

Why Bankable Energy Should Begin with Bankable Design

*We are financing 25-year revenue streams
based on energy assumptions made before
a realistic layout even exists*



Underperformance in the News



U.S. solar facilities lost \$5,720 per MW to equipment underperformance in 2024
(March 5, 2025)

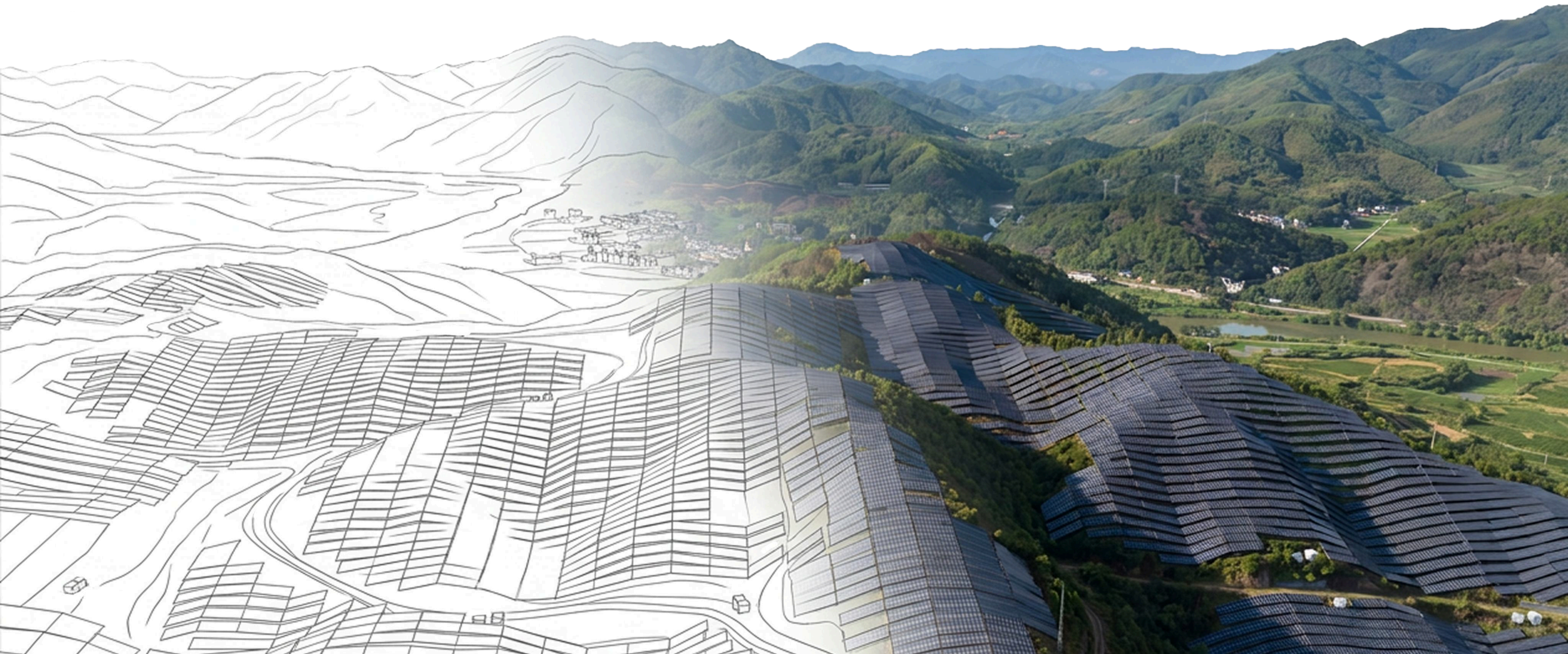
Solar assets are underperforming by 8%, kWh Analytics reports
(December 6, 2022)



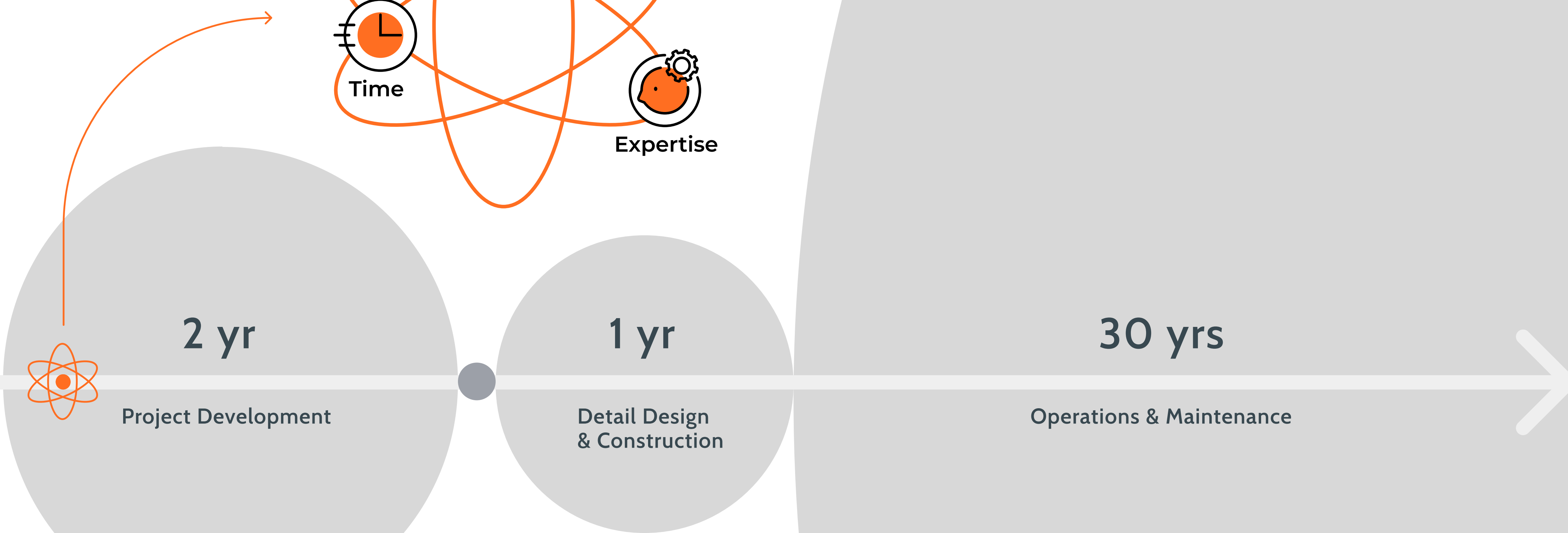
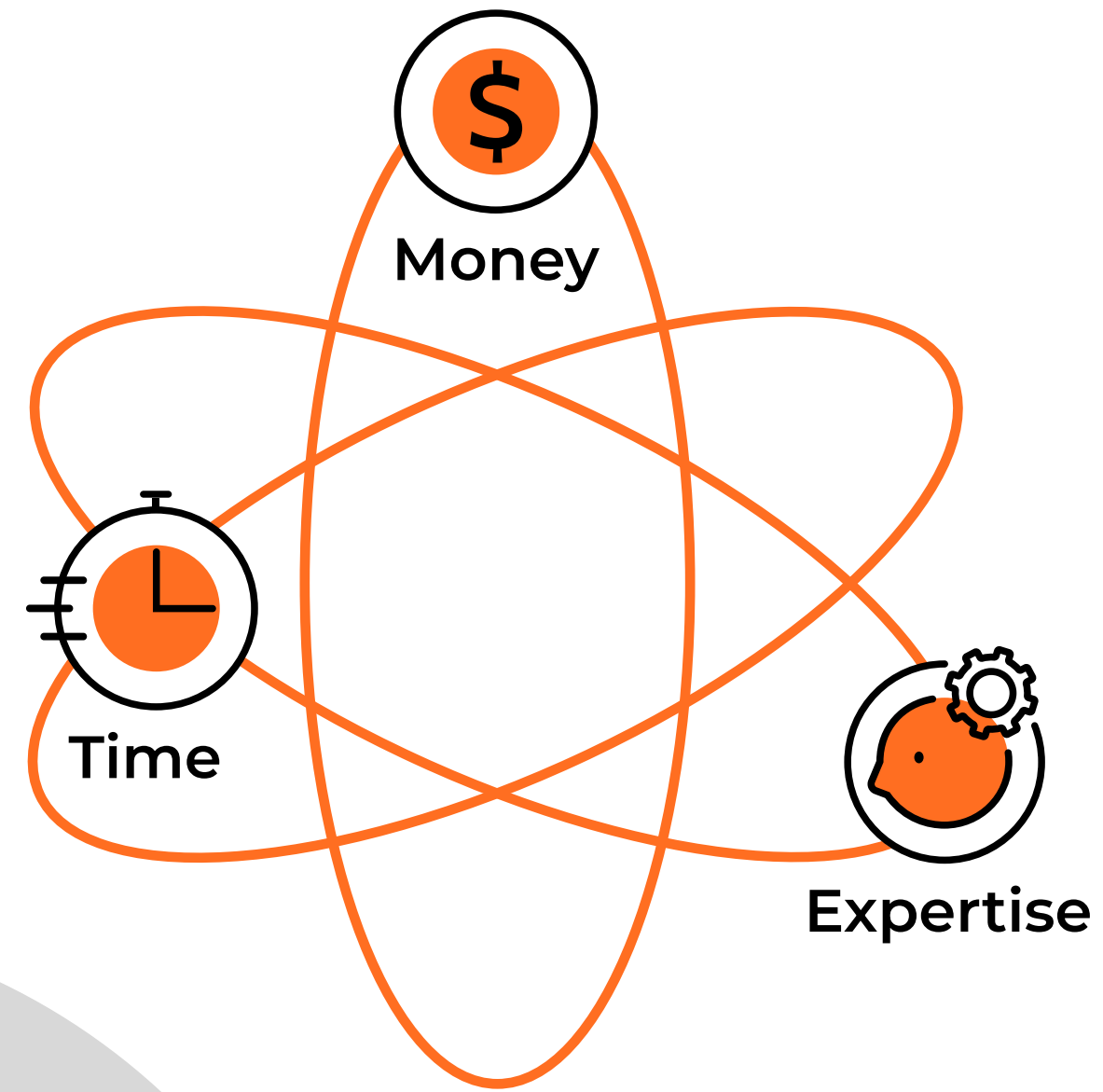
Raptor Maps: Global solar loses up to US\$10 billion to asset underperformance in 2024
(March 4, 2025)

Built solar assets are 'chronically underperforming' and modules degrading faster than expected, research finds
(June 8, 2021)

What is **Bankable Design**?



Why **Bankable Design** Doesn't Exist?



2 yr

Project Development

1 yr

Detail Design & Construction

30 yrs

Operations & Maintenance

Bankable Design

is the design behind the energy model which is :

- *site-specific,*
- *buildable,*
- *economically grounded.*

PVFARM

TERABASE

TERRAIN

FLOOD AREA

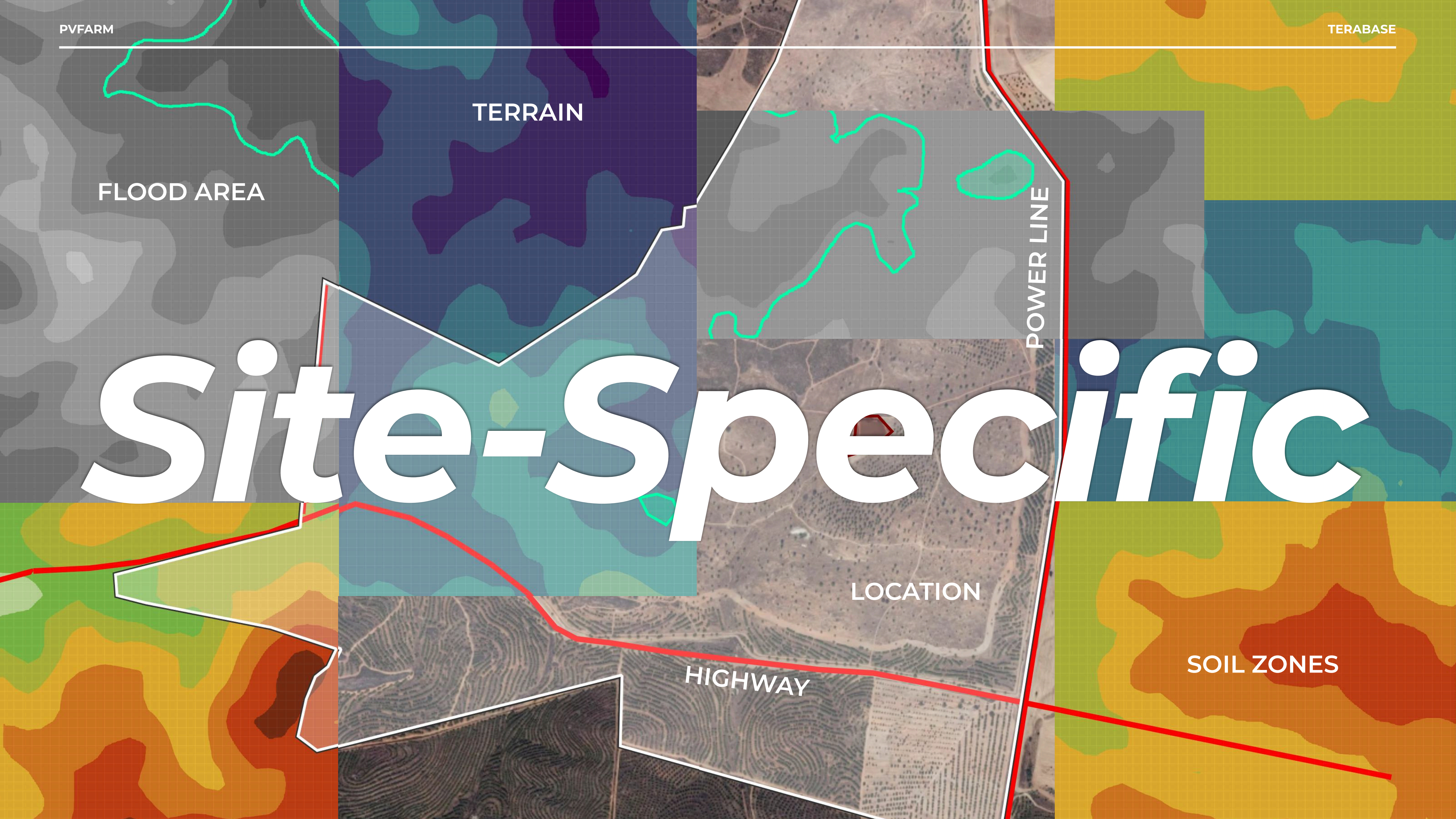
POWER LINE

Site-Specific

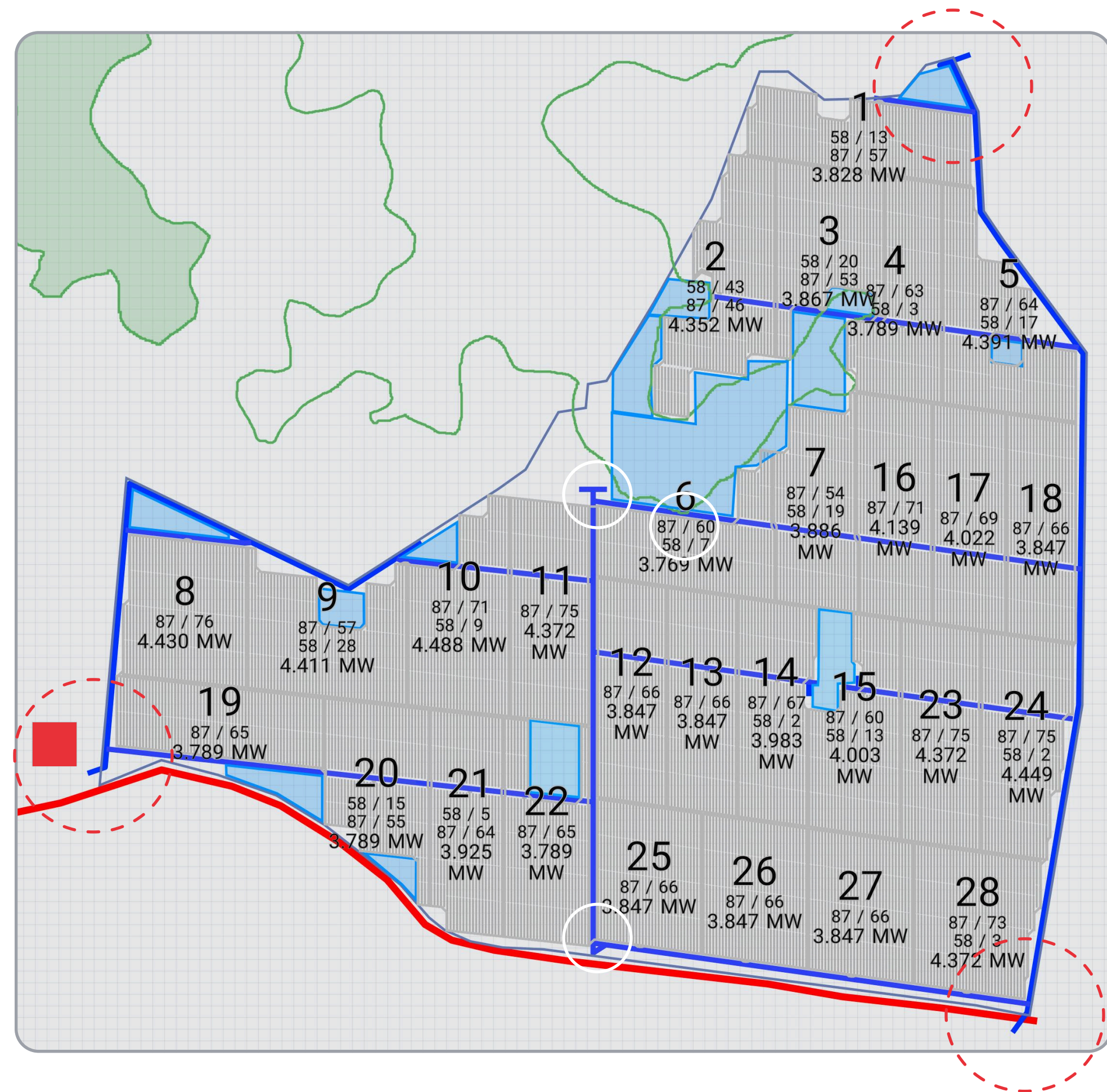
LOCATION

HIGHWAY

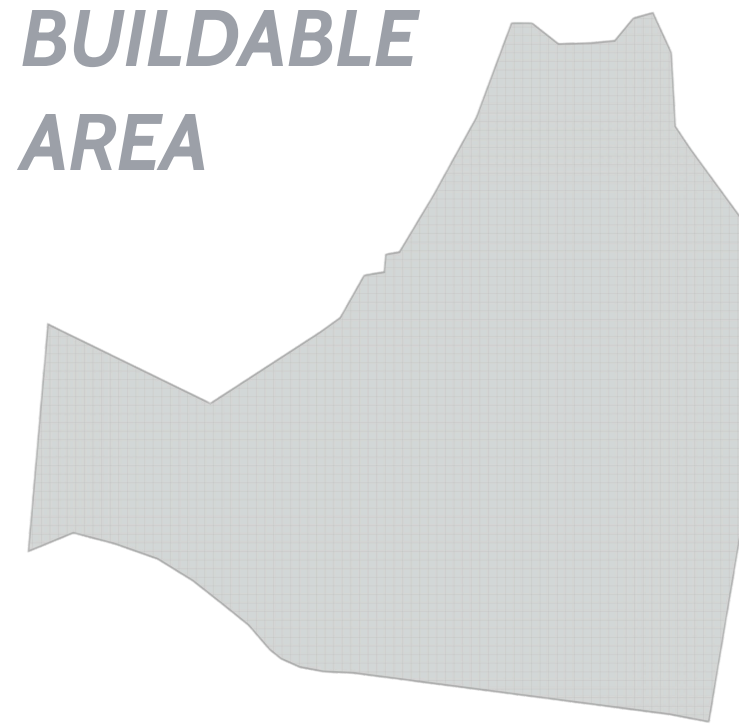
SOIL ZONES



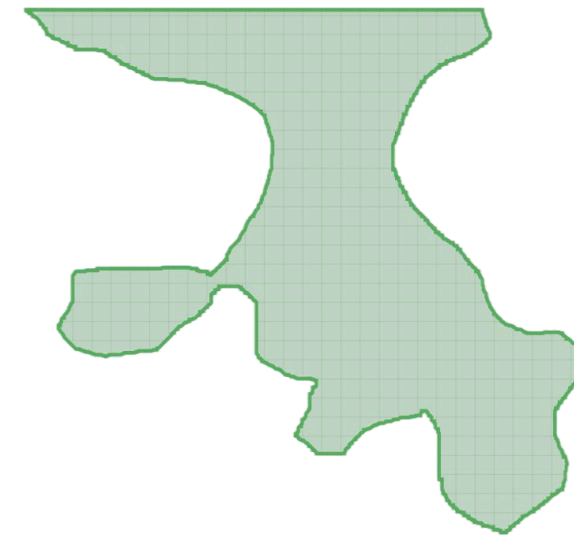
Buildable



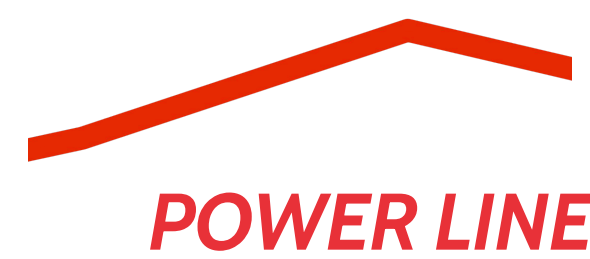
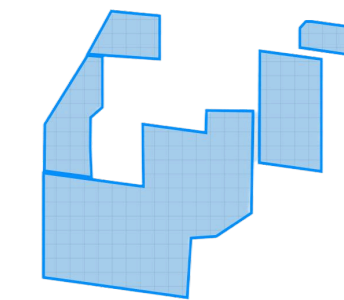
BUILDABLE AREA



WETLANDS



BASINS



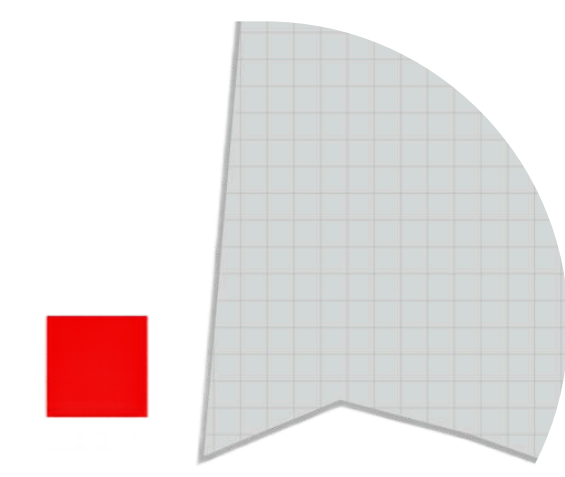
POWER LINE



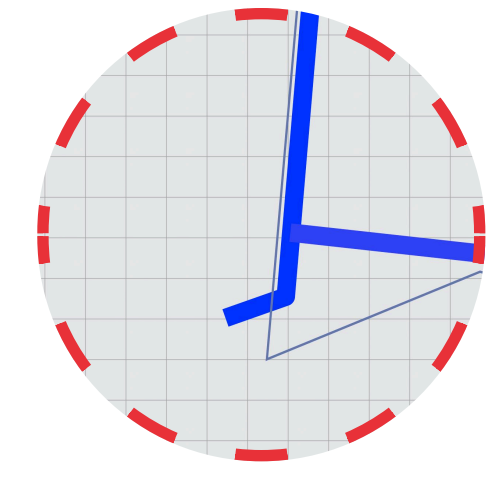
ACCESS ROADS



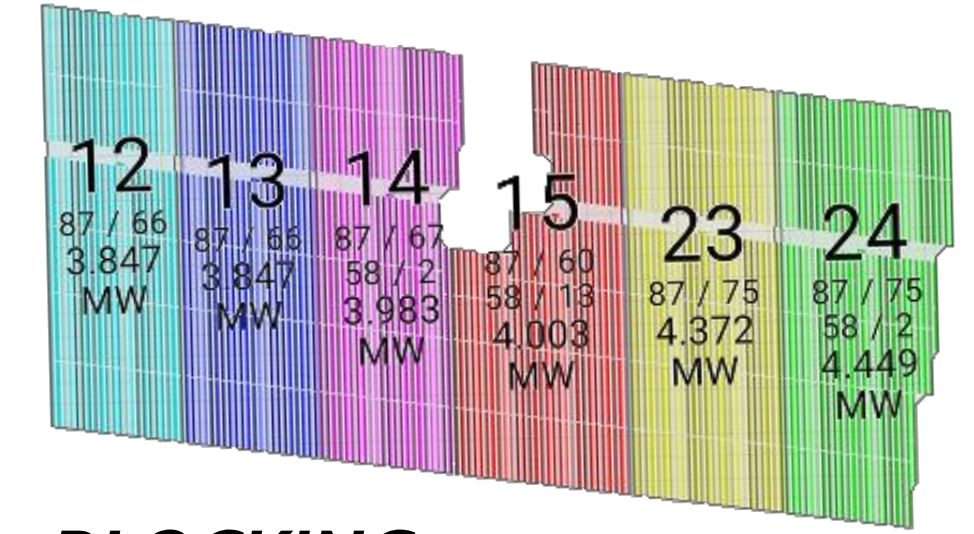
TURNAROUND



SUBSTATION

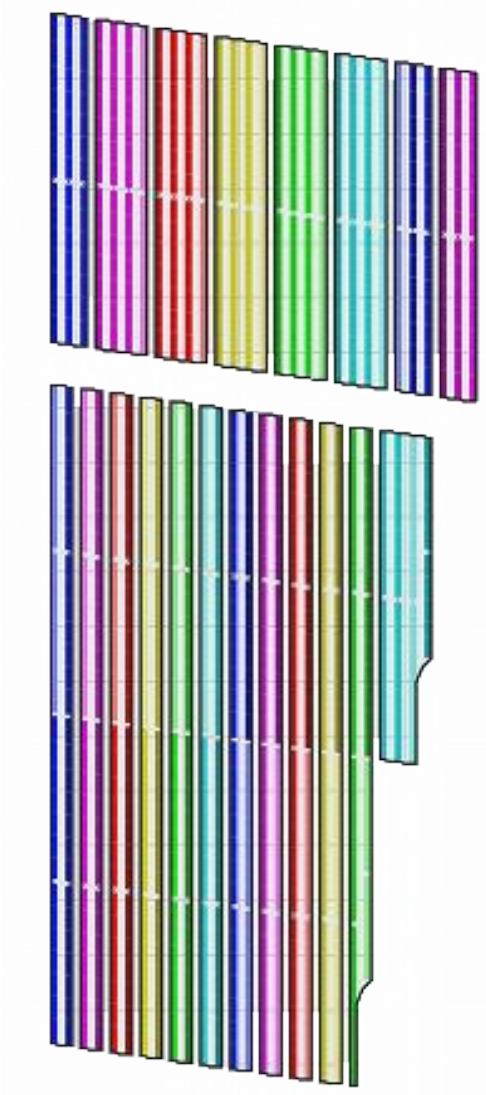
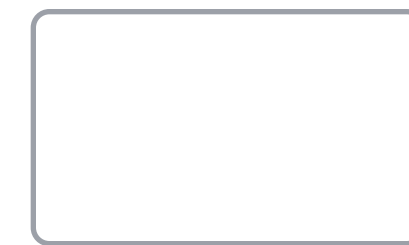


ENTRY



BLOCKING

LAYDOWN AREA



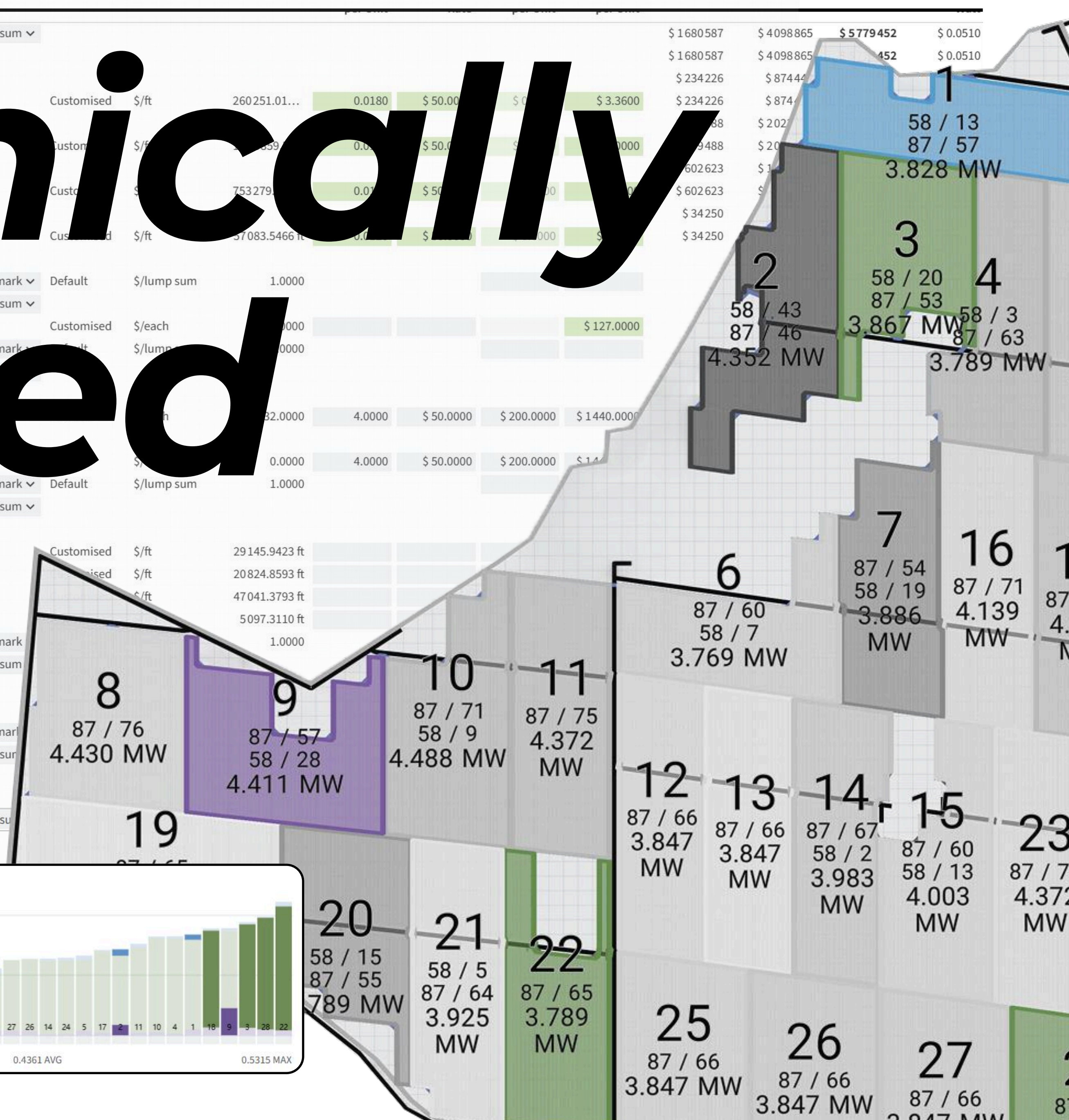
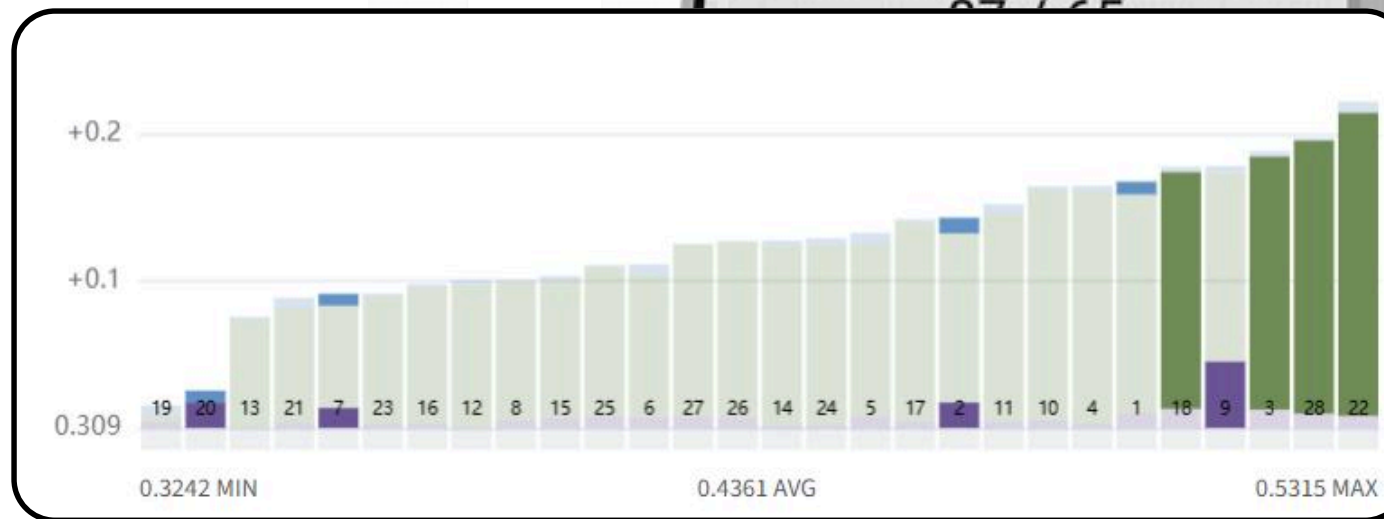
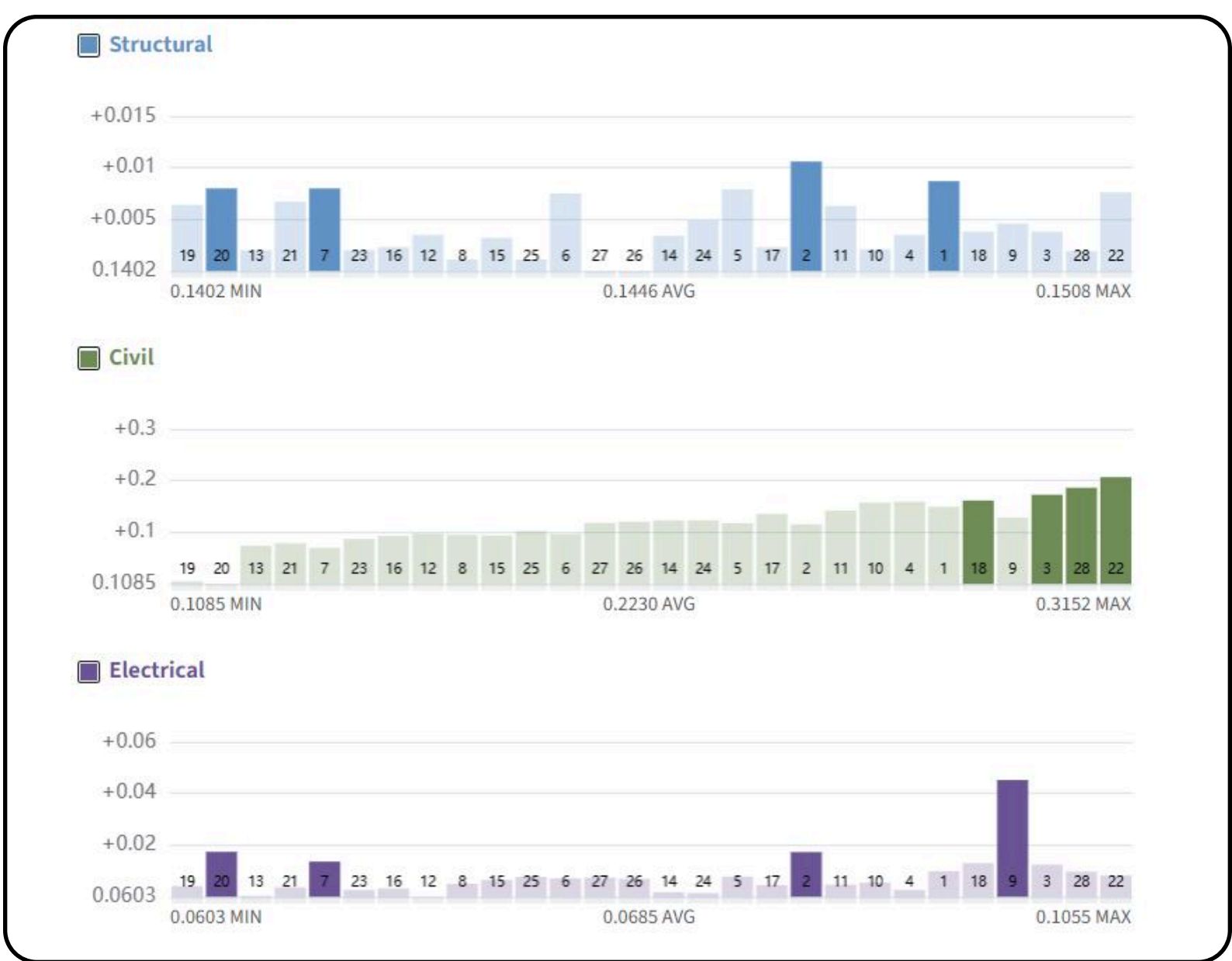
CBX CIRCUIT

RACKING



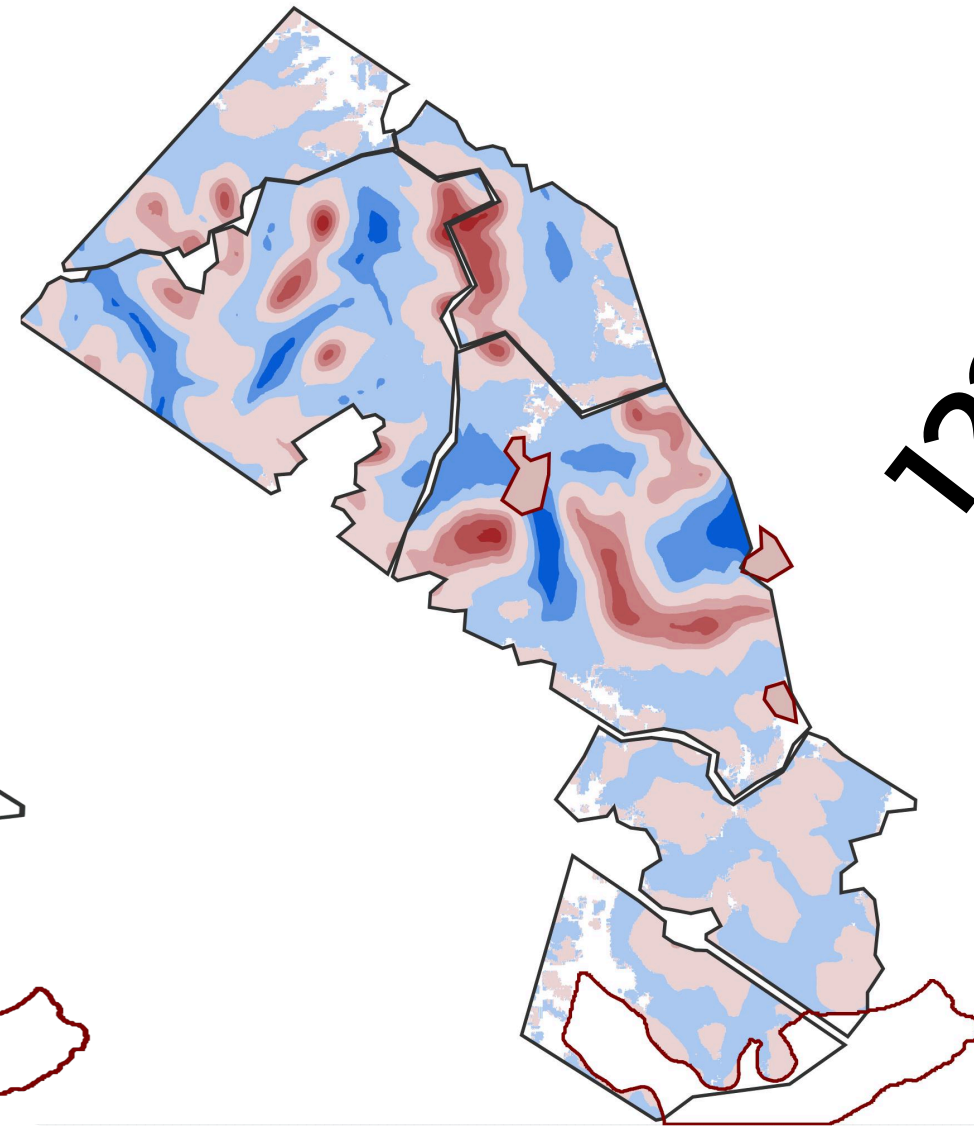
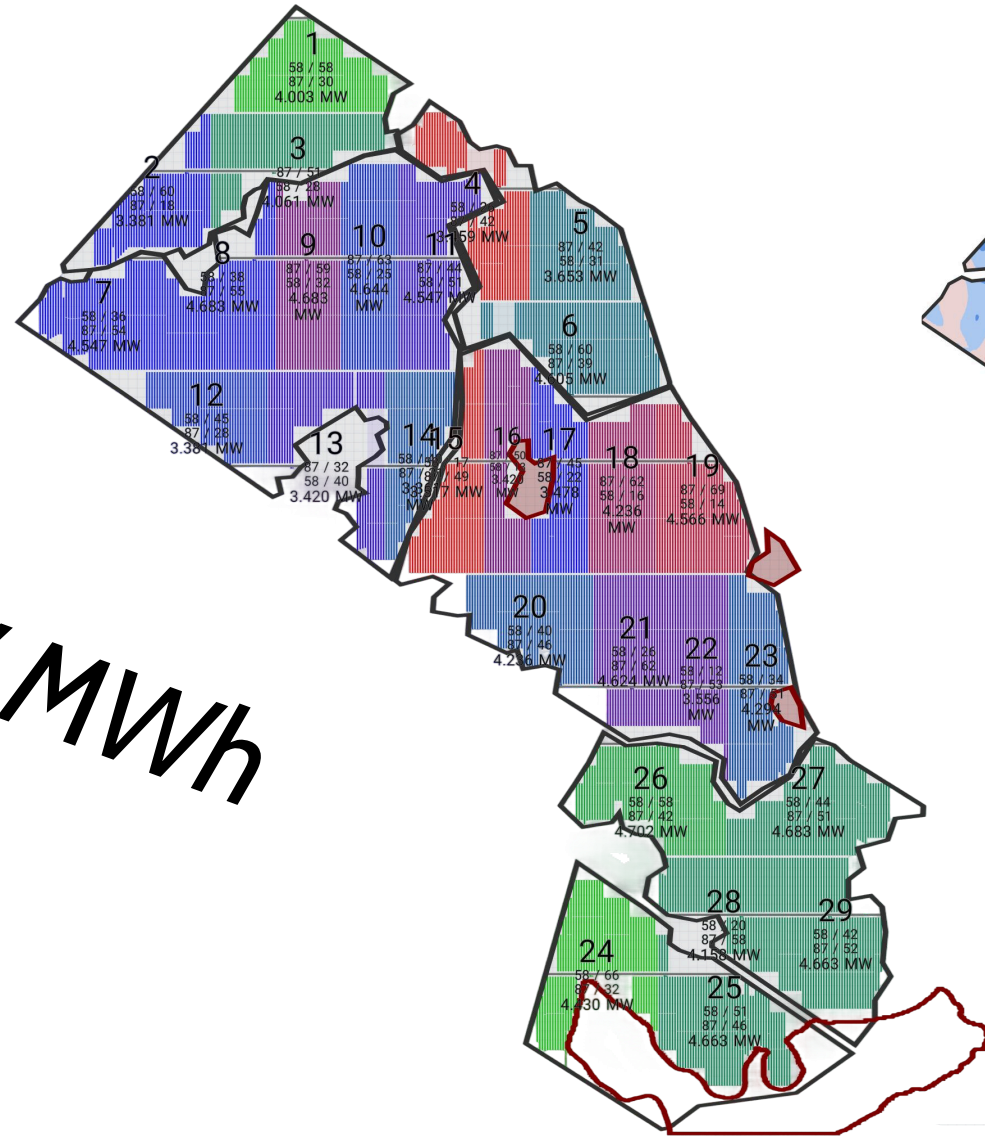
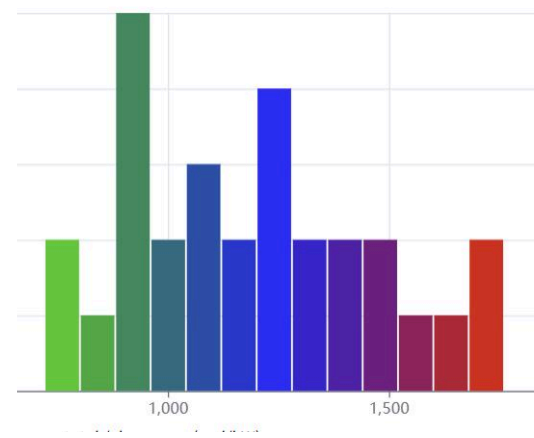
Economically Grounded

Category	Description	Unit	Quantity	Unit Price	Total Price
Low Voltage Elect Cable	DC				\$1680587
	DcFeeder				\$4098865
	750 kcmil aluminum	Customised \$/ft	260251.01...	\$0.0180	\$3,360.00
	Misc.	Benchmark \$/lump sum	1.0000		\$1,000.00
Medium Voltage Elect Cable	Mv Cable				
	#2 AWG aluminum	Customised \$/ft	29145.9423 ft		
	#4/0 AWG aluminum	Customised \$/ft	20824.8593 ft		
	500 kcmil aluminum	Customised \$/ft	47041.3793 ft		
Electrical Install	Sectionalizing cabinet				
	1.8 ft 4.0 ft 2.5 ft	Benchmark \$/lump sum	1.0000		\$1,000.00
	Misc.	Benchmark \$/lump sum	1.0000		\$1,000.00
	Trenching				
Electrical Subtotal	LV Trenching				
	DC_Feeder				



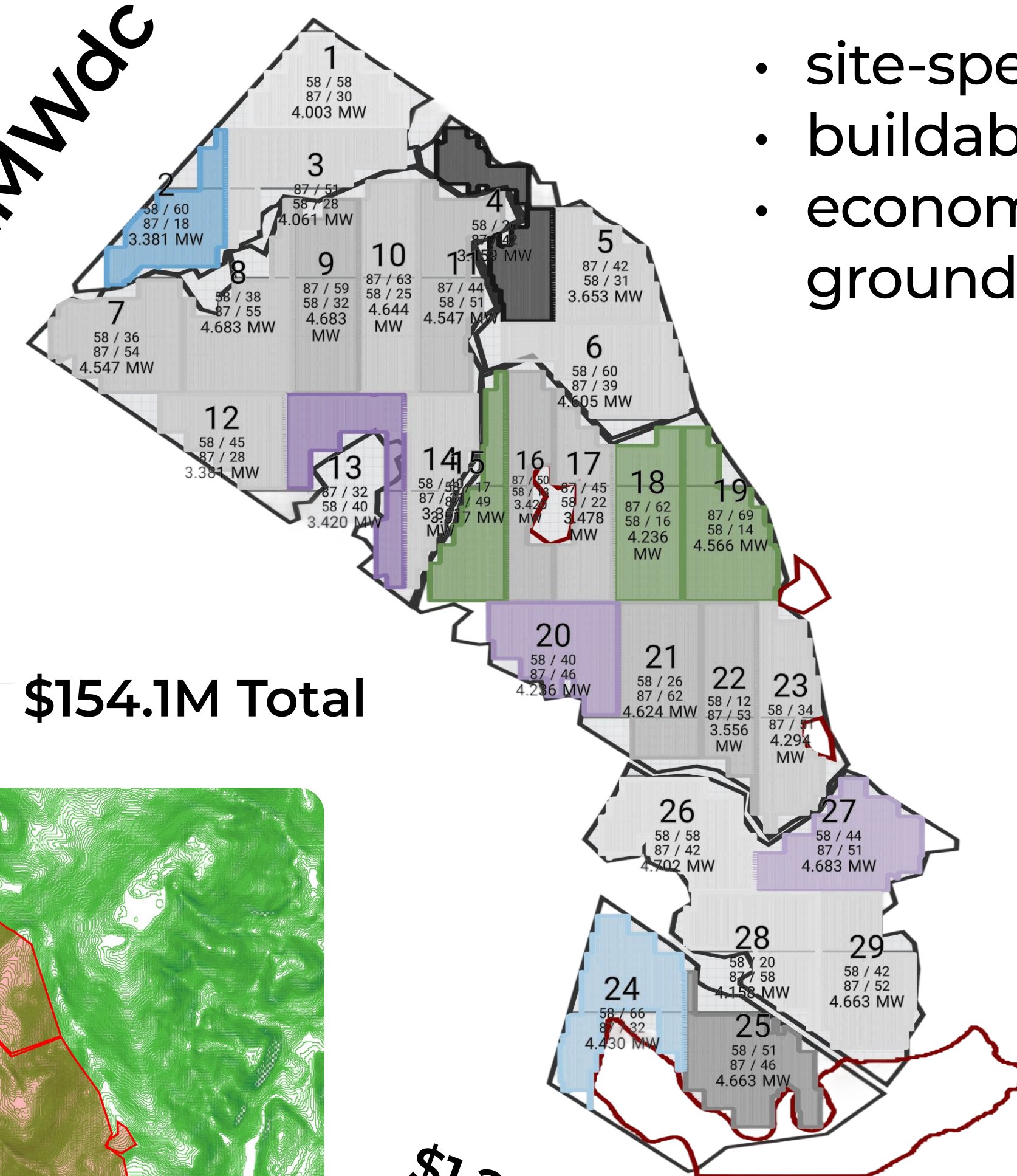
28 blocks

LCOE \$62.3 / MWh

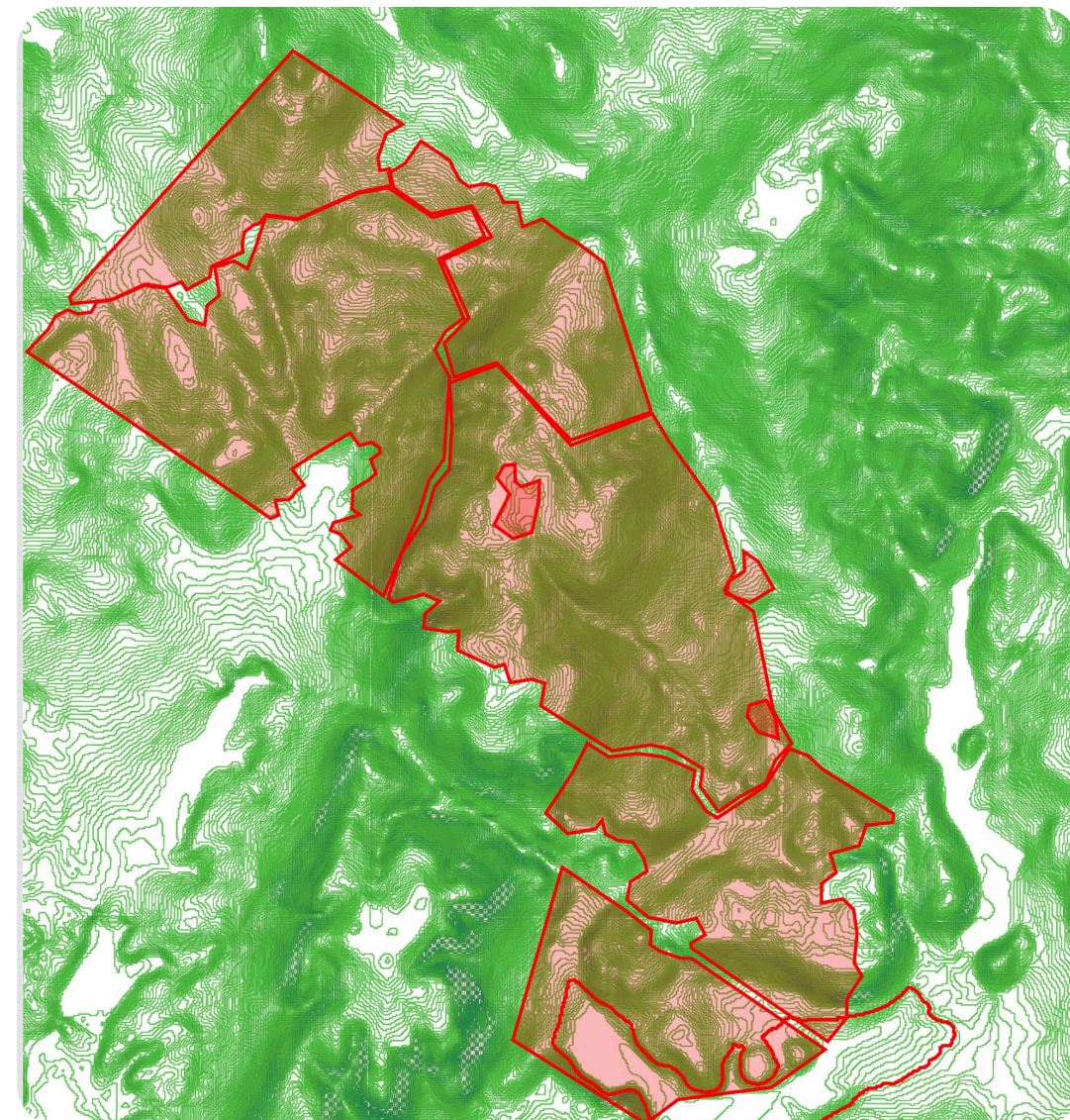
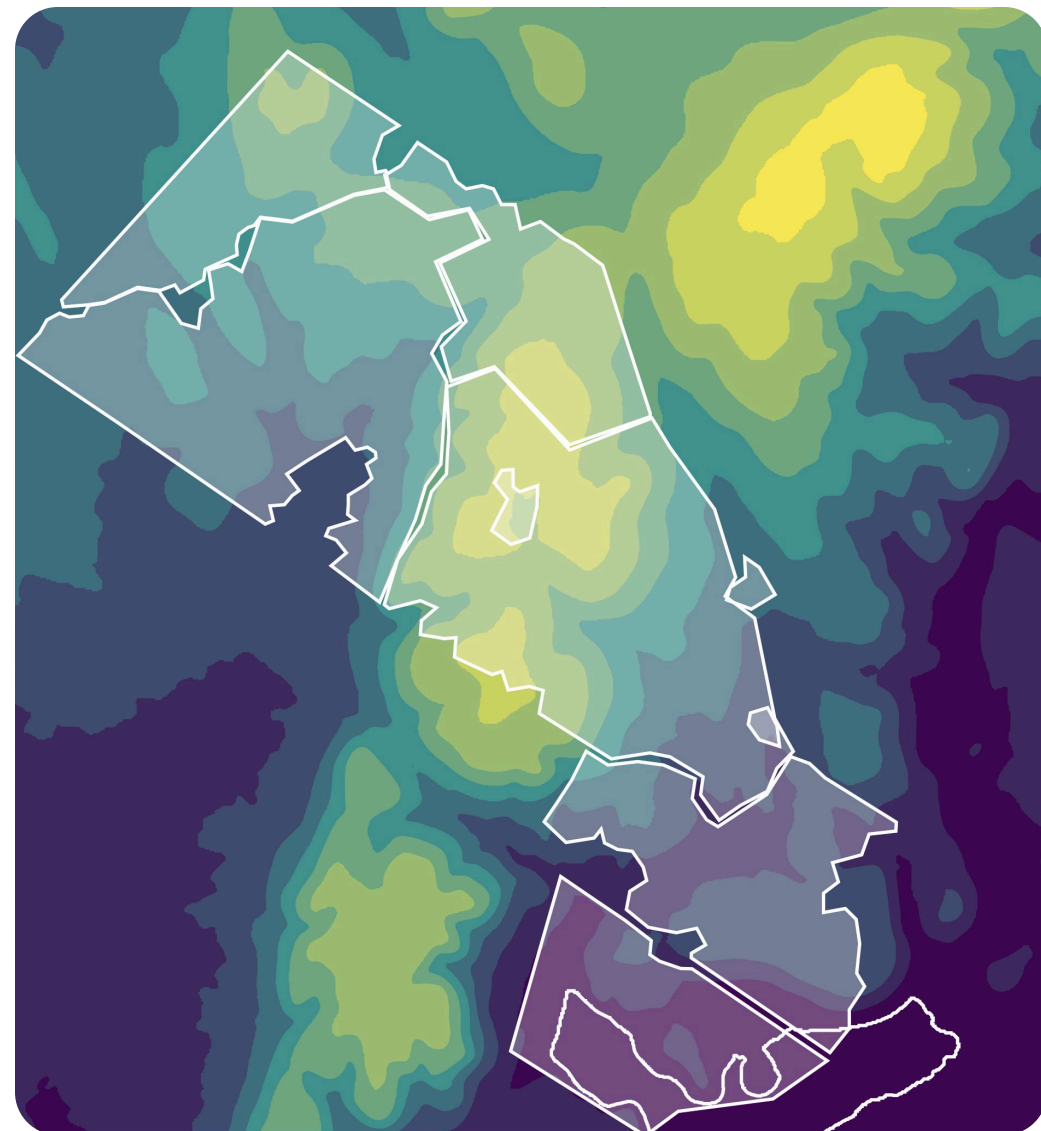


122MWdc

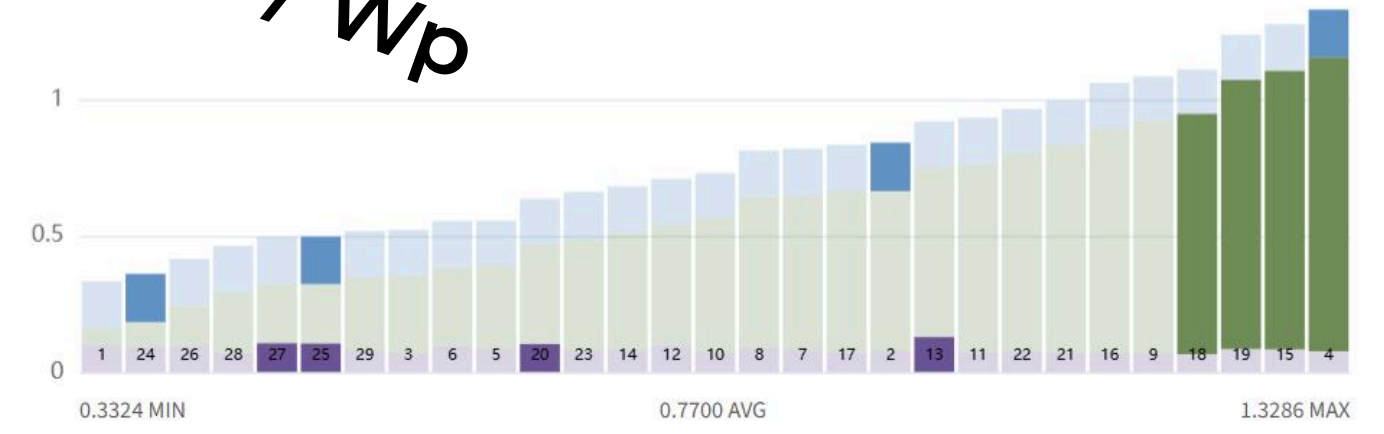
\$154.1M Total



- site-specific
- buildable
- economically grounded



\$1.26 / Wp



	SIMPLIFIED DESIGN	BANKABLE DESIGN
Structure	Not Modeled	Explicitly Modeled
Tables Orientation	Averaged	Site-Specific
Terrain	Not Modeled	Site-Specific
Civil Constraints	Not Modeled	Explicitly Modeled
Electrical	Not Modeled	Explicitly Modeled
Energy Modeling	Approximate	Detailed
Shadowing	Approximate	Detailed
Layout	Conceptual / Indicative	Site-Specific, Buildable, Economically Grounded



No Context, Simplified Equipment
Approximate Energy Model
 Trusted by Lenders and IEs



Real Context & Equipment
 Real Cost Distribution,
Real Energy Model

Industry challenge 1: Energy Without Context



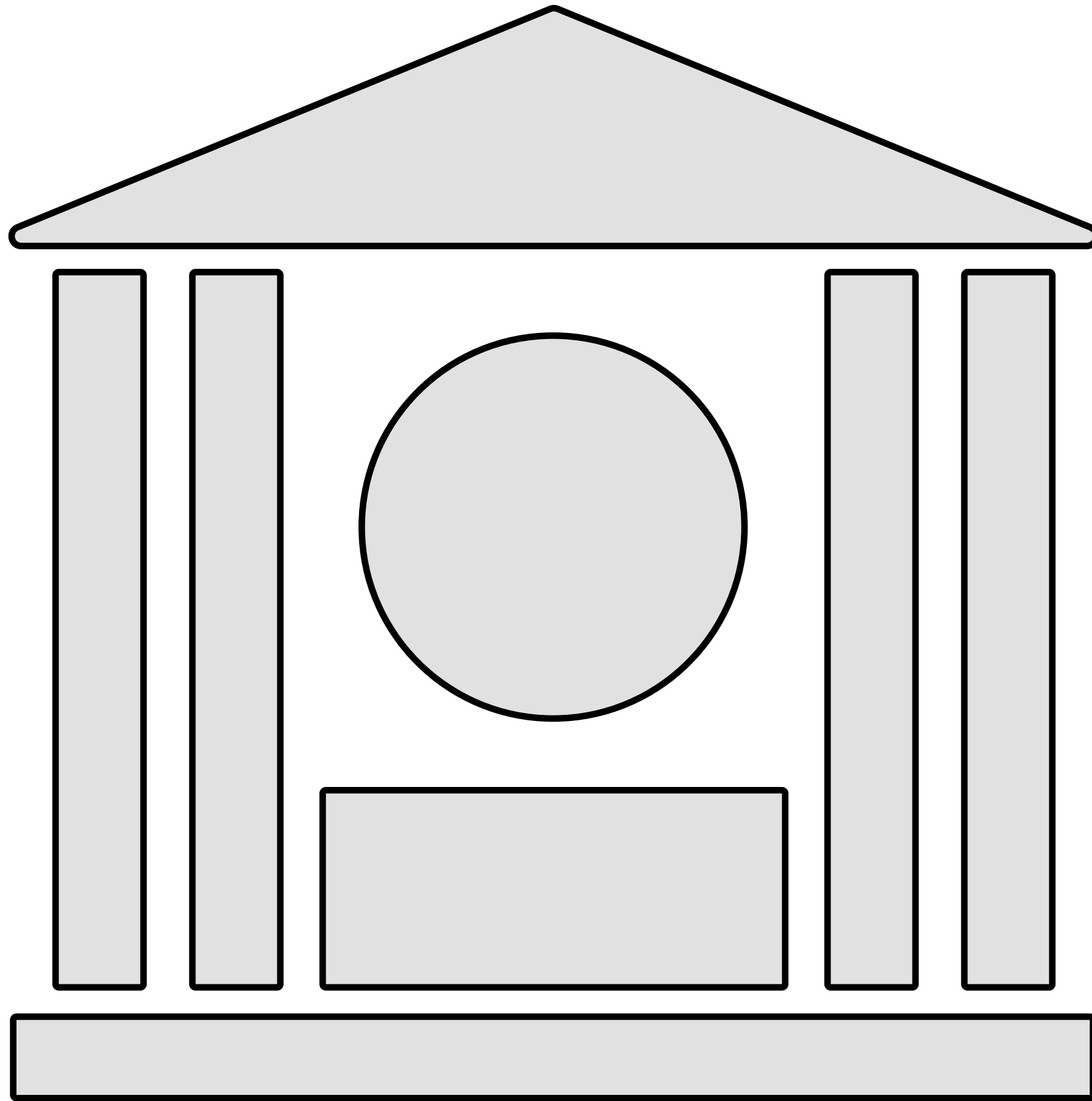
What is Context?

The business objectives, assumptions and constraints that define why a modeling or design task is being performed and how its results will be used.

Pitfall:

We focus on preparing the deliverable without fully understanding the business context driving the need for the deliverable.

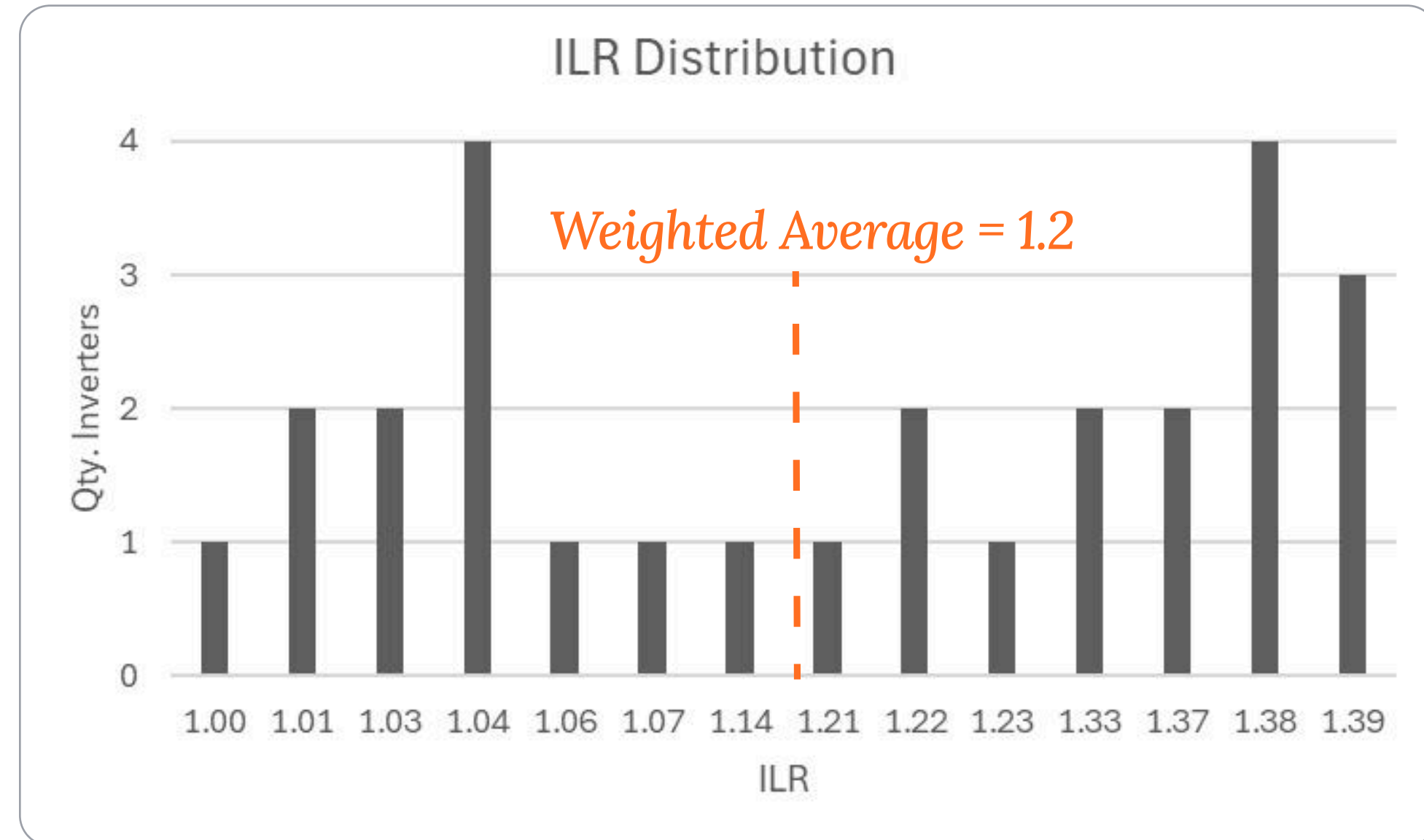
Simplified Design



Realistic Design



Example: Inverter Load Ratio (ILR)



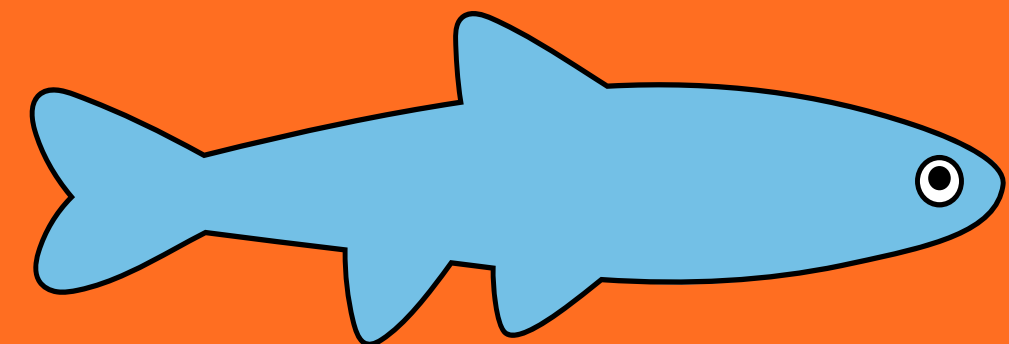
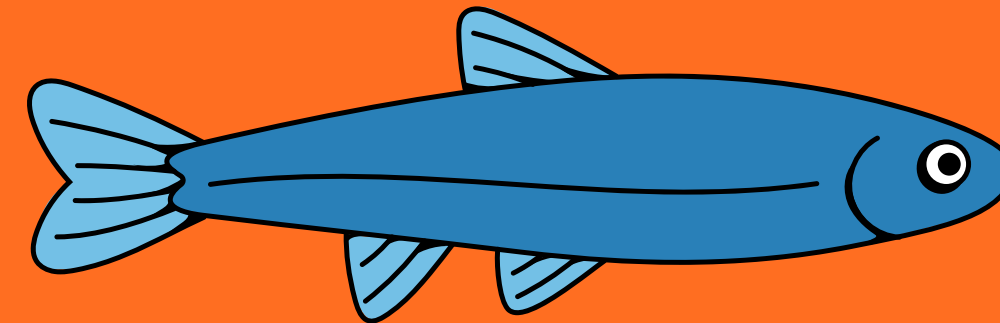
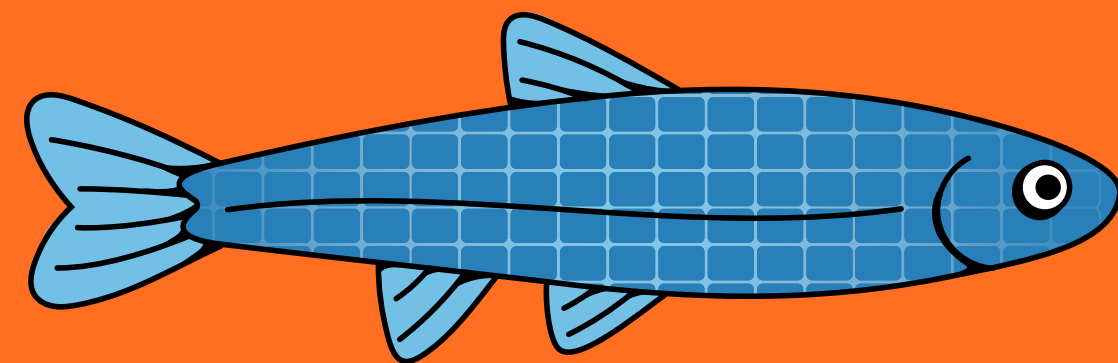
	Simplified (Average ILR)	Realistic (ILR Distribution)
Predicted Net Energy	233.1 GWh	229.6 GWh <i>(-1.5%)</i>
Predicted NPV (20 yr.)	\$135.8 M	\$133.8 M <i>(-\$2.0 M)</i>

Key Insight: Energy model simplifications may be acceptable, depending on business context.

Goal: Design accuracy and detail is sufficient to meet energy model business context.

Industry challenge 2: **Loss of Data Across Transitions**

Even when projects become more detailed over time, that detail is rarely preserved consistently across stages



What do we mean by Transition?

1. Hand-off between stakeholders (internal or external)
2. Migration or translation between different software applications

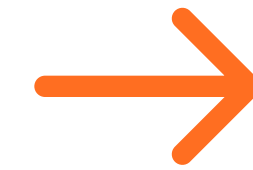
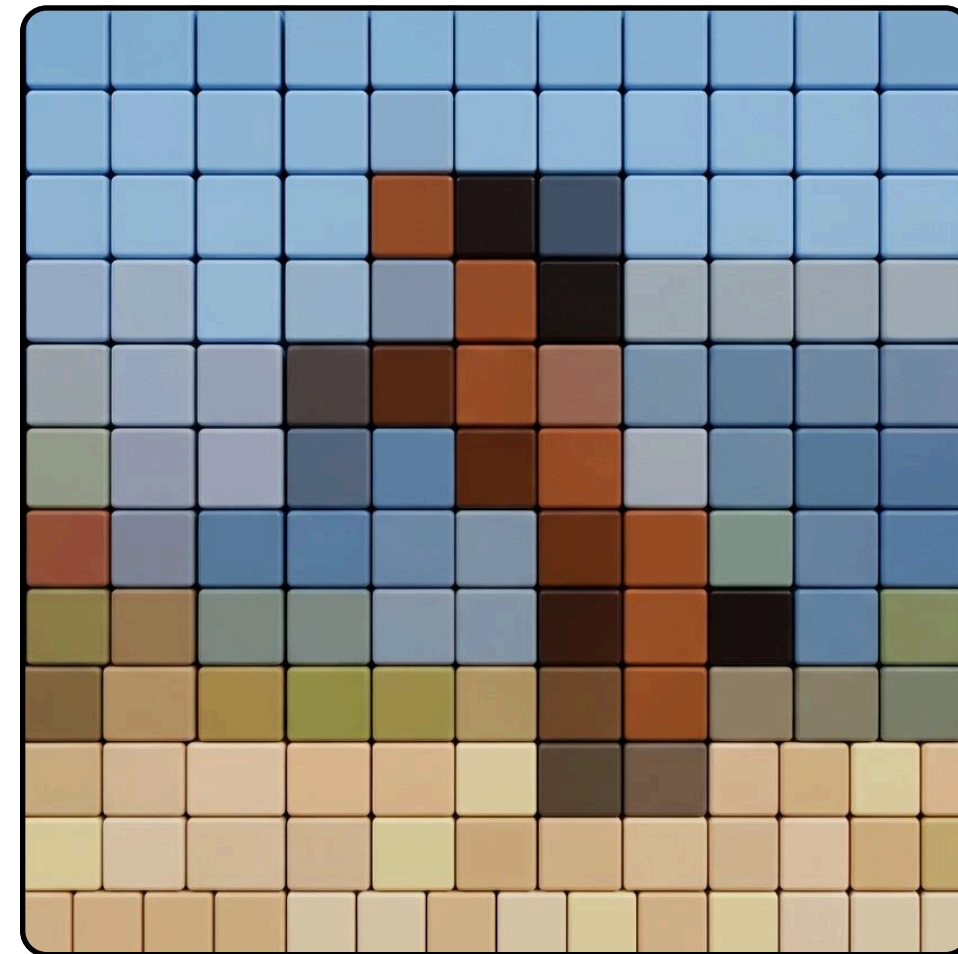
Today's focus:

Maintaining business context when transitioning between design and energy modeling software.

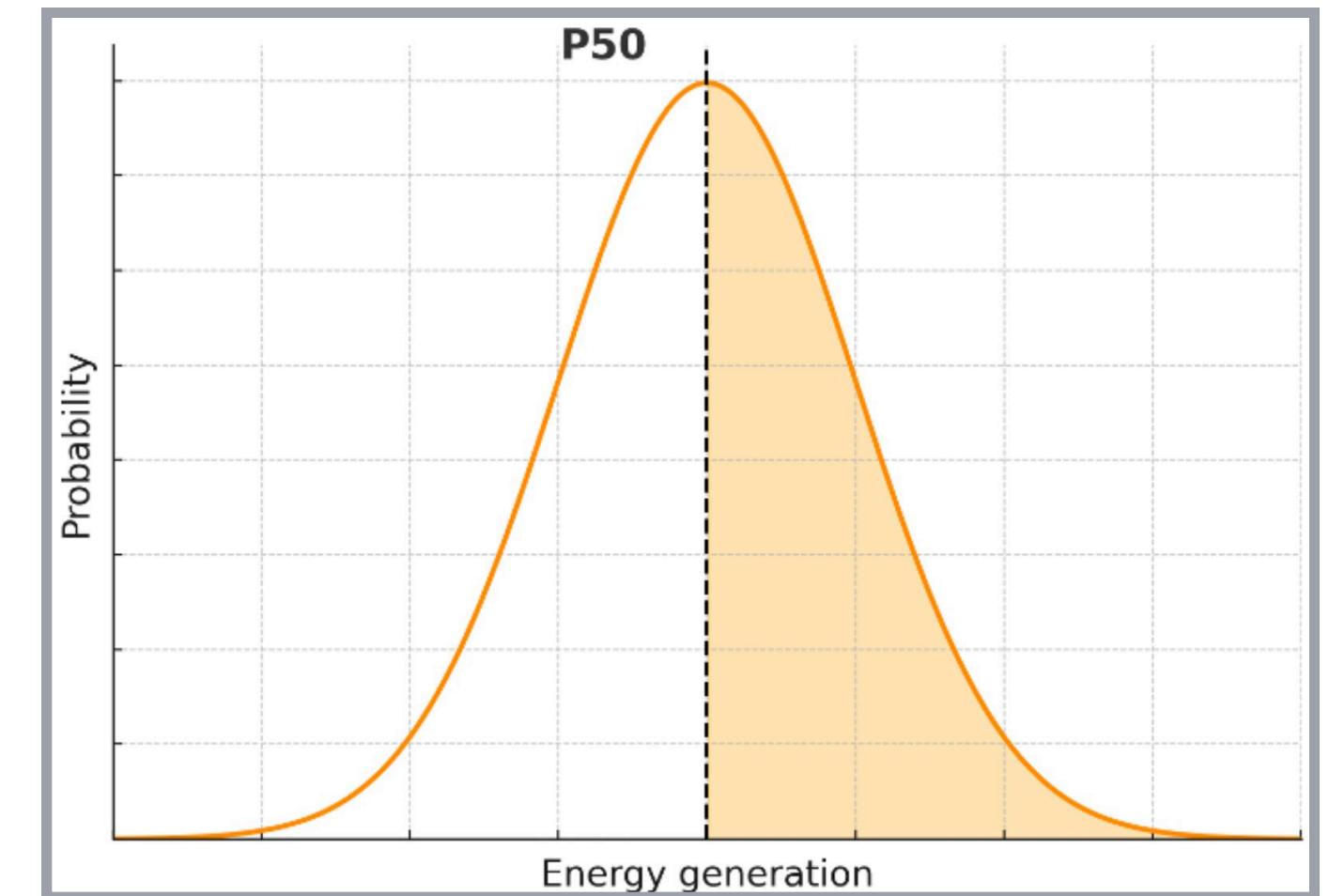
Realistic Design



Tool Transition



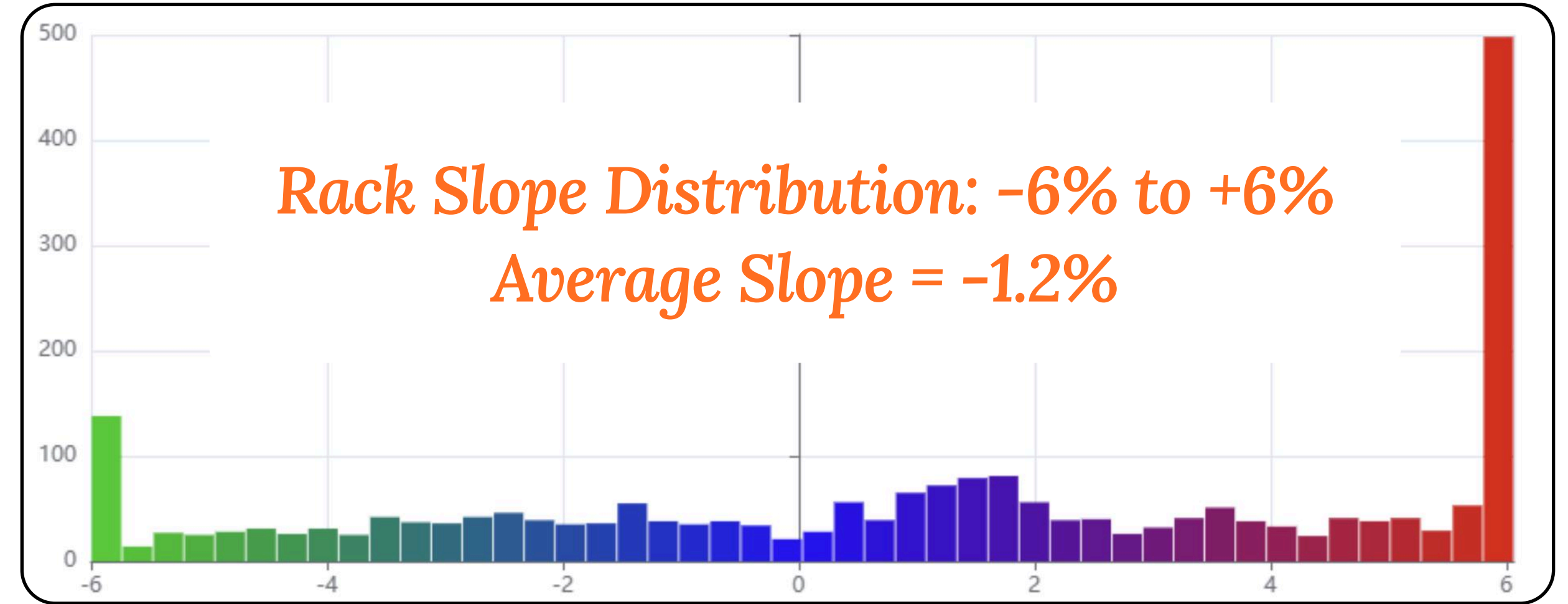
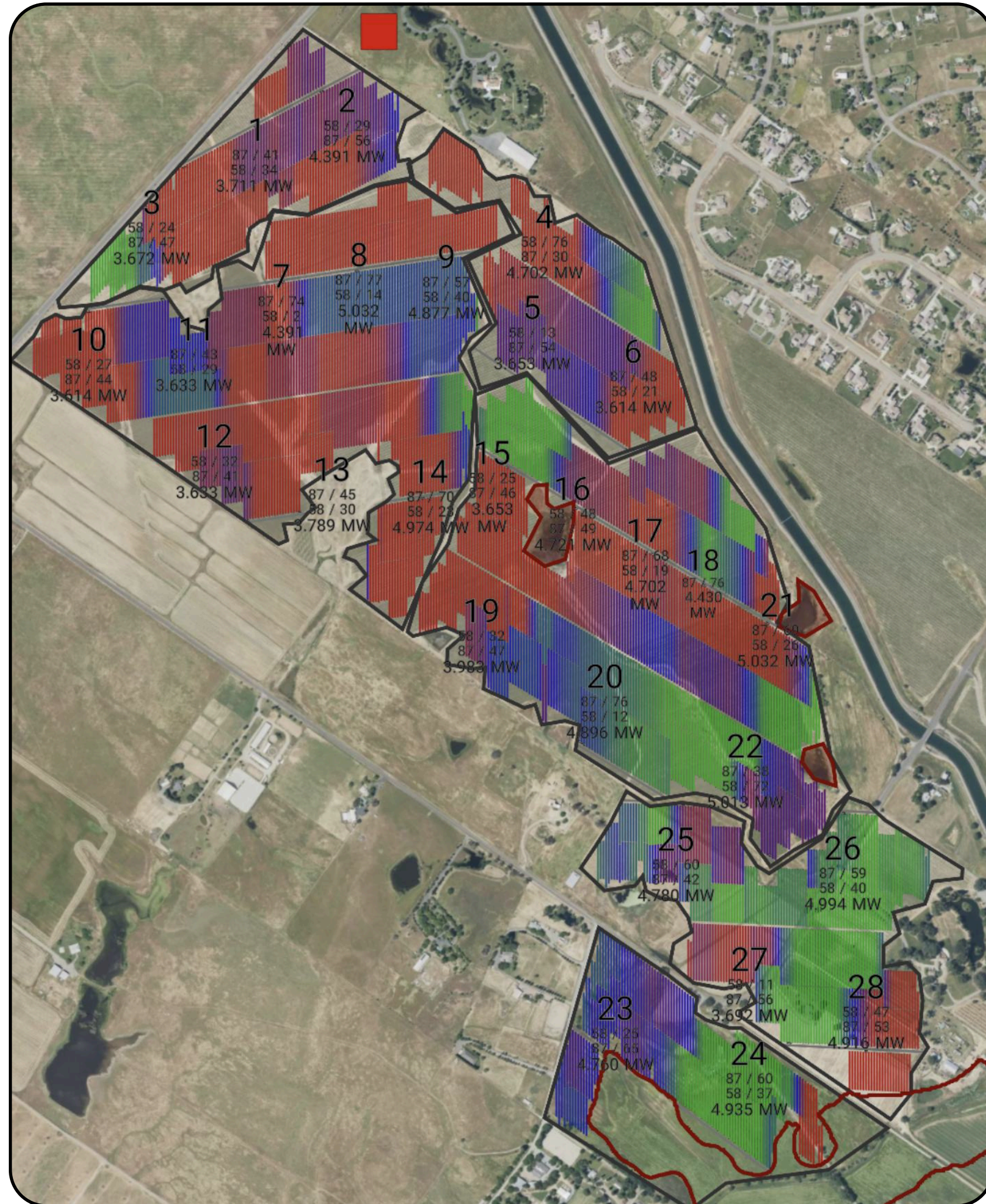
Bankable Energy?



Reasons we simplify:

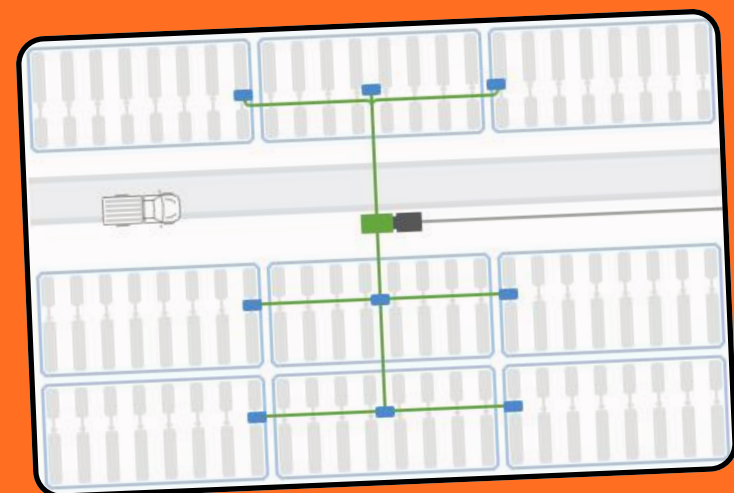
- The energy model cannot accept realistic design detail
- The time and resources to recreate the design in the energy model is too great
- The accuracy benefit of increased detail is not clear

Example: Racking Slopes & Orientations

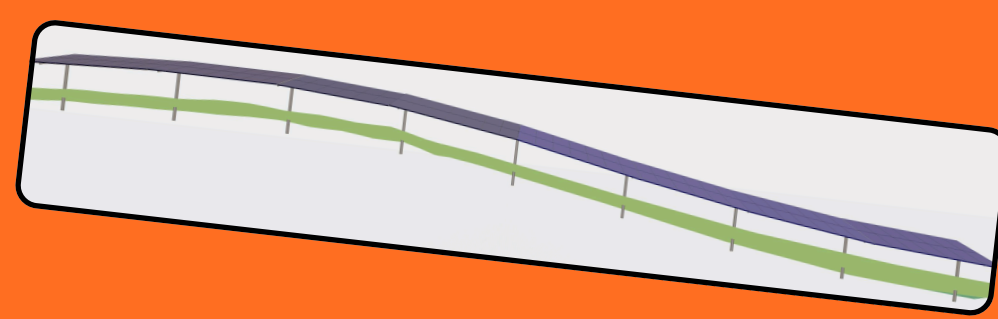
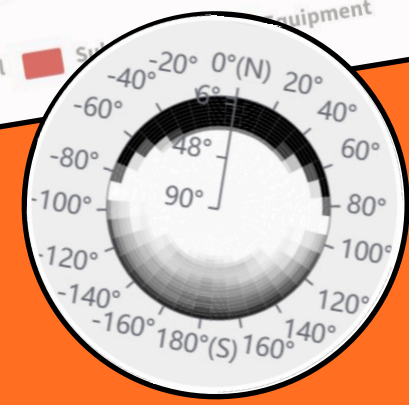
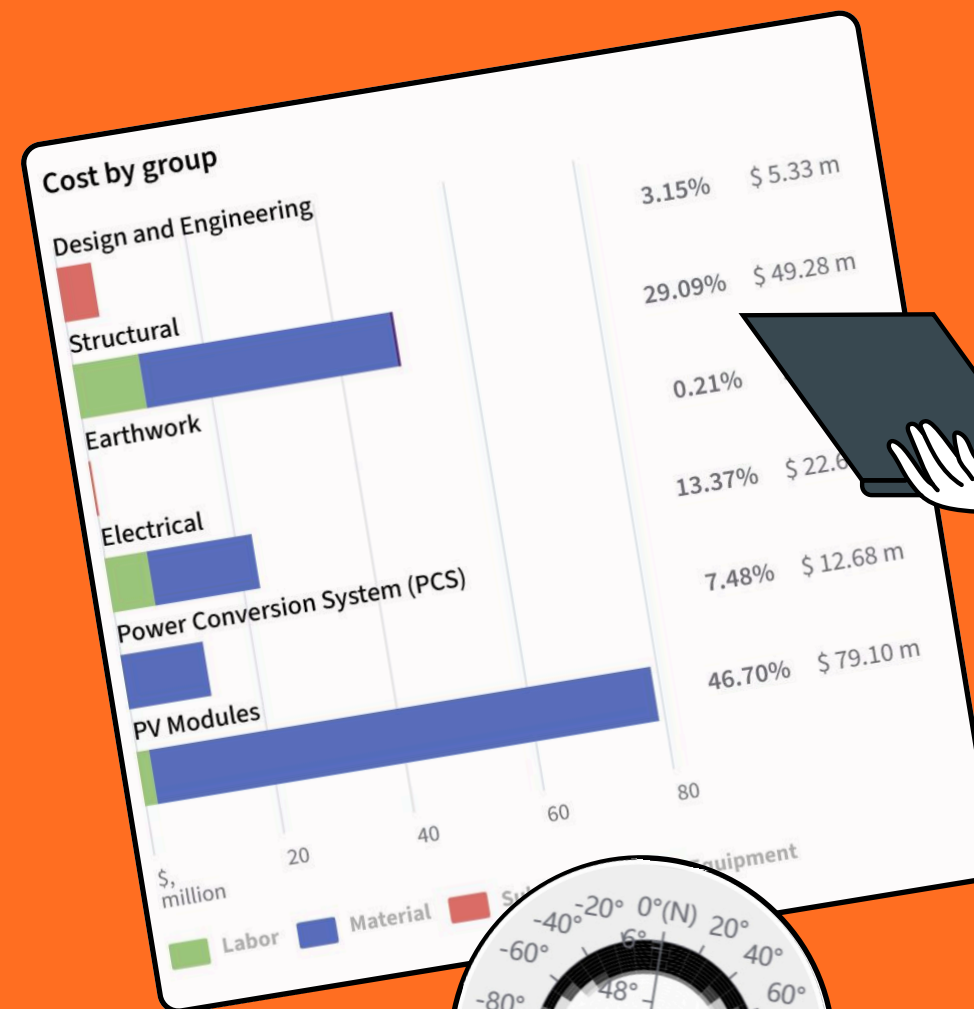
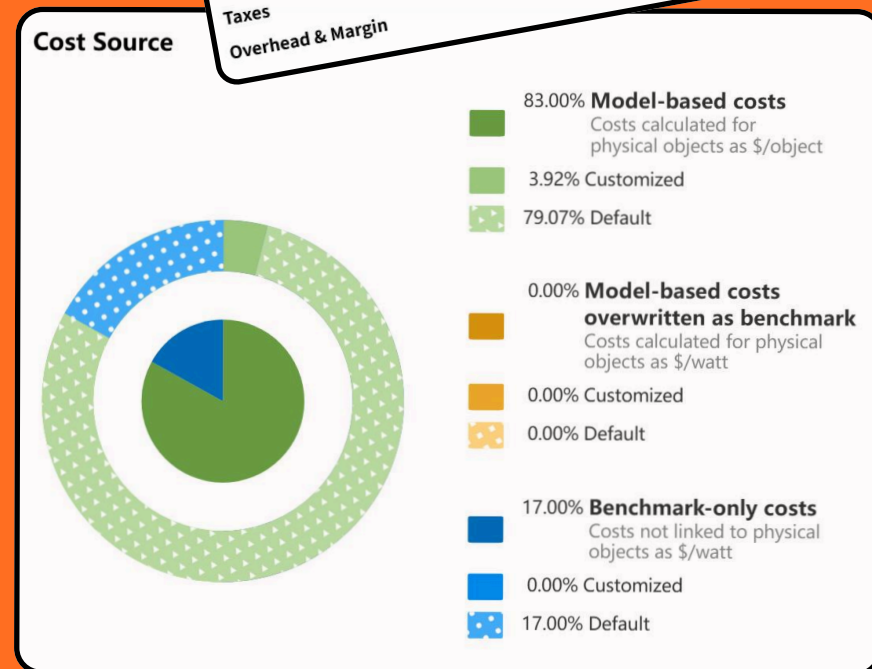


	Simplified (2D)	Simplified (Avg. Slope)	Realistic (Full 3D)
Predicted Net Energy	233.1 GWh	231.6 GWh (-0.6%)	224.1 GWh (-4.0%)
Predicted NPV (20 yr.)	\$135.8 M	\$134.9 M (-\$0.9 M)	\$130.6 M (-\$5.2 M)

Solution: Bring More Design Reality Sooner



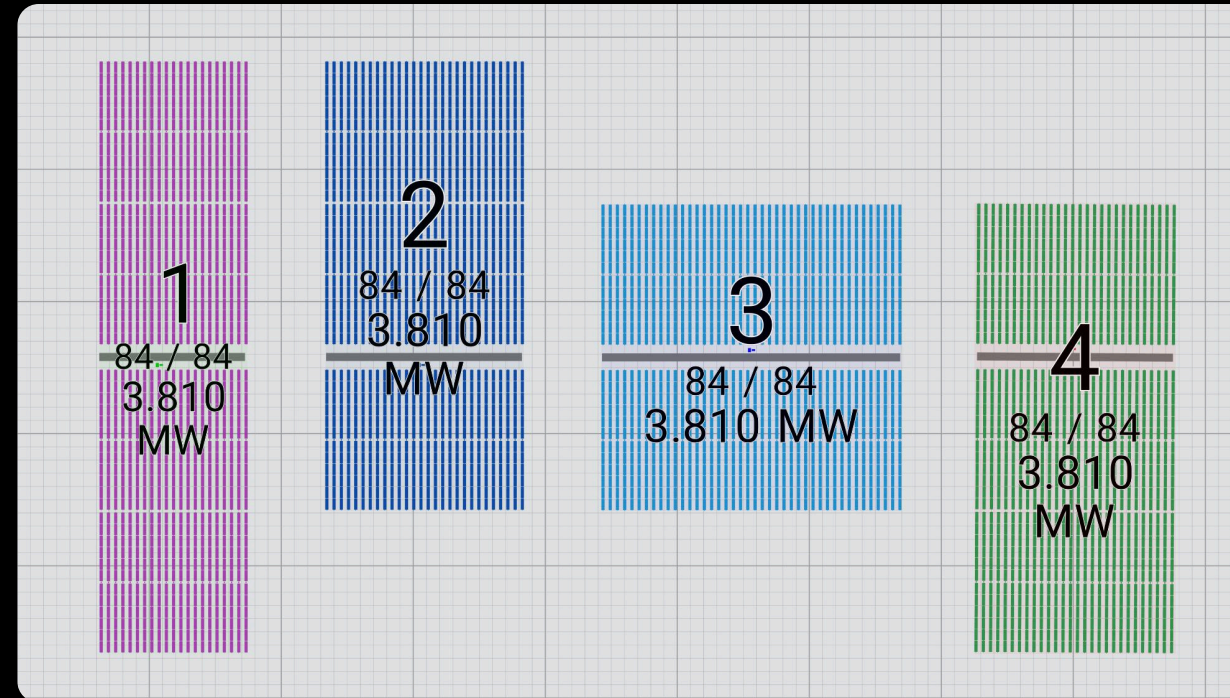
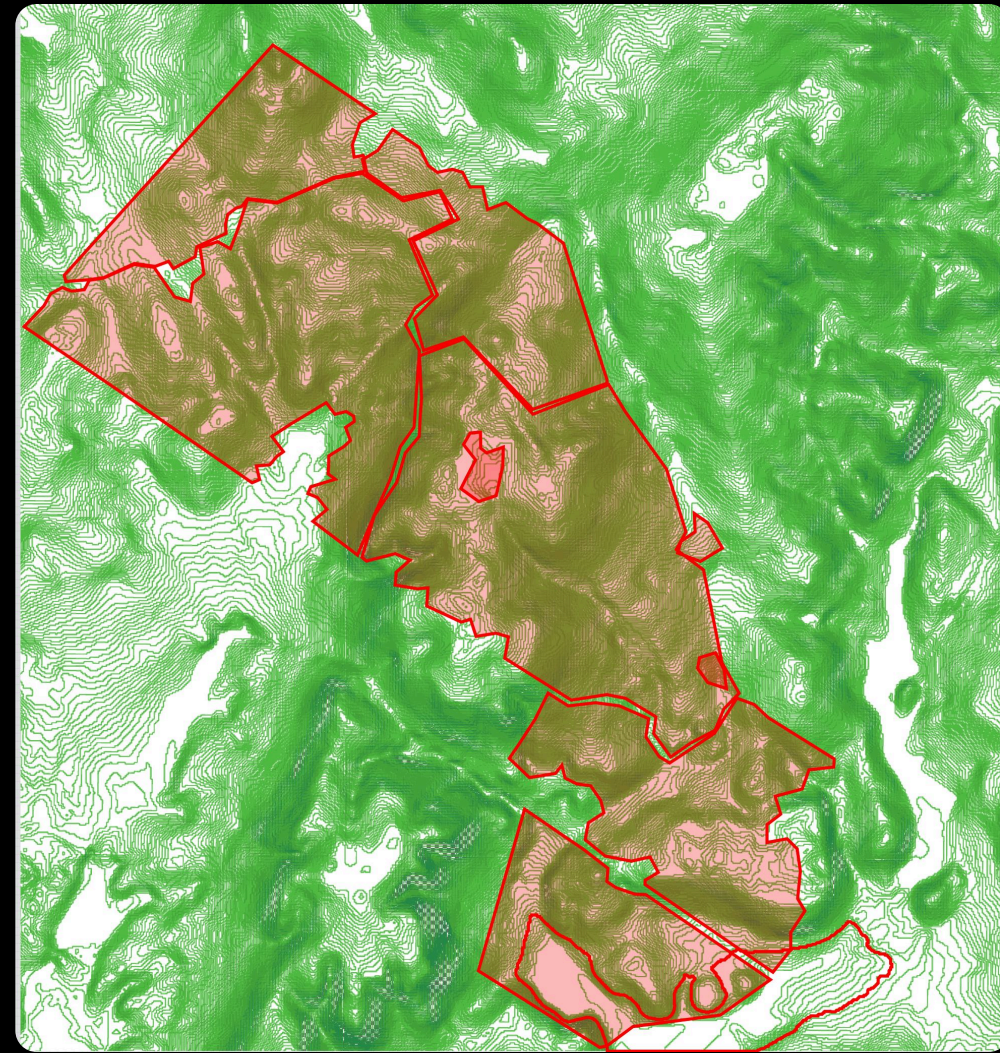
Description	Total Cost	Cost Per Watt
PV Modules Subtotal	\$ 79,097,760	\$ 0.4152
Power Conversion System (PCS) Subtotal	\$ 12,675,000	\$ 0.0665
Electrical Subtotal	\$ 22,647,958	\$ 0.1189
Earthwork	\$ 361,578	\$ 0.0019
Structural Subtotal	\$ 49,275,688	\$ 0.2586
Design and Engineering Subtotal	\$ 5,334,336	\$ 0.0280
Permitting	\$ 1,905,120	\$ 0.0100
Taxes	\$ 762,048	\$ 0.0400
Overhead & Margin		



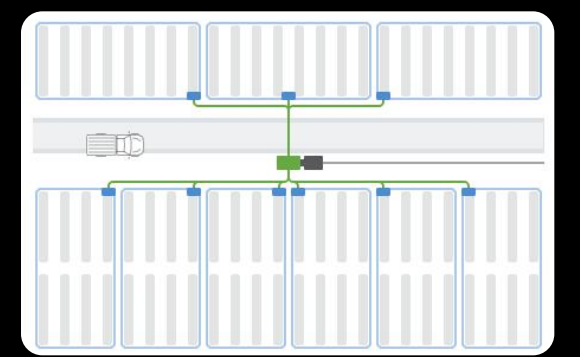
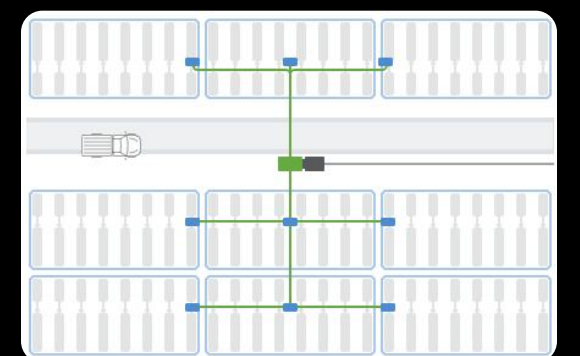
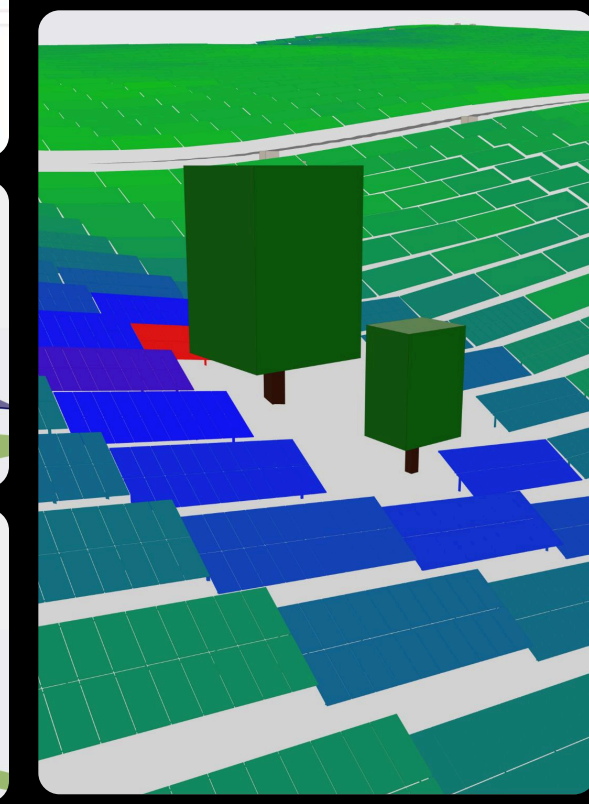
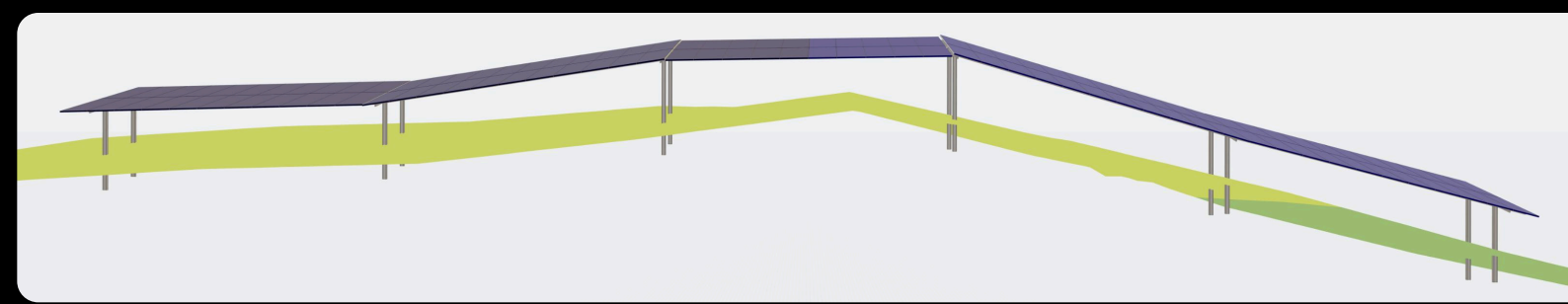
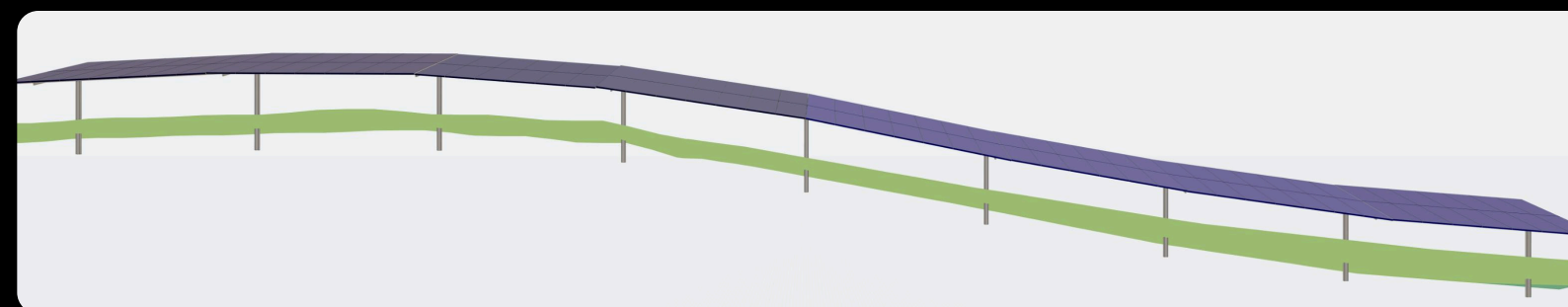
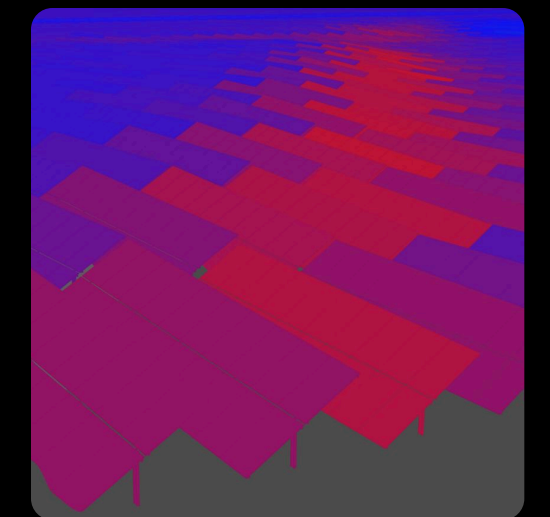
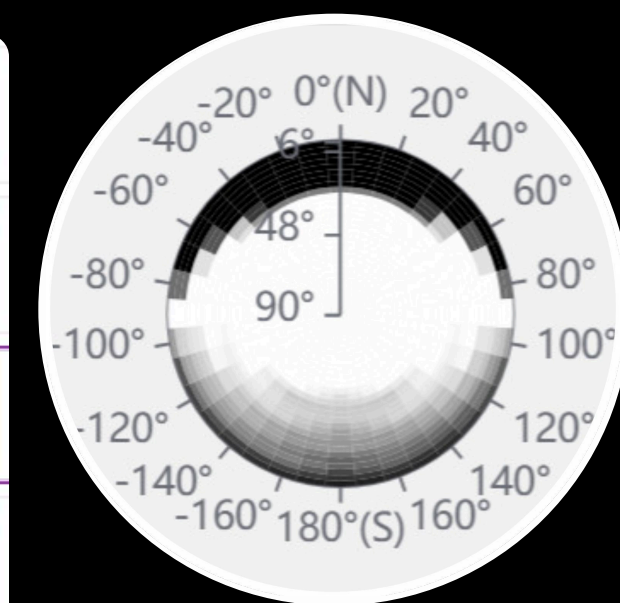
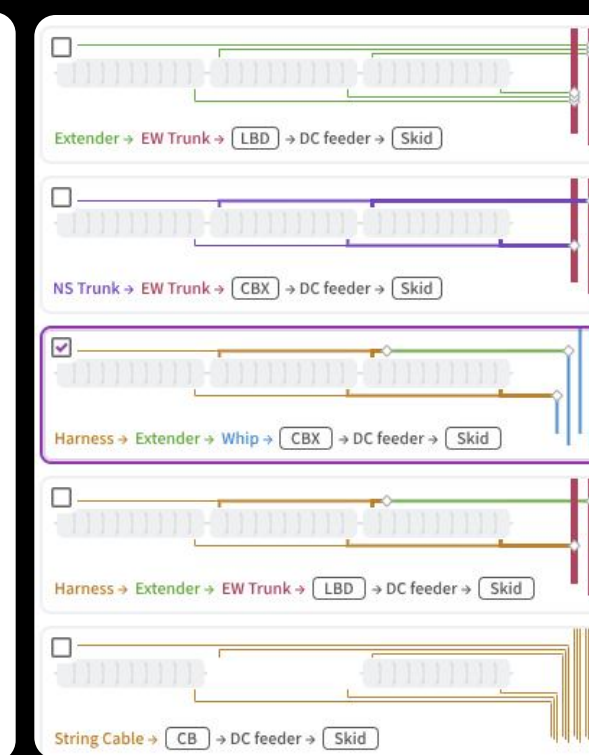
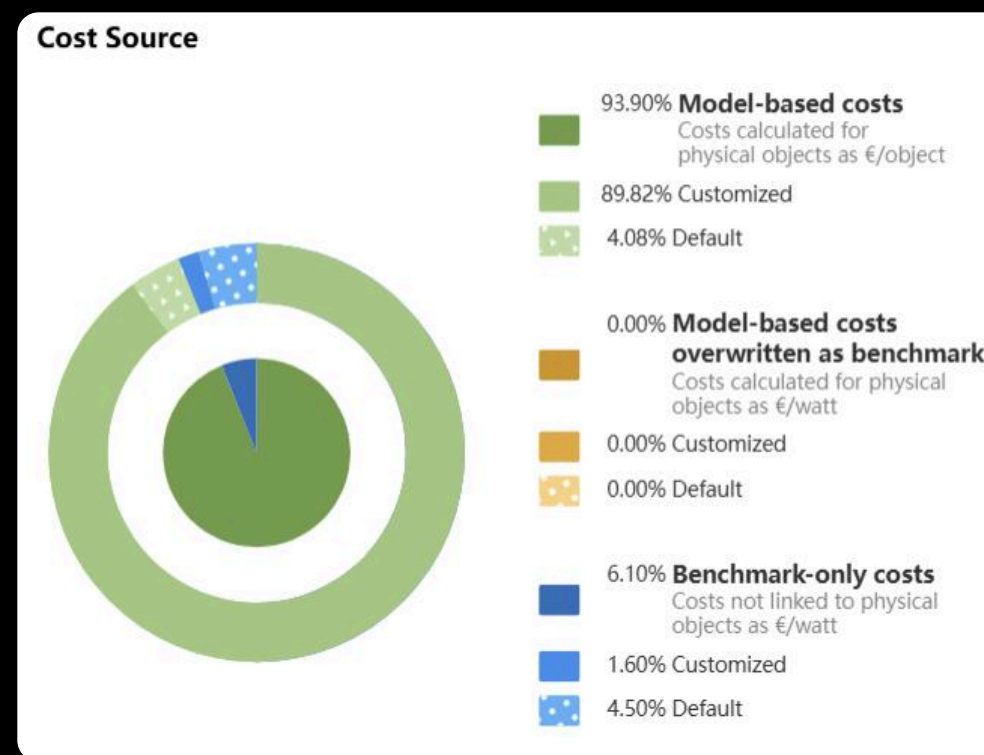
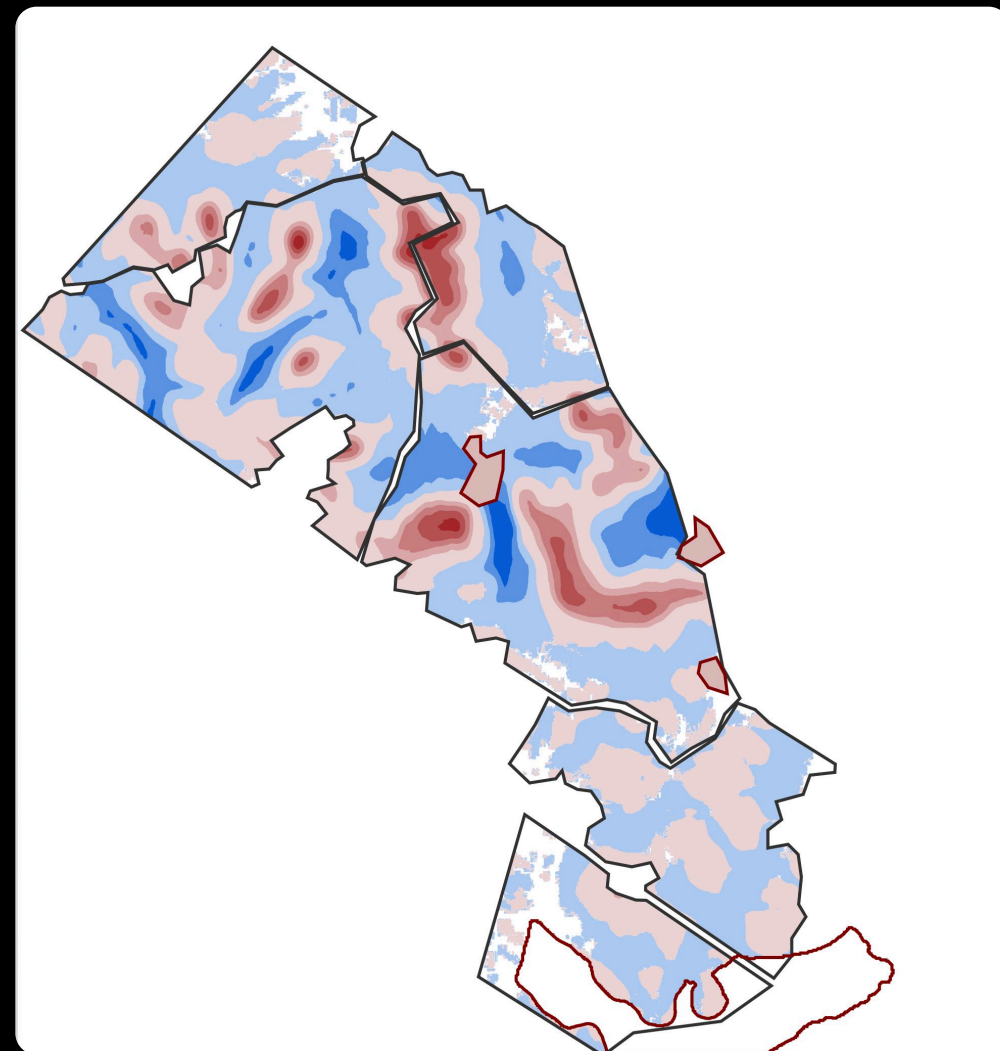
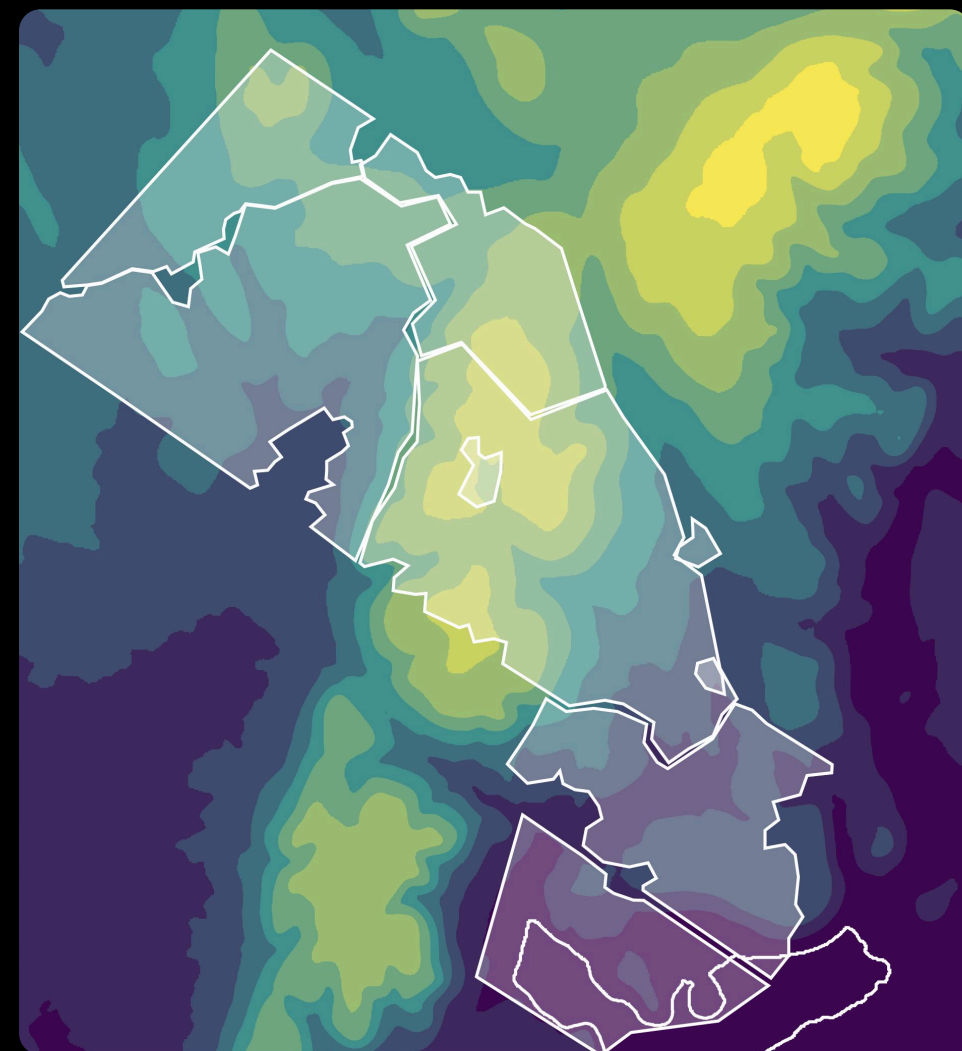
Category	Total Cost
total	\$ 3,040,836.8448
civil	\$ 67,348.4382
grading	\$ 67,348.4382
electrical	\$ 334,024.7048
lv	\$ 311,064.7048
combiner_box	\$ 22,960.0000
pcs	\$ 243,500.0000
transformer	\$ 67,500.0000
inverter	\$ 176,000.0000
pv_module	\$ 1,524,801.6000
install	\$ 38,808.0000
material	\$ 1,485,993.6000
equipment	\$ 871,162.1017
total	\$ 693,588.0000
total	\$ 177,574.1017
total	\$ 24,570.0000
total	\$ 153,004.1017

Category	Cost (\$/W)	Total Cost (\$ million)
Racking	0.1824 \$/W	\$ 34.75 m
Cut & Fill	0.0019 \$/W	\$ 0.36 m
Piles	0.0462 \$/W	\$ 8.81 m

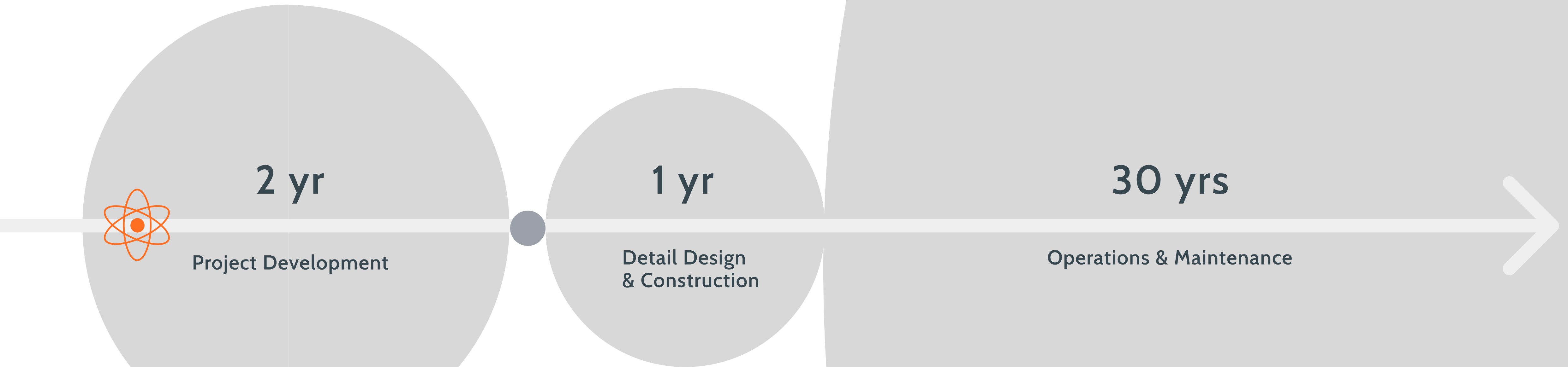
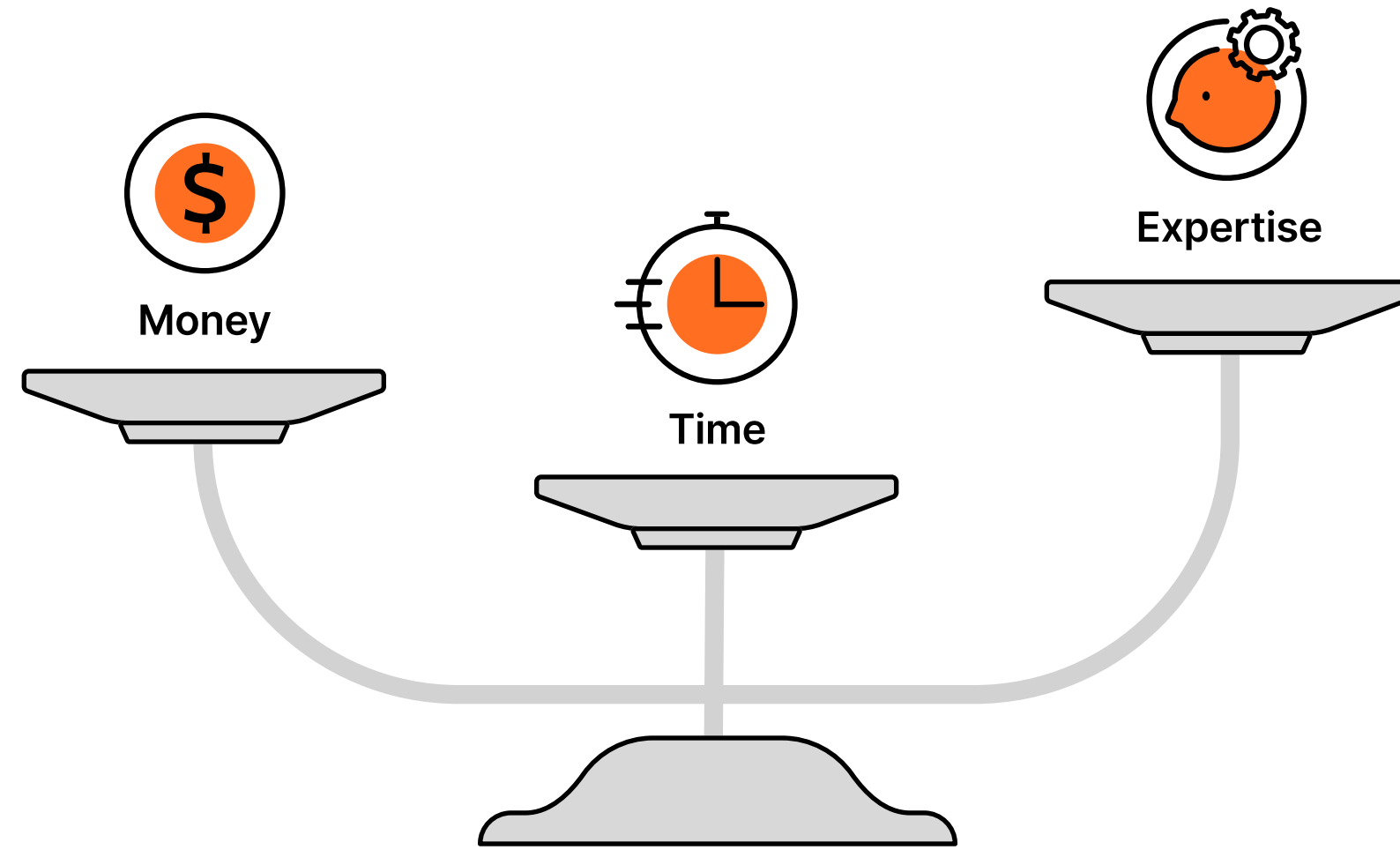
Bring More Design Reality Sooner



- SITE-SPECIFIC
- BUILDABLE
- ECONOMICALLY GROUNDED

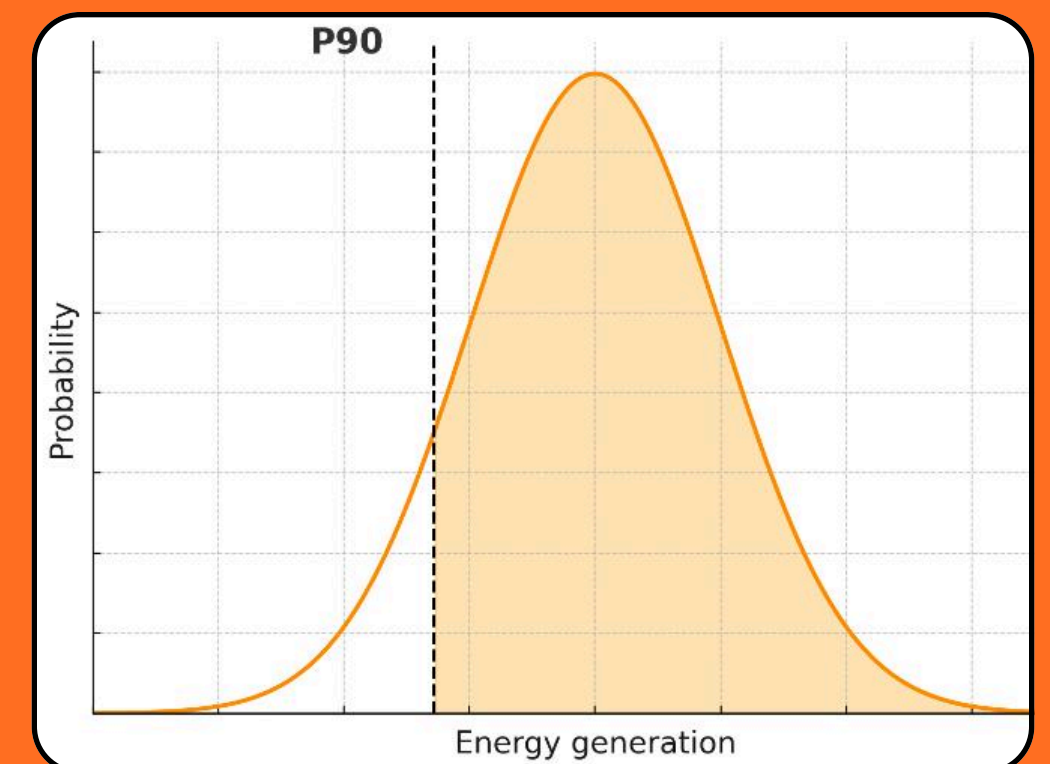


Rebalancing Trade-offs



Wrapping up: Is my energy model bankable?

- Informed by bankable design → P50
- Calculates downside risk → P90 / P95 / P99 →
- Prepared by Independent Engineering Firm



Thank you!

Any questions?



pvfarm.io



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