: Backwards Induction for Reinforcing the Grid

- This course teaches the backwards induction model for planning electricity grid reinforcement under uncertainty, aiming to find the most economical combination of network upgrades
- It uses a case study where the future number of electric vehicles is uncertain, so you learn how uncertainty affects reinforcement decisions and the chosen strategy
- You implement the approach in MATLAB to compare reinforcement strategies and run sensitivity analyses to see how results change when key assumptions vary
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 2 hours and 45 minutes
- **Instructor:** Dr. Spyros Giannelos (Imperial College London)

Course 53: Comparing Immigration across Countries and Years

- This course teaches you how to build a model in Python to analyze immigration related data
- The course includes examples on child immigration and international immigration and finishes with conclusions that summarize the key takeaways
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 39 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 54: Intro to Optimisation in Pyomo, GAMS and Mosel

- This course teaches how to formulate and solve optimization problems in three tools: Pyomo in Python, GAMS, and Mosel
- It starts by explaining what optimization is and introduces a real-world example based on an electricity substation
- It then shows how to implement the model in Python with Pyomo, in GAMS, and in Mosel
- It covers both linear and nonlinear models
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 29 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 55: Building Optimisation Models in Mosel

- This course teaches you how to build and solve optimization models using the Mosel language, which is a modeling and programming language commonly used in industry and academia to formulate and solve mathematical programming problems such as linear programming and mixed integer programming
- The course focuses on linear continuous models and linear mixed integer models, showing how to formulate the problem, solve it, and generate outputs
- You will practice core Mosel features such as arrays, summations, the forall statement, conditional logic, and good model structure using procedures and functions, plus explicit and implicit variable declarations
- The course also covers producing output for users, including writing the optimal solution to Excel and initializing input data from Excel
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 34 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 56: Essential Optimisation Concepts with Mosel

- This course teaches the essentials of optimization models using the Mosel language
- It explains, through Mosel implementations, what it means for a model to be optimal, infeasible, or unbounded
- It also introduces duality, which helps interpret how constraints affect the optimal result, and it explains activity and slack, which show whether a constraint is binding and by how much
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 22 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 57: DC Power Flow Modelling

- This course explains how to model the power flows in electricity grids using the DC power flow model and how to integrate it as part of optimization problems
- You also learn how to implement it in optimisation problems modelled in both Python and GAMS
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 9 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 58: Optimal Siting of Onshore Wind Farms

- This course shows how to build an optimization model in Python to find the best location for deploying an onshore wind farm at minimum cost
- You also learn to conduct a sensitivity analysis to understand how the best site changes when inputs or costs change
- **Prerequisites:** None
- **Video duration:** 1 hour and 2 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 59: Optimal Siting of Hydroelectric plants

- This course teaches how to build a Python optimization model that decides where to site a hydroelectric power plant so the total cost is as low as possible
- You work through a full case study, defining the model, inputs, decision variables, constraints, and an objective function, and then solving it with a chosen solver
- The course also covers sensitivity analysis and solver performance comparisons, and it introduces both a concrete model and an abstract model, including solving nonlinear versions of the abstract formulation
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 4 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 60: Optimisation for electricity grid reinforcement

- This course teaches how to build a Python optimization model for deciding which reinforcements should be made in India's electricity grid
- It starts by setting up the required optimization solvers needed to run the model
- It then walks through a case study where you define decision variables and parameters, write the objective function and constraints, and solve the model to identify cost-effective grid investment choices
- Finally, you learn how to visualize the results with plots and wrap up with key conclusions about the investment case for India
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 4 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 61: AC Power Flow Modelling

- This course teaches how to model power flows using the AC model

- The course explains the mathematics behind AC power flow equations, so you understand what the model is doing, not just how to code it
- You will build an optimisation model, in Python and GAMS, for an electricity grid where also energy storage is included, and where the power flows are modelled using the AC model
- **Level:** Intermediate
- **Prerequisites:** It is an intermediate-level course with the course "Economic Dispatch for a grid with thermal units" as a prerequisite
- **Video duration:** 1 hour and 34 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 62: Energy Storage allocation at minimum cost

- This course teaches how to build an optimization model that decides where to place energy storage units in an electricity grid so the system can operate at the lowest cost
- It explains how storage placement affects electricity flows, congestion, and operating decisions
- You learn the mathematical formulation for the storage allocation problem and how to translate it into a working model
- The course then shows two implementations: modeling in Python and modeling in GAMS
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 9 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 63: Economic Dispatch for a grid with thermal units

- This course teaches you how to build an optimization model for Economic Dispatch in an electricity grid that has only thermal power stations, meaning no renewables are included
- It starts by the basic formulation and shows how to solve the problem in Pyomo (Python), including how to read optimal results as well as dual and marginal values
- You also learn how to run sensitivity analysis in Python to see how results change when key inputs or constraints change
- The course then extends the model to Dynamic Economic Dispatch (DED), which adds time-coupling features such as ramping limits, and it includes a dedicated section on sensitivity analyses for ramp rates
- It also demonstrates how to implement and solve the same models in GAMS, including exporting outputs to Excel
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 54 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 64: Economic Dispatch for a grid with Renewables

- This course teaches beginners how to build an optimization model for economic dispatch in an electricity grid that has only thermal power stations (no renewables), and how to implement it in both Python and GAMS
- It starts with a clear introduction to what economic dispatch means and why optimization is used to schedule generation at lowest cost while meeting demand
- You then work through dynamic economic dispatch in a simple 3-bus power system, covering the mathematical formulation, a Python implementation, and how to interpret and analyze the results, followed by an equivalent model in GAMS
- The course also repeats the process for a 1-bus system
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 54 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 65: Economic Dispatch for heat-electricity grids

- This course explains how heat and electricity can be produced and scheduled together in a single "heat-electricity" system, including power stations, combined heat and power (CHP) units, and heat-only units
- You learn how economic dispatch works when heat and power decisions are linked
- You then build an optimization model for economic dispatch, defining constants, writing constraints, and understanding the feasible operating region and the resulting solution

- The course also includes an implementation in both Python and GAMS, showing how to model the same dispatch problem in different tools
- **Level:** Intermediate
- **Prerequisites:** It is an intermediate-level course with the course “Economic Dispatch for a grid with thermal units” as a prerequisite
- **Video duration:** 1 hour and 3 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 66: Economic Dispatch for grid with Wind & Storage

- The course teaches how to build economic dispatch models for electricity grids that incorporate renewable generation, specifically wind power, and energy storage systems
- It covers the mathematical formulation and implementation of these models using both Python and GAMS, while also addressing critical factors like CO_2 emission constraints
- The courses also expands into power system topology, reliability test systems, and the per-unit system to solve more complex grid problems
- **Level:** Intermediate
- **Prerequisites:** It is an intermediate-level course with the course “Economic Dispatch for a grid with thermal units” as a prerequisite
- **Video duration:** 4 hours and 31 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 67: Environmental Dispatch for Electricity Grids

- This course teaches how to build an optimization model in Python for environmental dispatch in an electricity grid, where you account for both the cost of generating electricity and the cost of CO_2 emissions
- The course explains how to define electricity generation cost functions and CO_2 emissions functions, then shows how to set up the model, write the mathematical formulation, and implement constraints in Python
- It also demonstrates solving the dispatch models in Python and in GAMS
- **Level:** Intermediate
- **Prerequisites:** Economic Dispatch for a grid with thermal Units
- **Video duration:** 60 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 68: Profit Maximisation in Energy + Reserve Markets

- This course explains how electricity Generation Companies can maximize profit by deciding how much electricity and spinning reserve to sell
- It introduces the economic strategy behind generator bidding and participation in the wholesale electricity market, the retail electricity market, and the market for ancillary services, also with a look at how deregulated electricity markets work worldwide
- You will build an optimization model that uses a price-based dynamic economic dispatch formulation for profit maximization
- The course shows how to implement the model in both Python and GAMS, first for selling electricity in the electricity market and then for selling spinning reserve in the ancillary services market
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 2 minutes
- **Instructor:** Dr. Giannelos, PhD Imperial College London

Course 69: Economic Dispatch for grids with Hydro units

- This course teaches how to build economic dispatch models for an electricity grid that includes both thermal power stations and hydroelectric units
- It explains the main hydro technologies used in dispatch problems, including dam (reservoir) hydro, run-of-river hydro, and cascaded hydro systems, and how their techno economics affect scheduling decisions
- You will learn the key differences between dispatching hydro and thermal generation, then develop the full mathematical formulation of hydro dispatch
- The course also shows how to prepare input data, define decision variables, and implement constraints and solve the model in Python, with an additional implementation and solution workflow in GAMS
- **Level:** Intermediate
- **Prerequisites:** Economic Dispatch for a grid with thermal Units

- **Video duration:** 1 hour and 9 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 70: Economic Dispatch for Electricity and Hydro systems

- This course explains how economic dispatch is done in systems that must meet both electricity demand and water demand, which is often called the electricity-water nexus
- It shows you how to build an optimization model for this setting and implement it in both Python and GAMS
- You begin with the context, the three types of energy units involved, and how a vertically integrated utility is structured
- Then you develop the mathematical formulation in Python, followed by a GAMS implementation
- **Level:** Intermediate
- **Prerequisites:** Economic Dispatch for a grid with thermal Units
- **Video duration:** 1 hour and 12 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 71: Pareto Economic Analysis for Heat-Power Systems

- This course teaches how to do Pareto economic analysis for heat and electricity systems by comparing three types of units: heat-only units (produce only heat), power stations (produce only electricity), and CHP units (combined heat and power, producing both)
- It explains the techno-economics behind each unit type and what a Pareto analysis means in economics, then shows how this is used to study trade-offs between competing objectives
- You will build an optimization model for the Pareto study, including the mathematical formulation, methodology, and sensitivity studies
- You will implement and solve the model in both GAMS and Python using Pyomo, including generating feasible regions for CHP units and solving a nonlinear optimization problem, then exporting results for plots and Excel-style analysis
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 42 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 72: Generation Shift Factors and Line Outage Factors

- This course teaches Generation Shift Factors (GSF) and Line Outage Distribution Factors (LODF)
- These are used to analyze power flows in electricity networks and show how the change in electricity demand or generation can affect line flows
- The course also connects these ideas to electricity trading
- You will also build optimization models for GSF and LODF and implement them in both Python and GAMS
- The course duration is 1 hour and 24 minutes and it is aimed at a beginner level
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 24 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 73: Unit Commitment for Power Systems

- This course teaches you how to build a Unit Commitment optimization model for power systems using Python and GAMS
- It explains why Unit Commitment is used in the day-ahead market structure and how it connects to dynamic economic dispatch, focusing mainly on thermal power stations
- You learn to model both the cost-based and the price-based versions of Unit Commitment, including binary on or off decisions for generators and start-up and shut-down costs
- The course also teaches how to handle non-linear fuel cost functions by linearizing them using piecewise linear approximations
- You implement the objective function and key constraints such as power balance, output limits, ramp constraints, and minimum up-time and down-time in both Python and GAMS
- **Level:** Intermediate
- **Video duration:** 4 hours and 25 minutes
- **Instructor:** Dr. Giannelos

Course 74: Optimization: Natural Gas and Electricity Grids

- This course teaches you how to build an optimisation model for operating an integrated energy system that includes a natural gas network and an electricity transmission network
- It shows the full workflow in Python, starting from a clear system description and moving into model development
- You learn how to prepare input data for the power system and the gas system in Python, then define decision variables, constraints for each network, solve the model and interpret the results
- The course also covers how to implement and solve the same type of model in GAMS
- The course also presents the underlying mathematical formulation
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 2 hours and 31 minutes
- **Instructor:** Dr. Giannelos, PhD (Imperial College London)

Course 75: The Economic Strategy of Wind Manufacturers

- This course teaches you how to build an optimisation model in Python for a wind-turbine manufacturer's economic strategy, using a practical case study
- It starts by helping you set up the required tools, including the optimisation solvers
- It then walks through the case study step by step, covering the mathematical formulation, input parameters, constraints, objective function, and how to solve the model
- Finally, it shows how to move from a concrete model to an abstract and more generalised formulation, including using externally sourced data and running multiple instances
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 54 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 76: Optimising Industrial Energy Systems

- This course teaches you how to build optimization models for industrial energy systems, starting from simple setups and moving toward more realistic multi-device systems
- You will model systems that can include furnaces, chillers, transformers, energy storage, combined heat and power (CHP), and electric heat pumps (EHP), and you will implement the models in Python and GAMS
- The course begins with an overview of industrial systems, then focuses on topics like heating and cooling demand and forward contracts for gas purchases
- It shows implementations and solutions in both Python and GAMS
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 2 hours and 25 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 77: The model for Locational Marginal Pricing

- This course teaches you how to build a model that calculates Locational Marginal Prices (LMPs) in electricity grids using Python and GAMS
- The course how LMP relates to other electricity pricing terms like the System Marginal Price, markets, retail pricing, and trading
- You then work through practical examples on various electricity networks, where you prepare input data, read and analyze results in Python, run sensitivity analyses, and quantify congestion cost
- You are also implementing the same models in GAMS
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 50 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 78: F-Factor Analysis for Energy Storage

- This course explains what the F-Factor model is and how it is used in electricity grids
- Specifically, this model measures the contribution of energy storage to the security of electricity supply to consumers

- When energy storage shaves the electricity peak demand, it contributes to increasing the security of electricity supply to consumers
- You learn the core ideas behind F-Factors for storage, how storage can reduce peak demand, and the extra practical details that affect F-Factor values
- The course then builds a mathematical optimisation model, covering the objective function and constraints, and describes the power system and demand profiles, including how to turn a peaky demand profile into a flatter one
- You implement the model in Xpress Mosel and study the results
- You also conduct sensitivity analyses across key energy storage and electricity demand characteristics
- The course concludes with topics on policy and regulation
- **Level:** Intermediate
- **Prerequisites:** None
- **Video duration:** 4 hours and 27 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 79: Capacity Expansion Planning with Energy Storage

- This course teaches you how to build a capacity-expansion planning optimisation model that decides how many power stations to build, what type they should be (for example coal and natural gas), and how much electricity each plant should generate to meet demand at the lowest total cost, while also including energy storage
- The modelling is done in Python, so you learn the full workflow from defining technologies and demand to setting decision variables, constraints, and the objective function
- It includes setup guidance such as installing Anaconda Navigator, Pyomo, and optimisation solvers
- You also learn how to solve the model and analyse the results
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 9 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 80: Pareto Analysis for Electricity Systems

- This course teaches you how to perform Pareto economic analysis for an electricity system, meaning how to compare trade-offs between competing objectives and map them as a Pareto frontier
- It also shows how to use fuzzy logic to pick an 'optimal' compromise point on that frontier using a linear membership method
- You will implement the full workflow in both Python and GAMS, including building the model, running the solution steps, generating the Pareto front, and improving the code
- The course also covers sensitivity analysis, showing how the Pareto results change when electricity demand changes, again in both Python and GAMS
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 2 hours
- **Instructor:** Dr. Giannelos, PhD (Imperial College London)

Course 81: Strategy of Power Stations in Spot Markets

- This course teaches how to build a Python optimization model that decides the best economic strategy for an electricity generation company operating in decentralized and spot electricity markets
- The course walks through a full case study, covering bilateral contracts, the mathematical formulation, input parameters, building an abstract model, solving it, and checking the optimal results
- Along the way, it explains core optimization theory topics like duality, convexity, how dual values relate to constraints, and the basic mathematics used by optimization solvers
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 3 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 82: Spinning Reserve for Electricity Grids

- This course explains what spinning reserve is in power system operation and how it helps the grid stay reliable when a power station unexpectedly trips or loses output
- It covers why spinning reserve is needed, the role of outages and credible contingencies, and how requirements are set using ideas like the N-1 generator contingency rule and limits on available reserve
- It also discusses how spinning reserve interacts with renewable generation and clarifies the difference between spinning and non-spinning reserves
- The course includes implementation in Python and in GAMS
- **Level:** Intermediate
- **Prerequisites:** Unit Commitment Optimisation
- **Video duration:** 1 hour and 14 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 83: How to model switchable Transmission Lines

- This course teaches you how to model electricity transmission lines that can be switched on or off, called switchable lines, and how to solve the resulting optimization problem
- You will build the model in Python, covering inputs, constraints on switching actions, and core system constraints, then compute an optimal solution
- The course also runs sensitivity analyses on congestion revenue, switching decisions, and demand, and introduces mixed-integer programming and duality
- Finally, it shows how to implement the same type of model in GAMS and applies the approach to a realistic 118-bus transmission system
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 29 minutes
- **Instructor:** Dr. Giannelos, PhD Imperial College London

Course 84: Transmission Expansion Planning

- This course teaches electricity transmission expansion planning, focusing on the Transmission Expansion Problem, which is an optimisation model used for reinforcing electricity grid infrastructure
- It shows how to plan upgrades by increasing the capacity of transmission lines, with implementations demonstrated in both Python and GAMS
- The content begins with key context such as grid topology, realistic modelling assumptions, and how deregulated electricity markets relate to expansion planning, then moves into modelling with parameters, decision variables, constraints, the mathematical formulation, and solving the model
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 46 minutes
- **Instructor:** Dr. Giannelos, PhD (Imperial College London)

Course 85: The model for Demand Response in Optimization

- This course teaches how to model the Demand Response technology inside optimization models for power system operation
- It shows how Demand Response works, what is its flexibility, how it is implemented in practice, and why economics and regulation matter for using it in real systems
- You will build the model in both GAMS and Python, including setting up inputs, writing constraints, solving the optimization problem, and running sensitivity analyses to see how results change when key assumptions change
- The course also covers practical challenges that appear when trying to use Demand Response in realistic studies
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 24 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 86: Smart Technologies for Power Flow Control

- This course teaches how to model Smart Power Flow technologies in optimization problems and understand where they are used
- It also covers the main concepts behind the computational challenges that can arise when solving these problems
- You will learn the real world applications of technologies like FACTS and Phase Shifting Transformers
- The course then walks through a full modelling Python workflow, including inputs, decision variables, constraints, the objective function, and how to obtain and interpret the solution
- It also shows how to evaluate the economic value of adding these technologies and how to visualize the results
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 2 hours and 30 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 87: F-Factor Analysis for Vehicle to Grid Systems

- This course introduces F-factor analysis for vehicle-to-grid (V2G) systems and explains how V2G can reduce peak electricity demand through peak shaving
- You learn the basics of V2G, including EV availability and how arrivals and departures affect how much flexibility the grid can use
- The course then teaches the F-Factor methodology, showing how to calculate f-factors and how V2G can support the security of electricity supply to consumers
- The course presents the mathematical optimisation model behind the method and then implements it in FICO Xpress using the Xpress Mosel language
- Finally, it covers how to analyse results with plots, heatmaps, and scatterplots, and it runs sensitivity analyses on peak duration and on different demand profile shapes before concluding with practical discussion on why EV owners might participate in V2G
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 2 hours and 7 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 88: Travelling Salesman problem for Energy

- This course teaches how to model and solve the Travelling Salesman Problem (TSP) in Python, and how to apply it to energy-related tasks
- It explains the TSP as finding the shortest route where a traveller starts from one city, visits every other city exactly once, and returns to the start while minimizing total distance
- You will learn practical steps such as working with GeoPandas maps, retrieving city coordinates, plotting the travel graph, and computing pairwise distances before solving the optimization problem
- Support is available via questions on Skool
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 39 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)
- **Note:** Learner support via Skool community

Course 89: How to linearize non-linear objective functions

- This course explains how to linearize a non-linear objective function using piecewise linear approximation, with all implementations shown in Python
- It introduces why linear models are often preferred in optimization, emphasizing faster solution times and the ability to reach a global optimum
- The course also teaches core ideas like linearity, convexity, and optimality, including how to check whether an objective function is convex
- It then connects piecewise linear approximations to typical energy-system optimization problems
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 4 hours and 24 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 90: Composite Uncertainty (Endogenous & Exogenous)

- This course explains the difference between exogenous uncertainty (outside the planner's control) and endogenous uncertainty (influenced by investment decisions) and how it applies to electricity grids
- The course shows how to develop a model for reinforcing the electricity grid when there is composite uncertainty (endogenous and exogenous)
- Uncertainty is modelled using a composite scenario tree that combines both uncertainty sources
- You will also learn how reinforcement technologies can be represented in the model and how input data feeds into the formulation and code
- The large model is then decomposed into simpler ones using Benders decomposition
- A special filtering algorithm is added to Benders to enable higher performance
- The implementation is done in FICO Xpress (Mosel)
- **Level:** Intermediate
- **Prerequisites:** 56. Essential Optimization Concepts with Mosel
- **Video duration:** 2 hours and 14 minutes
- **Instructor:** Dr. Giannelos (PhD Imperial)

Course 91: The Economics of a Coal Supply Chain Network

- This course explains how in a supply chain network (application: coal) the location of the warehouses is found so that the total annual transportation cost of coal is minimized
- In such a network, coal is being transported from the coal producers to warehouses and then to consumers. designed
- The course starts with the 'center of mass' method, and then introduces Monte Carlo simulation to model uncertainty, first assuming normal distributions and then exploring lognormal, uniform, and gamma distributions, including normality checks such as D'Agostino tests and Q-Q plots
- The course also covers economic risk analysis using Value at Risk and Conditional Value at Risk, plus correlation analysis to understand how inputs move together
- Next, it teaches unsupervised machine learning (k-means clustering) to group demand points and evaluate total cost, with sensitivity analysis for choosing between 1 and 5 warehouses
- Finally, it formulates and solves a mixed-integer programming optimization model that combines investment and operational costs, including a weighted k-means approach for warehouse locations
- The implementation is done in Python
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 5 hours and 5 minutes
- **Instructor:** Dr. Giannelos (PhD Imperial)

Course 92: Stochastic Optimisation and Backwards Induction

- This course compares Stochastic Optimisation and Backwards Induction in the context of electricity grid reinforcement under uncertainty
- It first revisits the Backwards Induction framework, including the underlying theory, the case study setup, sensitivity studies, and how to reproduce the results
- It then builds the Stochastic Optimisation model using a scenario tree to represent uncertainty, explains the structure of the model files, and shows how electricity demand is modelled
- Finally, it runs a sequence of stochastic optimisation studies to solve successive investment decisions (D1 to D4) and highlights the key comparison points between the two approaches, using Xpress Mosel for Stochastic Optimisation and Matlab for Backwards Induction
- **Level:** PhD-candidate
- **Prerequisites:** Backwards-Induction for Grid Reinforcement
- **Video duration:** 1 hour and 25 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 93: Power Grid Reinforcement with DLR and Storage

- This course explains how to decide how to reinforce the electricity grid at minimum cost, by choosing between conventional upgrades (such as line reconductoring) and deploying smart technologies (such as Dynamic Line Rating (DLR), and energy storage) when key inputs are uncertain, like electricity demand and wind farm installed capacity

- The course shows how to represent uncertainty using a scenario tree and how different load and wind patterns affect planning decisions
- You learn how to model the grid topology and technology performance, including the DLR capacity factor, and how to compare investment alternatives across multiple scenarios
- The course introduces stochastic optimization and Benders decomposition to evaluate the ‘option value’ of smart technologies
- It also walks through several solution cases, including situations where only line upgrades are allowed, where DLR or storage is added, where all technologies are available, and where no investments are made, plus how to run sensitivity analysis
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 33 minutes
- **Instructor:** Dr. Giannelos (PhD Imperial)

Course 94: Technical Characteristics of Power Stations

- This course explains the main technical and economic characteristics of different electricity generation technologies and how these characteristics affect their operation and costs
- It covers key electricity generation technologies such as hydro, wind (onshore and offshore), coal and oil, natural gas (OCGT and CCGT), nuclear, biomass, geothermal, tidal, solar photovoltaic, and concentrated solar power
- You learn practical performance measures like installed capacity, technology maturity, capacity factor, availability factor, ramp rates, startup times, minimum stable generation, efficiency, dispatchability, flexibility, and emissions intensity, including the difference between baseload and peaking plants
- The course also includes a module on understanding capacity factors, with examples for wind, baseload plants, hydro, and nuclear units using different time granularities
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 32 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 95: Why reinforce the electricity grids?

- This course explains what creates the need to reinforce the electricity grid
- Reinforcement can be done by increasing the capacity of existing transmission lines, building new transmission lines, and deploying smart grid technologies
- The course focuses on the main drivers that push grid investment decisions such as decarbonisation, flexibility and future peak electricity demand
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 33 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 96: Financial Discounting in Energy

- This course teaches how to use financial discounting as part of the economic evaluation of energy projects
- It explains key ideas such as discounting, epochs, horizon, and the time value of money, and shows how cumulative discounting works across multiple years
- You will learn how to calculate regular and cumulative discount factors for discounting operational costs and capital expenditure
- The course includes implementation in both Python and Excel
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 8 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 97: Incremental & Strategic Grid Reinforcement

- This course explains the economics of two approaches that are used for reinforcing electricity grids
- Specifically, it compares the incremental with the strategic approach
- It presents real-world style scenarios to examine a case study that includes estimating electric vehicle peak demand and accounting for investment costs

- The course includes a basic analysis plus sensitivity analyses that test how results change with different investment costs, discount rates, and investment delays
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 15 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 98: Smart Grid Technologies for Grid Reinforcement

- This course explains how smart-grid technologies can postpone electricity grid upgrades (deferral) or completely avoid the need for them (displacement)
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 7 minutes
- **Instructor:** Dr. Giannelos, PhD (Imperial College London)

Course 99: Wholesale Electricity Price in Python

- This course explains how wholesale electricity pricing works in both centralized and decentralized electricity markets, and how market structure influences the wholesale electricity price
- You will use Python to build a wholesale electricity price model and use it to study which inputs and assumptions drive the resulting price
- The course guides you through finding the cut-off (marginal) generator, and calculating the wholesale price from the merit order
- You will also learn how to create a merit order plot, run sensitivity analysis, and build an interactive plot to explore how changes in inputs affect outcomes
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 32 minutes
- **Instructor:** Dr. Giannelos, PhD Imperial College London

Course 100: Capitalisation Factor for Energy Investments

- This course teaches financial modelling for energy investments, focusing on the capitalisation factor and the maths that supports it
- You will learn how to model and annualise costs in Excel and then replicate the same calculations in Python
- The course also covers how the capitalisation factor changes when discount rates vary over time
- It compares three different ways to calculate the capitalisation factor so you can understand when each approach is useful
- **Prerequisites:** None
- **Video duration:** 57 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 101: Energy Subsidy Mechanisms

- This course explains how energy subsidies work and why they are used in the energy sector, with examples focused on energy storage, wind farms, and solar photovoltaic units
- It shows how to build subsidy models in Python and Excel for common mechanisms such as Contracts for Difference (CfD), Renewables Obligation Certificates (ROC), and Feed-In Tariffs (FiT)
- You start by learning what a subsidy is, where it is used in energy, and the main arguments for and against subsidies, including how subsidies relate to smart grid technologies
- Then you implement general subsidy examples in Python, such as supporting wind farm construction and enabling energy storage to sell services at lower cost
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 57 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 102: Investment cost methods for Transmission Lines

- This course explains how to calculate the fixed and variable investment costs for building electricity transmission lines

- It focuses on the Spackman method, which is used to estimate loan repayments and translate financing terms into investment cost profiles
- You will implement the approach using both Excel and Python, learning how to structure inputs and compute cost components consistently
- By the end, you should be able to model transmission investment costs and apply the Spackman method in practical spreadsheets and code
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 50 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 103: Valuation of Demand Side Response Contracts

- This course explains how to calculate the economic value of Demand Side Response (DSR) contracts signed between aggregators and electricity network operators, based on the benefit these services provide to the power grid
- It introduces what a DSR scheme is, what an aggregator does, and which technologies can deliver DSR in practice
- You then build an Excel-based financial valuation model, covering key inputs like contract timescales and the investment cost required to enable DSR
- The course also introduces scenario analysis using a scenario tree to represent uncertainty in the electricity grid and to quantify the contract's value under different outcomes
- It includes specific valuation examples for smart chargers and smart charging contracts
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 30 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 104: Technology S-Curve Analysis with Python

- This course teaches how to build an S-curve, in Python, for understanding a technology's lifecycle
- You learn how the S-curve helps visualize key phases such as introduction, growth, and maturity, based on a technology's characteristics
- It also covers practical applications of S-curve analysis, including examples related to smart technologies
- The course includes a Python implementation section that introduces the standard normal distribution approach for creating an S-curve
- It also explains the learning curve effect and how it relates to technology development over time
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 56 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 105: Energy Balance Data Analysis

- This course explains what energy balances are and how to use them to analyse a country's energy supply and energy demand
- It shows, step by step, how to process an energy balance dataset and turn it into clear indicators using data analysis
- The course demonstrates how to calculate and interpret supply indicators, and how to break down and study the structure of energy demand
- All examples and the full implementation are done in Python
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 3 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 106: Environmental Economics and Marginal Abatement

- This course teaches environmental economics by showing how to develop and interpret a marginal abatement cost curve (MACC) for 12 different abatement measures
- It explains what abatement measures are, what key characteristics describe them, and how these inputs shape the final curve
- You will build a Python model that defines the measures, calculates their marginal costs, and draws the MACC

- The course also focuses on how to read the curve and use it to compare measures and understand which options reduce emissions at lower or higher cost
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 4 hours and 37 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 107: The Economics of Smart Grid Deployment

- This course explains focuses on smart grid technologies, specifically soft open points and smart electric vehicle (EV) chargers
- It shows how to use stochastic optimisation (an optimisation method that accounts for uncertainty) to decide how many of these technologies should be installed under different scenarios
- You will learn key concepts around the system topology, uncertainty modelling, and build-time
- The course then walks through running the study first for soft open points and then for smart EV chargers, with a clear step-by-step guide
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 1 hour and 25 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 108: Investment in Smart Chargers under Uncertainty

- This course teaches how to use stochastic optimisation to decide the best strategy for deploying smart chargers for electric vehicles in electricity distribution grids when future EV charging peak demand is uncertain
- It explains how uncertainty is represented with a scenario tree, and how this uncertainty changes investment decisions
- You learn the economics of smart charger investments, including build time (investment delay) and the option value
- Through a case study, the course focuses on the interrelation between smart charging investments, smart charging flexibility and the level of conventional network reinforcements (e.g. line upgrades)
- It also introduces how to measure social cost and demonstrates how social cost influences both the amount of network reinforcement needed and the level of option value of smart smart charging
- **Level:** Intermediate
- **Prerequisites:** 107: The Economics of Smart Grid Deployment
- **Video duration:** 2 hours and 30 minutes
- **Instructor:** Dr. Giannelos

Course 109: Option Value Analysis of Smart Technologies

- This course teaches how to economically evaluate smart grid technologies when key inputs are uncertain, and how to calculate the “option value” for smart technologies
- It explains the system topology, how uncertainty is represented with a scenario tree, and how “build time” affect investment decisions
- You will then review different technology options, including a case where only conventional technologies are considered
- The course applies the concepts through stochastic optimization implemented in FICO Xpress Mosel, with examples such as the option value of Dynamic Line Rating and the option value of a portfolio of smart technologies
- **Level:** Intermediate
- **Prerequisites:** 55. Building Optimization Models in Mosel
- **Video duration:** 49 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 110: Day-Ahead & Balancing Electricity Markets

- This course explains how the UK electricity market is structured
- Then it shows how to model key parts of the wholesale electricity market in Python
- It focuses on two components: the day-ahead market and the balancing mechanism, using practical examples
- The course also walks through the day-ahead market process, including registering available capacity, submitting bids, and forward contracts
- **Level:** Beginner
- **Prerequisites:** None

- **Video duration:** 2 hours and 46 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 111: Retail Electricity Market in Python

- This course teaches how to implement the retail electricity market in Python, with a focus on how it works in the United Kingdom
- You will learn how to calculate retail electricity prices, compute monthly bills under two tariff structures, and derive the base rate used in pricing
- The course also shows how bills change under different consumption levels and how to calculate the retailer's monthly profit
- **Level:** Intermediate
- **Prerequisites:** 110. Day-Ahead & Balancing Electricity Markets
- **Video duration:** 1 hour and 20 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 112: Oil Forward Contracts in Python

- This course teaches how to implement crude oil forward contracts in Python, starting from the basic idea of what a forward contract is and how the forward price is negotiated
- You will build forward contract objects in Python and use them inside a trading portfolio
- The course explains key trading and risk concepts such as notional value, market value, spot price, profit and loss (PnL), settlement, hedging, and Value at Risk
- You also compute portfolio position metrics and run scenario analysis to see how PnL changes under different outcomes
- Finally, you work through examples, including the case where the settlement spot price is higher than the forward price and how a seller can hedge using forward contracts
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 2 hours and 15 minutes
- **Instructor:** Dr. Giannelos (PhD, Imperial College London)

Course 113: Option Contracts for Crude Oil

- This course teaches how to implement crude oil option contracts in Python
- It explains core option concepts such as calls vs puts, option chains, expiration dates, moneyness, intrinsic and extrinsic value, option premium, risk-free rate, volatility (as the annualized standard deviation of log returns), and how commodity options relate to options on futures
- You will build an oil options chain class and compute time to expiry, then use it to price options with the Black-76 model
- The course also covers practical details like settlement and delivery for crude oil options and connects the pricing approach to a Black-Scholes interpretation
- **Level:** Intermediate
- **Prerequisites:** 112: Oil Forward Contracts in Python
- **Video duration:** 2 hours and 2 minutes
- **Instructor:** Dr. Giannelos

Course 114: Deterministic Optimisation in Energy

- This course teaches how to build a linear, deterministic optimisation model in Python to minimise cost
- It assumes the optimisation problem has no uncertainty, meaning the model uses fixed input values when it is solved
- To generate inputs, we generate demand and renewable output data using a Gaussian distribution, and then treat those generated values as known data for the deterministic model
- The content covers generating the input data first, and then formulating and solving the linear deterministic optimisation model
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 33 minutes
- **Instructor:** Dr. Giannelos

Course 115: Monte Carlo Simulations & Gaussian Uncertainty

- This course teaches how to build a model, in Python, that performs Monte Carlo simulation

- The results allow to observe how sensitive the operating cost is to changes in demand and available renewable generation
- Monte Carlo involves running a deterministic optimization model thousands of times
- The model uses normally distributed uncertainty for electricity demand and solar output to represent real-world variability
- **Level:** Intermediate
- **Prerequisites:** 114. Deterministic Optimisation in Energy
- **Video duration:** 27 minutes
- **Instructor:** Dr. Giannelos

Course 116: Stochastic Optimisation & Gaussian Uncertainty

- This course teaches how to model two-stage and three-stage stochastic optimization in Python, using Gaussian data to build a scenario tree
- You apply stochastic optimization to the day-ahead operation of an Energy Hub, which is a smart building that must meet its electricity demand over a 24-hour period
- The course walks through the full workflow, including defining inputs and the scenario tree, adding probability information, building the optimization model, and finding the optimal solution
- **Level:** Intermediate
- **Prerequisites:** 115. Monte Carlo Simulation & Gaussian Uncertainty
- **Video duration:** 2 hours and 2 minutes
- **Instructor:** Dr. Giannelos

Course 117: Reinforcement Learning in Energy

- This course teaches how to build a single-agent Reinforcement Learning model in Python for smart buildings (energy hubs) when the uncertain parameters follow a Normal distribution
- The course explains the basics of Reinforcement Learning, including the role of the agent, the environment, rewards, penalties, and the PPO algorithm used as the learning method
- Also, the course shows how to validate the environment, train the model, evaluate it, and test its reliability through Monte Carlo simulations
- **Level:** Intermediate
- **Prerequisites:** 116. Stochastic Optimization & Gaussian Uncertainty.
- **Video duration:** 2 hours and 10 minutes
- **Instructor:** Dr. Giannelos

Course 118: Kernel Density Estimation

- This course explains how to solve Monte Carlo and 2-stage stochastic optimization models using KDE-based data instead of Gaussian data, making the results more realistic and accurate
- It also shows how to generate KDE-based data and how this approach better matches real CityLearn data
- The lessons cover data scaling, converting scaled results back to original kWh values, solving a 2-stage stochastic optimization model with KDE-based uncertainty, and running a Monte Carlo model with KDE-based load and renewable output data
- Overall, the course focuses on improving earlier Gaussian-based models (online courses 115 and 116) by using a more flexible data-driven method
- **Level:** Intermediate
- **Prerequisites:** 116. Stochastic Optimization & Gaussian Uncertainty
- **Video duration:** 38 minutes
- **Instructor:** Dr. Giannelos

Course 119: Machine Learning for Battery Arbitrage Trading

- This course explains how to model a battery trading arbitrage strategy by combining supervised machine learning, specifically Random Forest, with optimization.
- It focuses on forecasting next-day wholesale electricity prices instead of assuming those prices are already known with certainty.
- The course also covers the full workflow, including feature engineering and model performance evaluation, in a simple applied setting.
- **Level:** Intermediate
- **Prerequisites:** 38. Battery Trading & Arbitrage with Optimisation

- **Video duration:** 4 hours, 34 minutes
- **Instructor:** Dr. Giannelos

Course 120: Investment Frameworks for Power Systems

- This course presents the most important investment decision frameworks for power systems. These frameworks use optimisation to find the optimal reinforcement decisions for a power system, such as upgrading line capacity or deploying smart technologies. The case study is a power system with uncertain demand growth driven by electric vehicle adoption.
- **Level:** Beginner
- **Prerequisites:** None
- **Video duration:** 5 hours
- **Instructor:** Dr. Giannelos