LOW CARBON CONTRACTS COMPANY

POWERING NET ZERO

Low Carbon Contracts (LCCC) Levy Forecasting Methodology

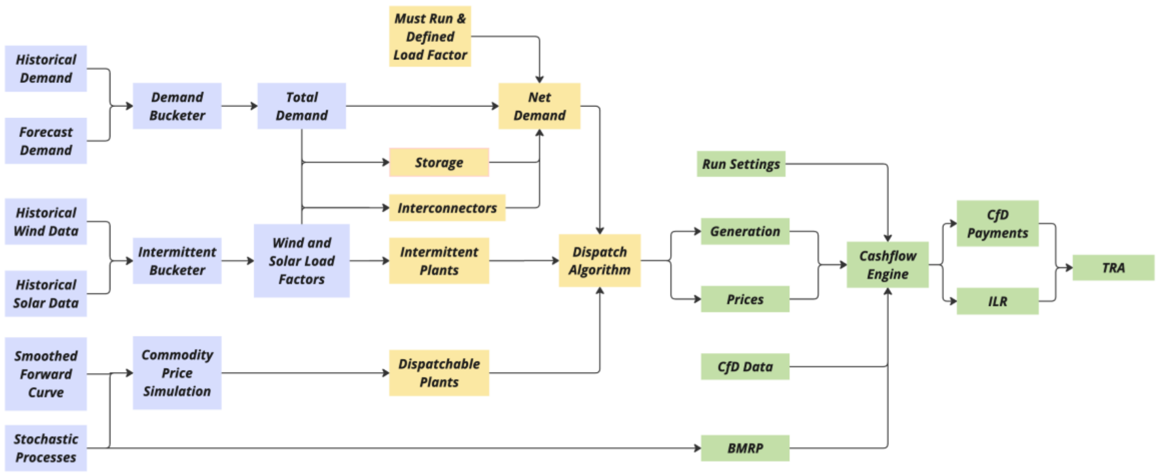
Version 1 July 2024

Version 1

Introduction

Each quarter, the LCCC forecasts the CfD ILR and TRA one quarter in advance, as required by Supplier Obligation Regulations. LCCC uses an internally-developed forecasting model (ELFO) to forecast electricity generation. ELFO uses generation and prices to calculate CfD payments, cashflows and ultimately the ILR and TRA. This model is part of LCCC's broader framework for forecasting all schemes under its purview.

Model Map



Key Features

- **Stochastic Modelling**: ELFO captures a range of potential scenarios that reflect the uncertainties of the electricity market. It stochastically models key inputs, including: demand, commodity prices, wind generation, solar generation, and plant outages.
- **Monte-Carlo Simulation**: A crucial process to accurately forecast the TRA. The model runs numerous scenarios from stochastically generated inputs to produce a wide spectrum of results.
- **Hourly Dispatch**: Dispatch decisions are simulated on an hourly basis for each individual plant throughout the simulation period, ensuring granular predictions of wholesale prices and generation.
- **Two Year Projection Window:** ELFO uses available energy markets data to produce forecasts for up to two years in the future, while maintaining the hourly granularity of results.

Model Inputs

1. **Model Run Settings**: Basic information defining the period to simulate, ensuring all relevant data aligns with the simulation timeline.
2. **Plant Data**: Comprehensive details of all generating units, including capacities, online and offline dates, specific operational characteristics such as efficiency, start-up costs, and minimum stable generation levels.

3. **Wind Data**: Historical and projected data for simulating potential wind output, adjusted for geographical and temporal variations.
4. **Solar Data**: Historical and projected data for simulating potential solar output, incorporating seasonal and daily patterns.
5. **Commodity Prices**: Daily prices for gas, coal, and carbon, crucial for determining short-run marginal costs of dispatchable plants.
6. **Demand**: Central projections and historical data to simulate demand uncertainty, essential for aligning generation capacity with consumption patterns.
7. **Power Forward Prices**: Used to adjust the reference prices to align with market expectations.
8. **Interconnectors**: Interconnector flows are simulated using Machine Learning models, using features such as demand and intermittent generation to predict cross-border electricity flows.

Simulation Steps

1. **Initialisation**: Define the simulation period and validate input data for accuracy and completeness before proceeding with the model run.
2. **Stochastic Inputs Simulation**:
    - **Wind and Solar Outputs**: Model renewable variability and uncertainty. Use ERA5 data and historical plant load factors to build "buckets" of potential hourly load factors, which are randomly sampled for each simulation.
    - **Commodity Prices**: Model the trend and volatility in commodity prices. Produce daily price distributions for gas, coal, and carbon using stochastic simulations tailored to each commodity. For example, Ornstein captures mean reverting behaviour and Normal Inverse Gaussian Levy captures fat tailed behaviour of gas prices in recent history.
    - **Demand**: Model realistic demand patterns through stochastic sampling from historical demand data to create intra-day noise around a central projection based on a linear regression model.
3. **Generation Capacity Calculation**: Determine the available capacity of each generating unit, factoring in scheduled and unscheduled outages and potential intermittent load factors. This calculation involves adjusting the capacity based on historical performance and expected availability.
4. **Dispatch Algorithm**:
    - **Net Demand Calculation**: Adjusts for must-run and defined load factor generation to calculate the demand that dispatchable units must meet.
    - **Bid Prices Determination**: Calculates bid prices based on short-run marginal costs, start costs, and operational characteristics. Each plant submits bids reflecting its cost structure and operational constraints.
    - **Operational Plant Determination**: Ensures the most economical units are dispatched first, to meet demand cost-effectively. Selects and ranks plants to

meet demand changes at the lowest cost, considering constraints such as minimum on/off times.

- **Price Determination**: Reflects supply and demand dynamics. Sets the market electricity price based on the highest bid of operating plants, aligning with marginal costs.

5. **Cashflow Engine:**

- **Market Reference Prices (IMRP and BMRP)**: Adjusts marginal prices in each simulation to match future power curves, ensuring the results align with market expectations.
- **CfD Payments**: Calculated for each CfD plant in each simulation, taking into account contract parameters, hourly generation and reference prices.
- **ILR**: Determines the charges to suppliers. Calculates ILR as the average of the CfD payments over the quarter, divided by average gross demand.
- **Cashflows**: CfD and supplier payments are transformed into cashflows on a paid basis, per each simulation.
- **TRA**: Ensures sufficient reserves to remain cash-positive during the quarter. Selects the minimum cashflow position in each simulation, ranking these positions, and selecting the lowest 5th percentile.