LCOE Review

By: Bill

What is LCOE / why does it matter

- LCOE is the sum of three key components
    - Capital cost amortized over life of plant + O&M cost per year
    - Variable costs
    - Fuel costs
- Allows the comparison of different technologies of unequal life spans, project size, different capital cost, risk, return, and capacities
- Useful investment metric for comparing new options
- Can be thought of as
    - Long run average cost
    - **Breakeven** cost over an assumed financial life and duty cycle
    - Long run marginal cost of power plant
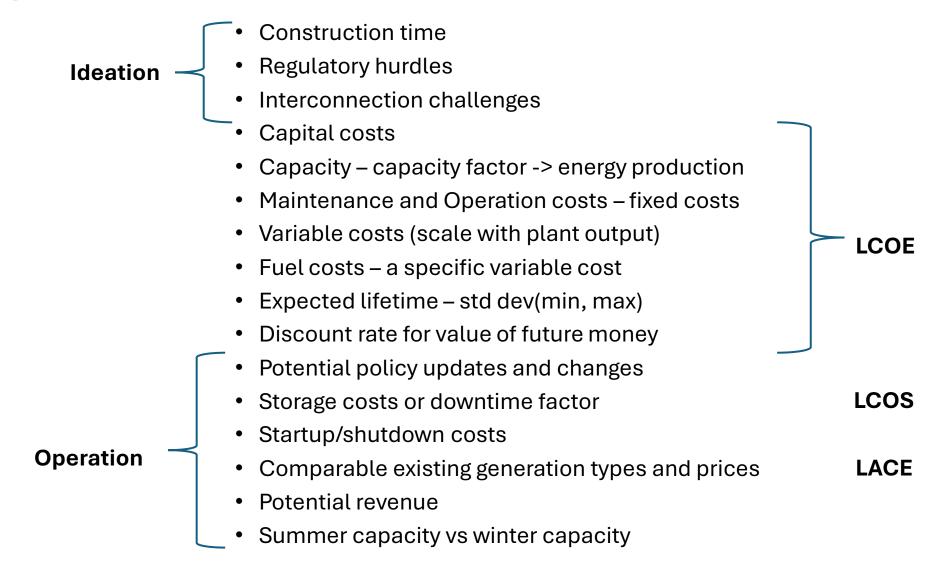   - The minimum price of electricity sold to the grid

What are the Drawback

- Assumes a kWH is the same as any other kWH
  - This can artificially favor VRE compared to baseload
- Hard to compare a new plant to an existing plant
- Not useful when looking at energy systems because time factors are not included
  - Supply has no obligation to meet demand
- Does not take storage costs into account
- Requires an assumed interest rate for future dollars
  - This can negatively impact plants with longer lifecycles like nuclear
- Not every quoted LCOE is calculate the same
  - LCOE doesn't always take capacity factor into account
  - Sometimes measures total life and sometimes is annualized
  - Sometimes MWH instead of kWH

How Can We Fix it

- Get more data
- Calculate LCOE from scratch as opposed to pulled from other sources
- Require storage be included VRE over a certain capacity size after a certain VRE penetration percentage
- Automate and update metrics more frequently
- Be more transparent with calculations
- Favor baseload power after certain VRE penetration percentage
- Use LCOE, LCOS, or LACE when applicable in the modeling loop

Key factors

Ideation
- Construction time
- Regulatory hurdles
- Interconnection challenges

- Capital costs
- Capacity – capacity factor -> energy production
- Maintenance and Operation costs – fixed costs
- Variable costs (scale with plant output)
- Fuel costs – a specific variable cost
- Expected lifetime – std dev(min, max)
- Discount rate for value of future money

LCOE

Operation
- Potential policy updates and changes
- Storage costs or downtime factor
- Startup/shutdown costs
- Comparable existing generation types and prices
- Potential revenue
- Summer capacity vs winter capacity

LCOS

LACE

Appendies

Sources

- https://www.energy.gov/sites/prod/files/2015/08/f25/LCOE.pdf
- https://www.nrel.gov/analysis/tech-lcoe.html
- https://www.nrel.gov/analysis/crest.html
- https://www.nrel.gov/docs/legosti/old/5173.pdf
- https://commercialsolarguy.com/you-know-lcoe-but-how-about-lcos-energy-storage-analysis-from-lazards/
- https://www.pnnl.gov/lcos-estimates
- https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf

Hypothetical Modeling Flow

- Estimate demand, based on supply calculate a price (factor in PTC for renewables), if price(LACE) is higher than LCOE add generation capacity of certain types, based on new supply recalculate price, at new price which sectors would grow demand

- Remove generation or demand that is no longer economically viable

- Add time lag for construction of both demand and supply nodes
  - Time to construct power plant of X capacity
  - Time to construct data center
  - Time to construct EV super charger
  - Time to construct X miles of transmission – what if HV

- Loop cycle to a max of X times per balancing era

Building a new plant, factors to consider

- Risk
- Potential gain
- Time to get return on investment
- https://www.youtube.com/watch?v=UC_BCz0pzMw&t=836s
- Construction costs, fuel cost, construction time

- Revenue costs are very complicated to calculate