



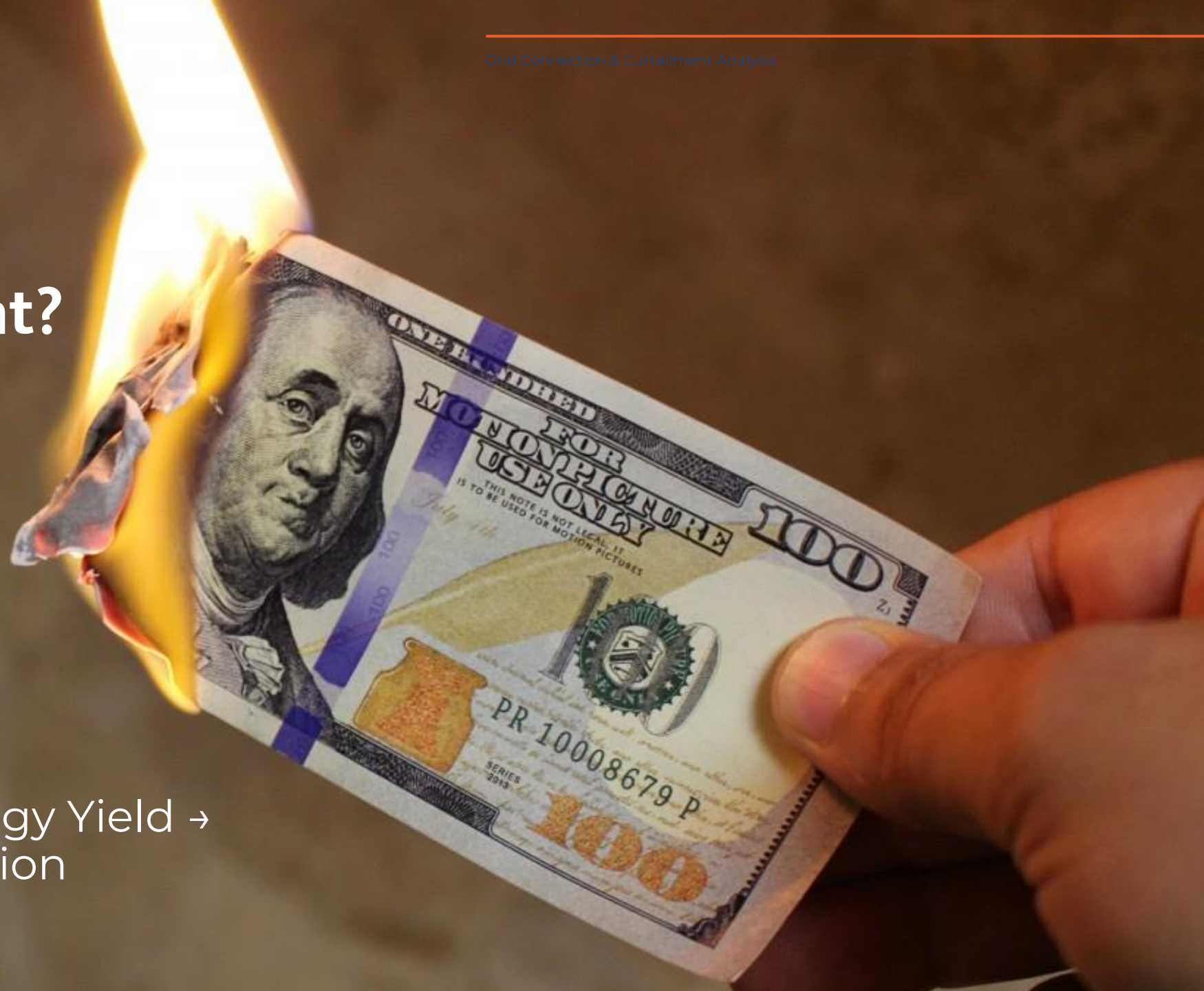
NovoGRID

**Curtailment
&
PPAs**



What is Curtailment?

Curtailment Risk → Energy Yield →
PPA Price & Risk allocation



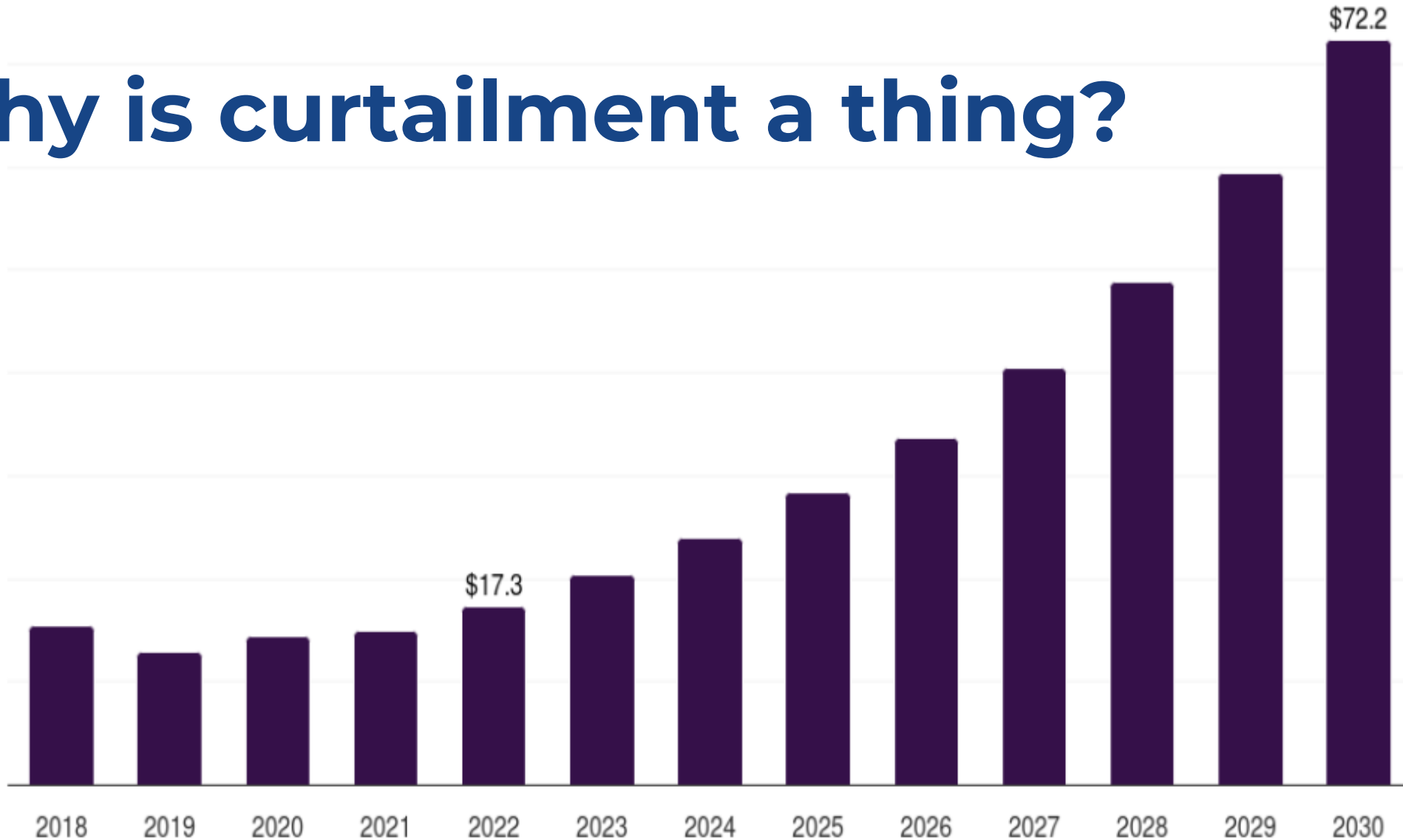


Relatable?



Spoiler Alert!

Why is curtailment a thing?



Why is curtailment a thing?

The Economist explains

Why Britons love to queue

The economics of queuing—is it really the best system?





$$A = \pi r^2$$

$$C = 2\pi r$$

$$V = \pi r^2 h$$

Why are the projections so wrong?

	30°	45°	60°
sin	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$
cos	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$
tan	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$

$$\int \frac{dx}{\cos^2 x} = \tan x + C$$

$$\int \tan x dx = -\ln|\cos x| + C$$

$$\int \frac{dx}{\sin x} = \ln\left|\tan \frac{x}{2}\right| + C$$

$$\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \arctan \frac{x}{a} + C$$

$$ax^2 + bx + c = 0$$

$$a\left(x^2 + \frac{b}{a}x + \frac{c}{a}\right) = 0$$

$$x^2 + 2\frac{b}{a}x + \left(\frac{b}{a}\right)^2 - \left(\frac{b}{a}\right)^2 + \frac{c}{a} = 0$$

Impact

Generators

- Revenue
- Financial Viability

Offtakers

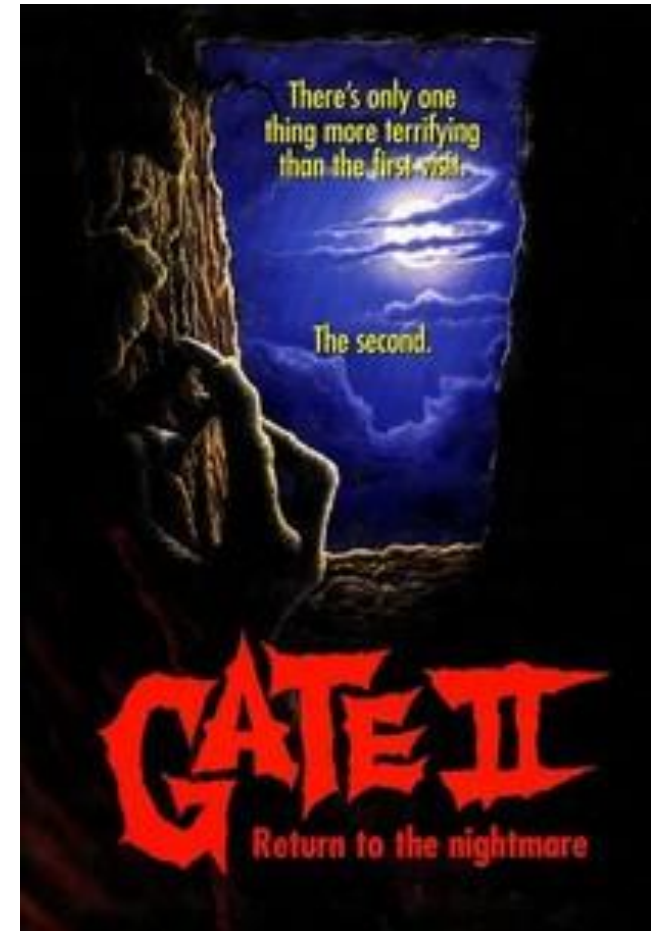
- Energy Shortfall
- Increased Procurement Costs

Investors

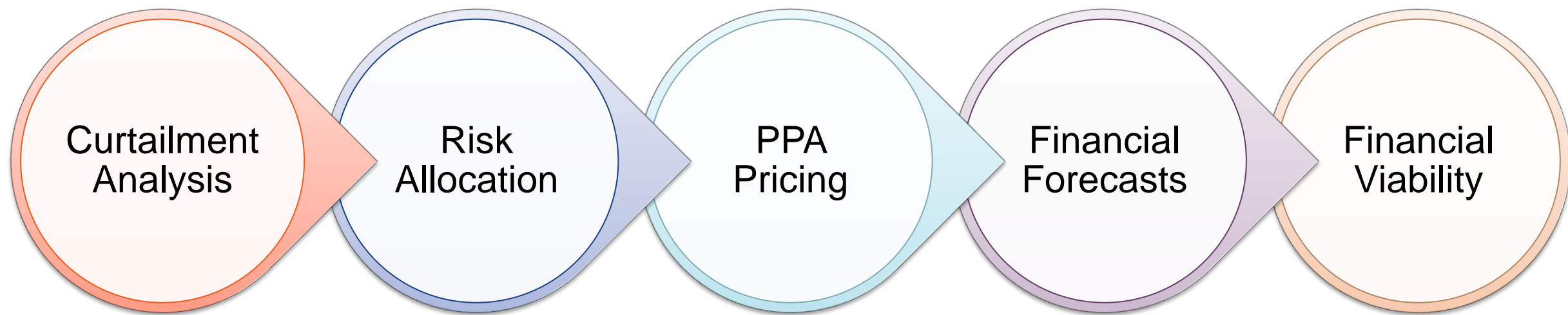
- Reduced Shareholder Returns

It's about to get more complex

- Risk of project losing position
- Project won't connect in next 5 or 10 years



How on earth do we model for this?



Power flow analysis

Multiple Future Scenarios

	Normal Conditions			Outage Conditions		
Queue Position	5	10	15	5	10	15
Hours Curtailed	837	839	1197	1620	1622	1986
% Availability	90.45	90.42	86.34	81.51	81.48	77.33
Total curtailment [MWh]	11,742.34	11,797.44	39,750.78	49,704.61	49,712.17	58,380.84
Max curtailment [MW]	21.59	21.43	40.00	40.00	40.00	40.00
Adjusted yield [MWh]	65,128	65,073	37,120	27,166	27,158	18,490
% Curtailment	15.27	15.34	51.71	64.66	64.67	75.94

Changes in future demand and supply

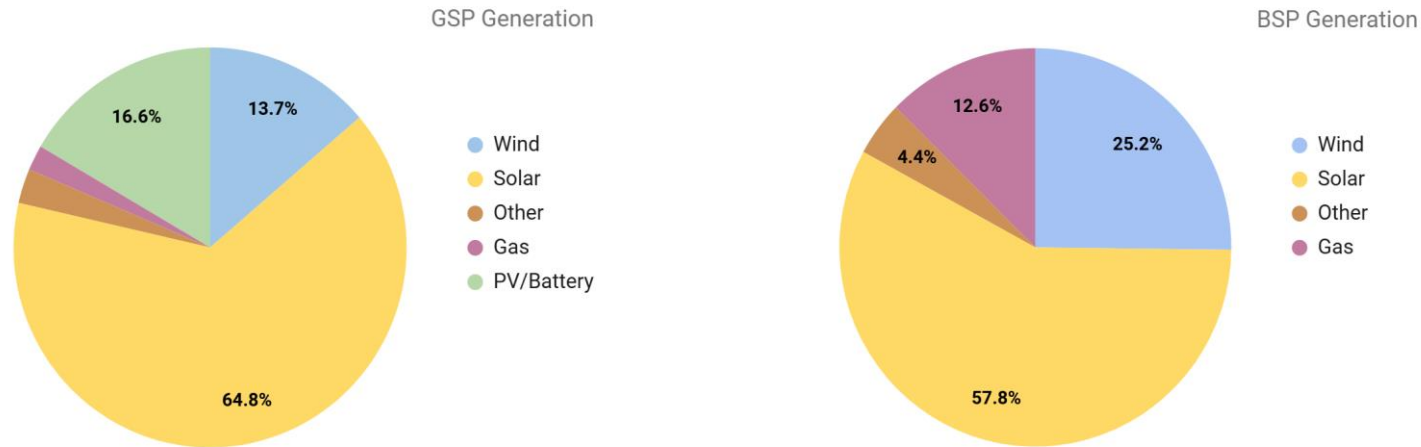
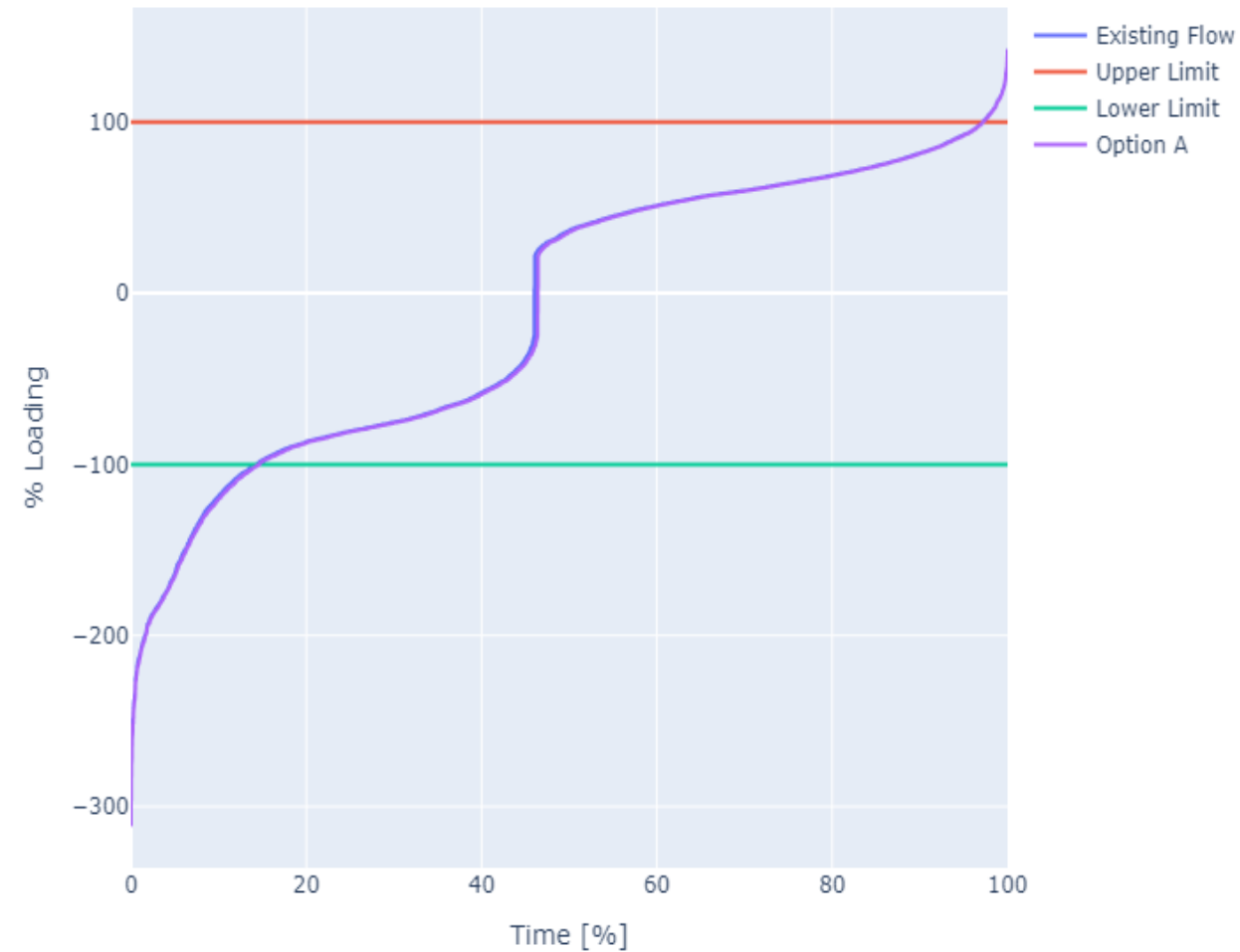


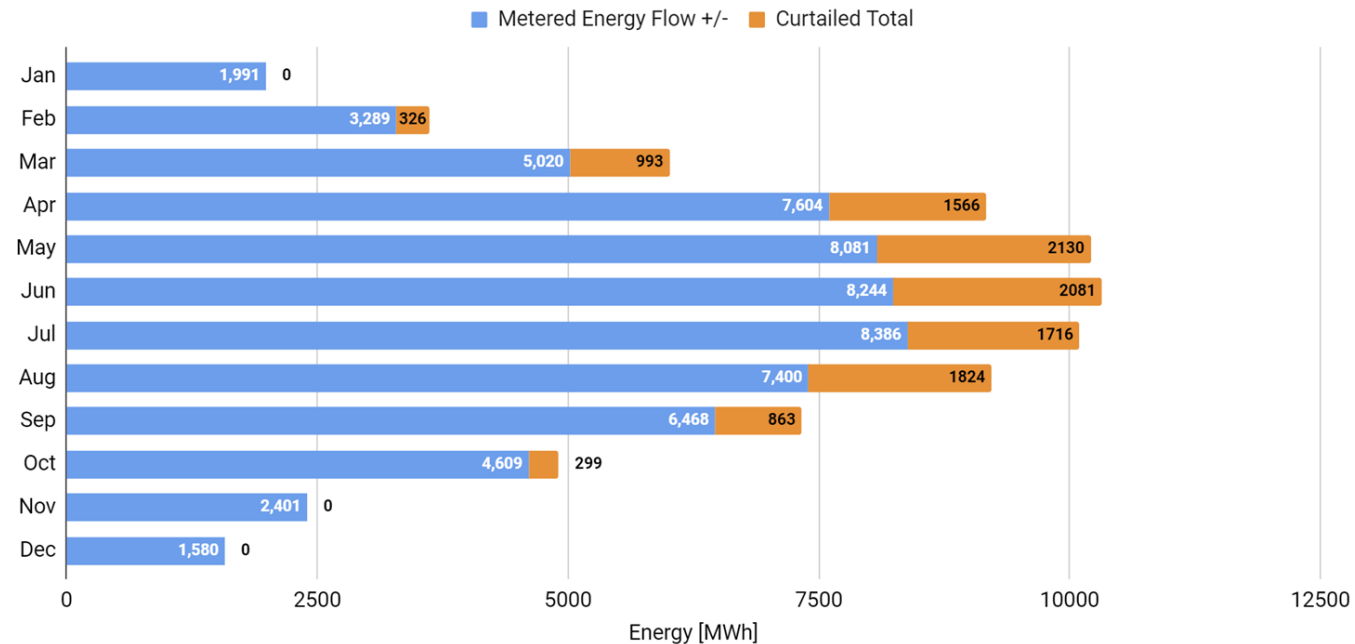
Figure 1. Proportion of Generator Connections by Technology (GSP & BSP)

Remedies



Input into financial models and investor packs

Monthly Energy Curtailed from Total Metered Flow



GB wide coverage and beyond





10 working days

Thank You!

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