

# UL 2024 Offshore Backcast

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## Intro

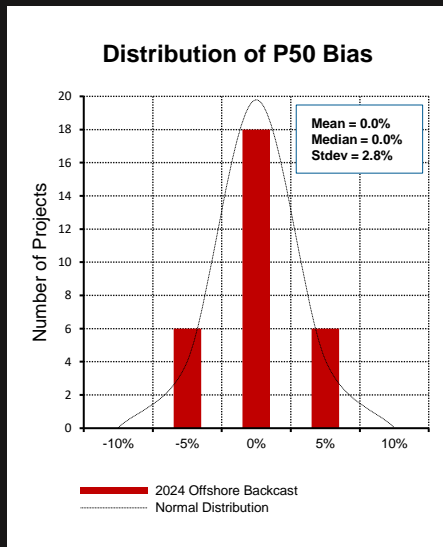
Backcast: the process of validating energy production estimation methods against operating plant performance.

2024 Offshore Backcast is UL Solutions' first offshore-specific study with the following goals:

- **Establish and validate** offshore-specific energy production estimation methods
- **Build and maintain** trust and confidence in energy estimation methods and results

## Method

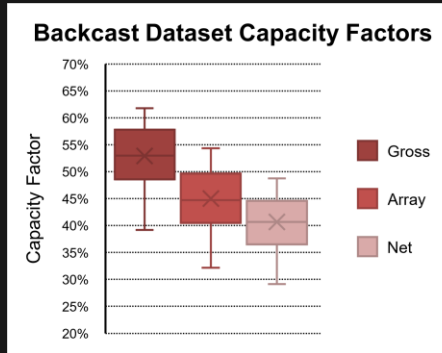
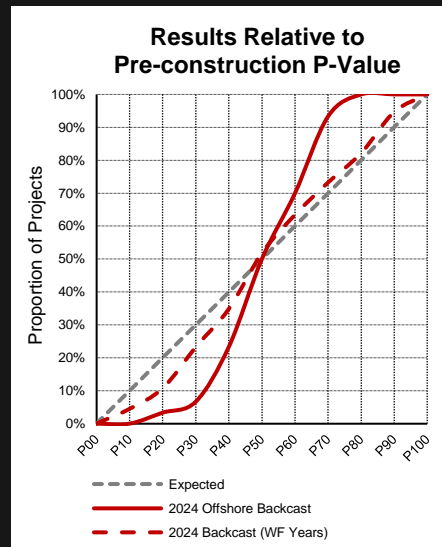
- Assess pre-construction and operating energy from 30 offshore projects in Northern Europe spanning a range of sizes and technologies
- Utilize publicly available measurement and production data, modeled data, monthly operating reports and SCADA data
- Incorporate WRF wind flow modeling, wake model development and validation, availability studies, power curve test results, wave data and more...
- Analyze and adjust methodologies



Losses	Array	Plant	Total
Mean (Range)	15% (9% - 23%)	10% (8% - 12%)	23% (17% - 30%)



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## Results

- 2024 Offshore Backcast has a mean bias of 0.0% with a standard deviation of 2.8%

## Offshore Refinements

- **Array Loss:** adjustments to Deep Array Eddy Viscosity Wake Model settings
- **Turbine Availability:** Energy-based, variable, typical range of 3-5%
- **Electrical:** Default loss of 3.8%, adjustable based on valid study or confirmation of electrical system design
- **Power Curve:** Site and technology dependent, typical range of 0.5%-1.5%
- Uncertainty increased for projects outside of backcast dataset envelope

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