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Solar vs Wind vs Hybrid - Risk and financing through an energy lens

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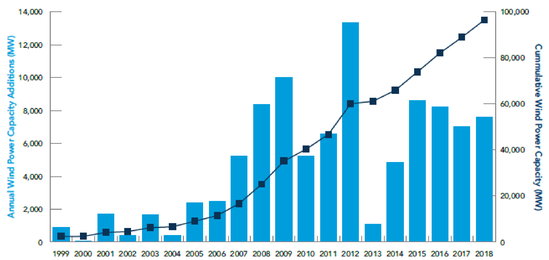
BACKGROUND

Renewable energy projects are being financed in the U.S and across the world with various mechanisms such as project finance and tax-equity financing. These mechanisms not only differ with respect to the developer and lender requirements, but also with respect to each technology. This poster attempts to elaborate on differences between solar, wind and hybrid (solar plus storage) projects with an focus on energy modelling.

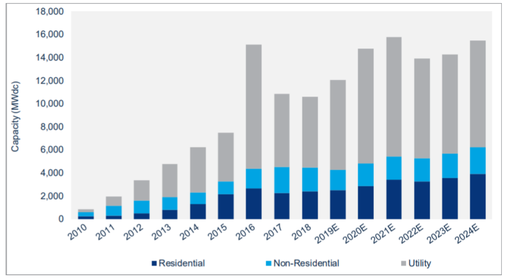
OBJECTIVE

- To identify how energy assessment methodologies differ between wind, solar and hybrid energy assessments.
- To identify how risk and uncertainties differ between wind, solar and hybrid energy assessments, and how that drives financing decisions and standards.
- To predict how the market will change in the coming years in terms of prevalence of wind versus solar versus hybrid projects, how financing these projects may change in the future, and how risk continues to evolve over time for wind and solar projects.

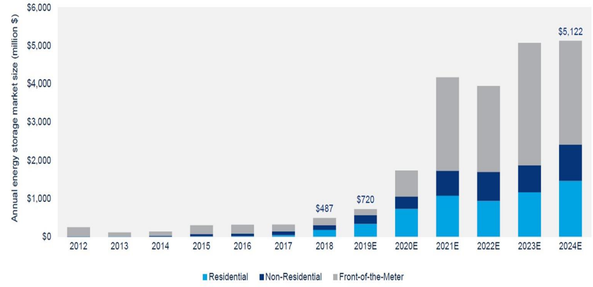
US ANNUAL WIND DEVELOPMENT[1]



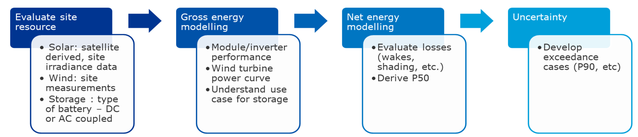
US ANNUAL SOLAR DEVELOPMENT[2]



US ENERGY STORAGE MARKET FORECAST[2]

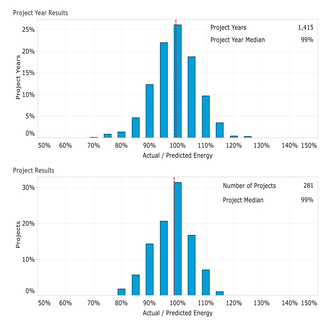


ENERGY ASSESSMENT METHODOLOGY

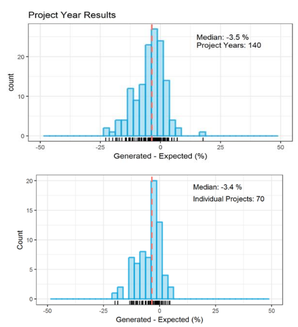


ENERGY MODELING VALIDATION

It is important to validate energy modeling processes for additional confidence in the investment and to de-risk the project



Wind energy modeling validation



Solar energy modeling validation

COMMON FINANCING TYPES FOR SOLAR, WIND AND HYBRID

Construction Loans

Banks lend money to projects to pay for turbines, construction costs, and other capital expenditures.

Banks may also lend for a longer tenor, well into the operating life.

- IER completion and "Closing" — IER finalization, equity review, first draw, form of certificates
- Construction on budget? On schedule? Per the spec? — Site visits/Construction Monitoring; Draw certs (supported by SVRs) provide our approval for payments from loan
- Has anything changed since "closing" — CS/IE substantial completion cert/bringdown

Tax Equity

Banks invest money at COD and effectively become a part-owner of the Project, along with the Sponsor.

- IER completion and "Closing" — Tax equity "commits" by signing an agreement, but commits no cash.
- Construction is high quality, per spec? Built to operate well? — Budget and schedule are less of a concern. Quality is paramount – will the project work?
- Has anything changed since "closing"? Is everything complete? — CS/IE substantial completion cert.; Tax equity invests their money and "buys out" the construction loan.

KEY RISKS FOR EACH TECHNOLOGY TYPE

WIND

- Resource assessment and wind flow modeling
- Turbine technology reliability
- Availability warranties
- Production requirements under offtake contracts
- Noise or permitting curtailment
- Power performance

SOLAR

- Module and system degradation assessment
- Warranty verification
- Resource selection, energy & financial optimization
- Modeling assumptions on Soiling, Light Induced Degradation (LID), Incidence Angle Modifier (IAM), etc.

HYBRID

- Battery degradation assessment & warranty verification
- Project and site safety analysis & code compliance
- Understanding the use case for storage
  - DC/AC coupled
  - Application
    - Shifting or Firming or Catering to merchant market revenue

REFERENCES

1. AWEA
2. Wood Mackenzie Power & Renewables

CONTACT INFORMATION

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