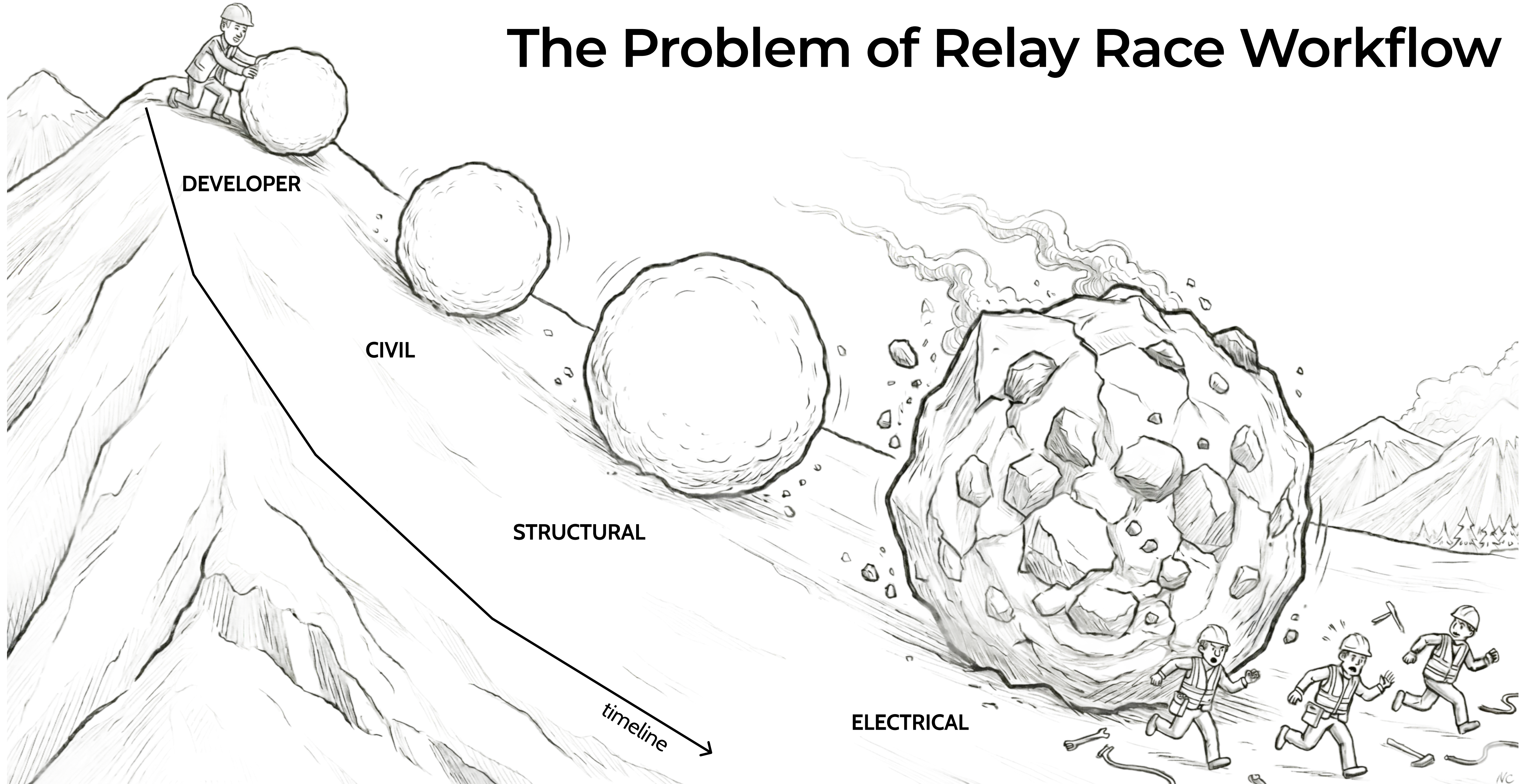


Holistic Design

*Ending the Relay Race
in Utility-PV Projects*

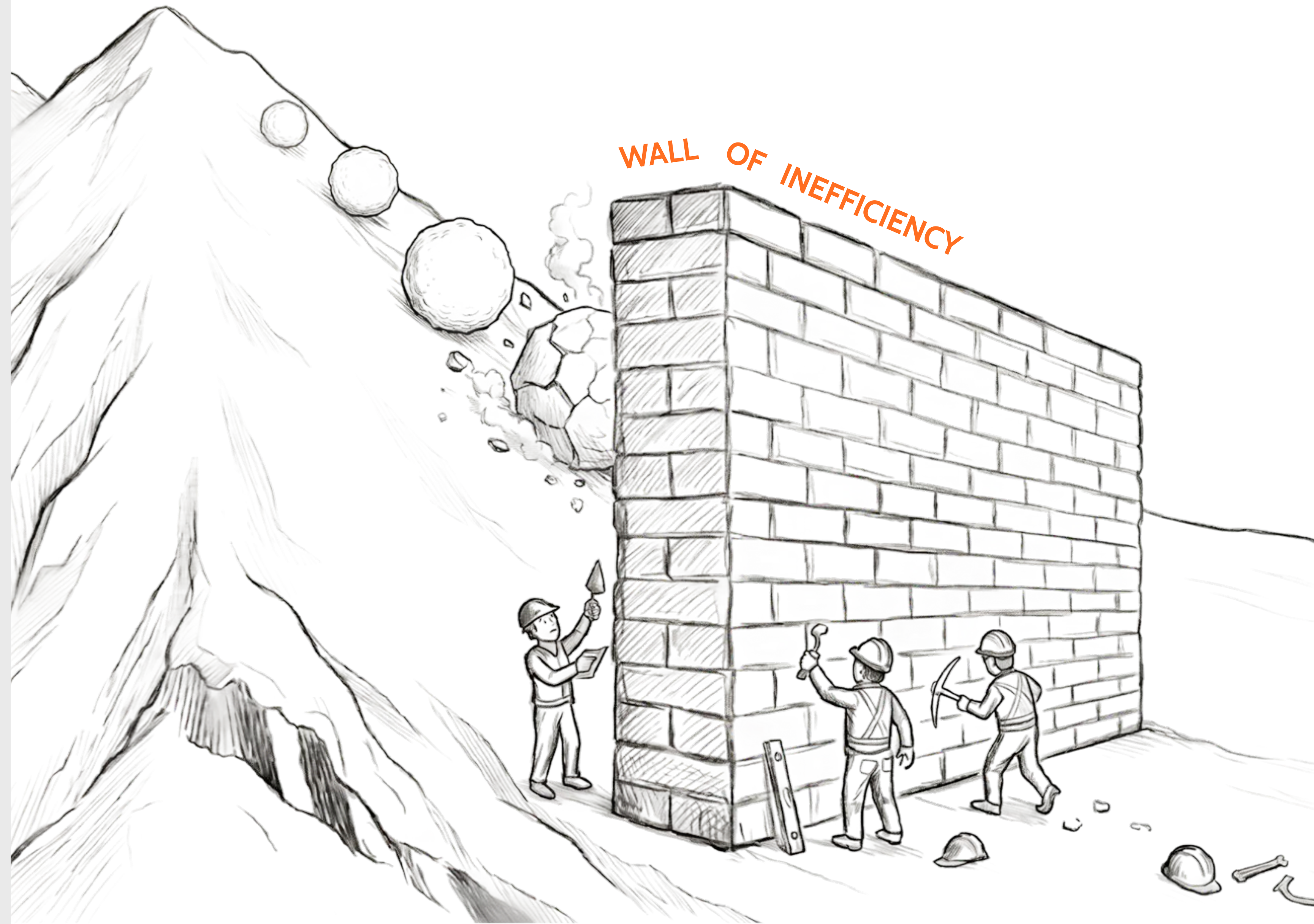


The Problem of Relay Race Workflow

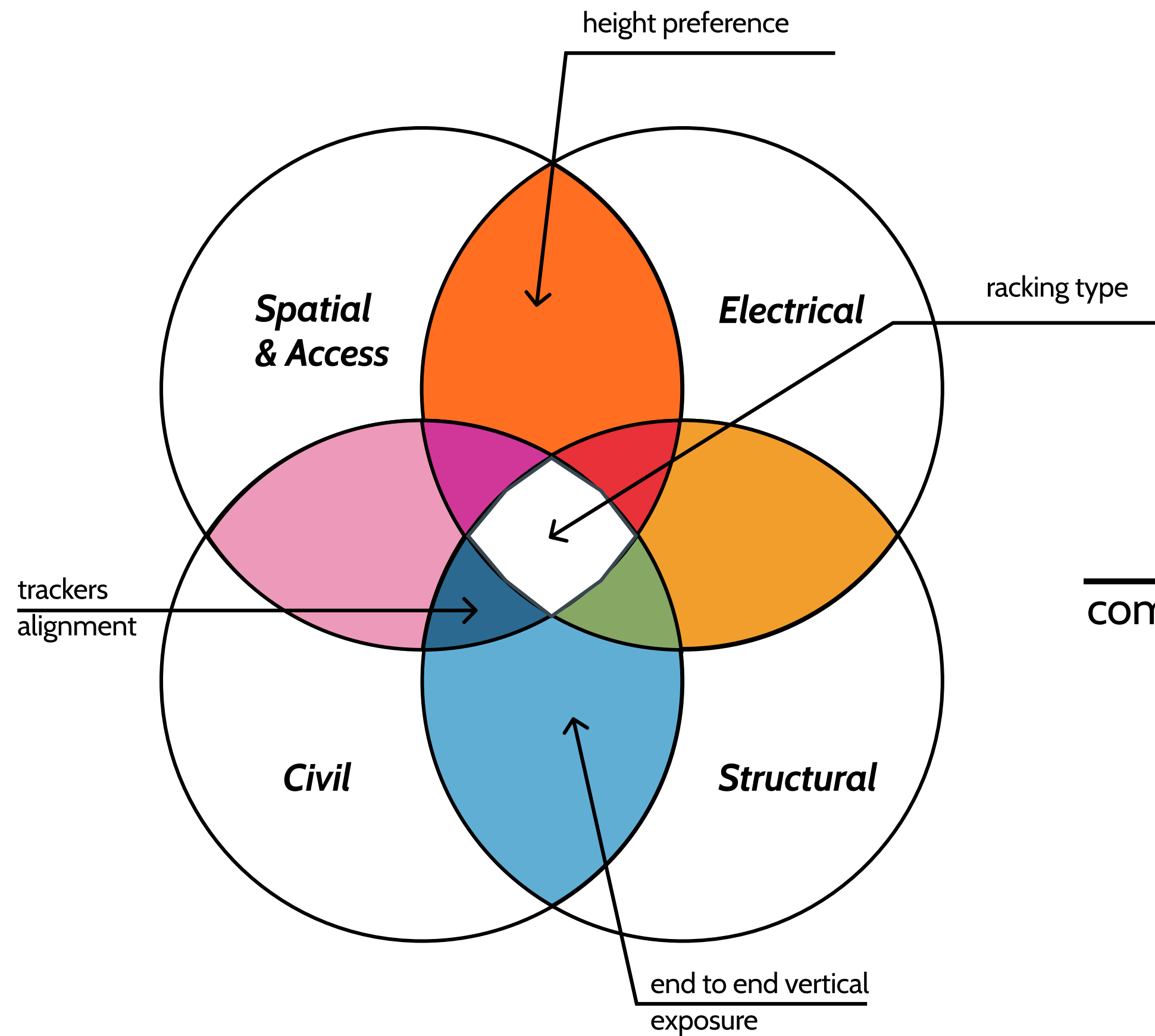


Solution?...

We build
the Wall of Inefficiency
to avoid
the Snowball Effect

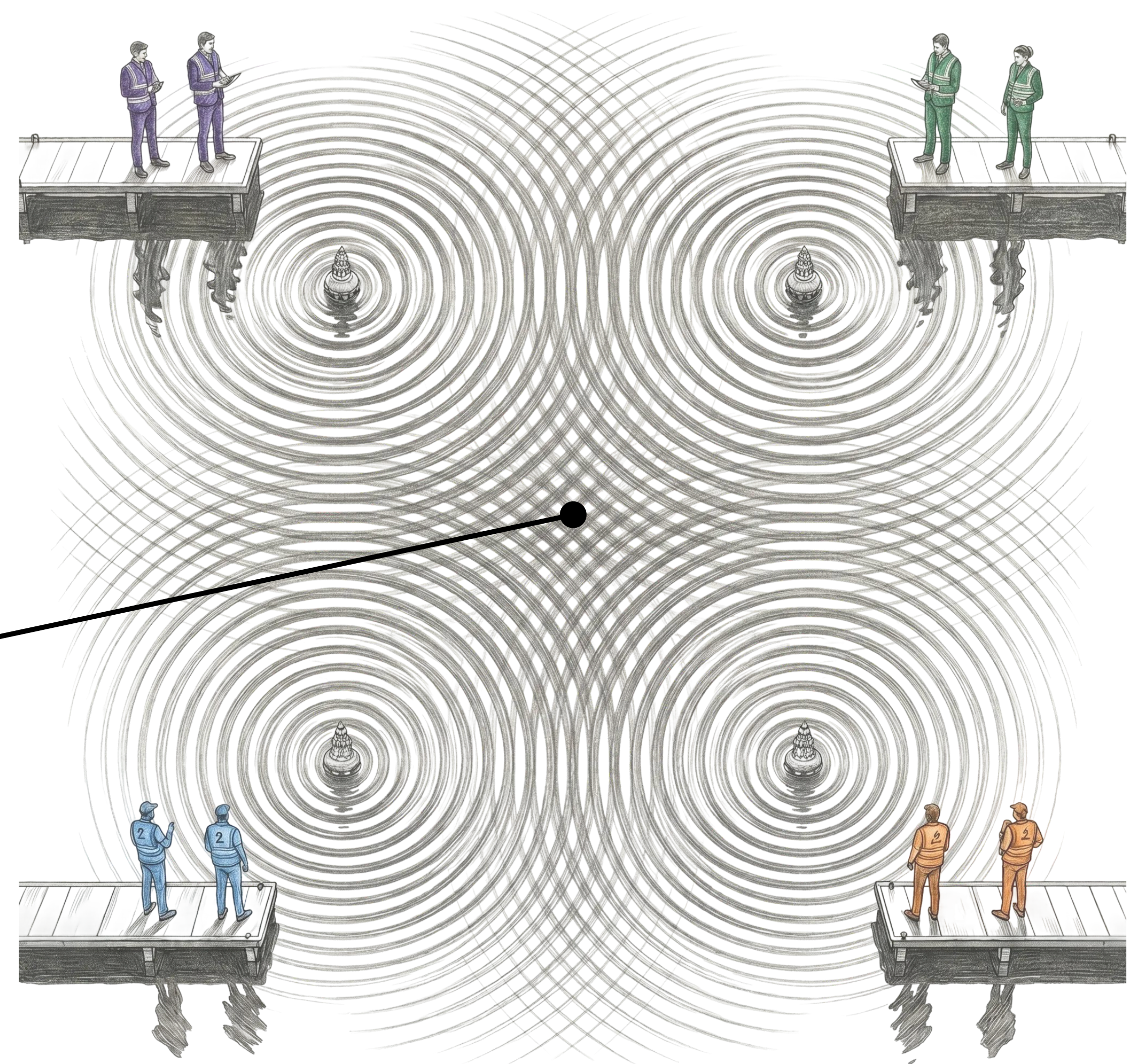


Holistic Feasibility



DEVELOPER

CIVIL

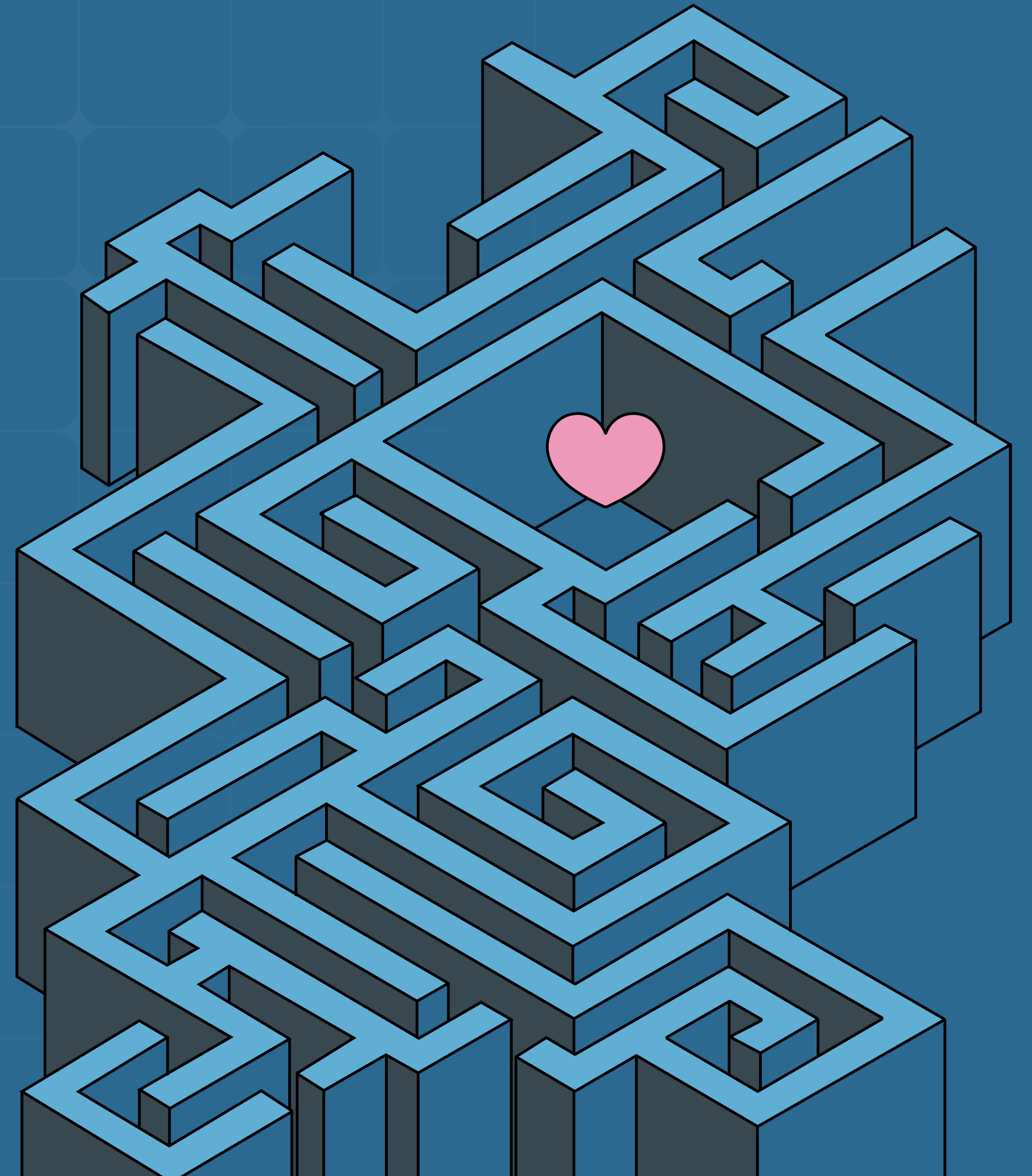


STRUCTURAL

ELECTRICAL

NC

Phase 1: Conceptual / Preliminary Design

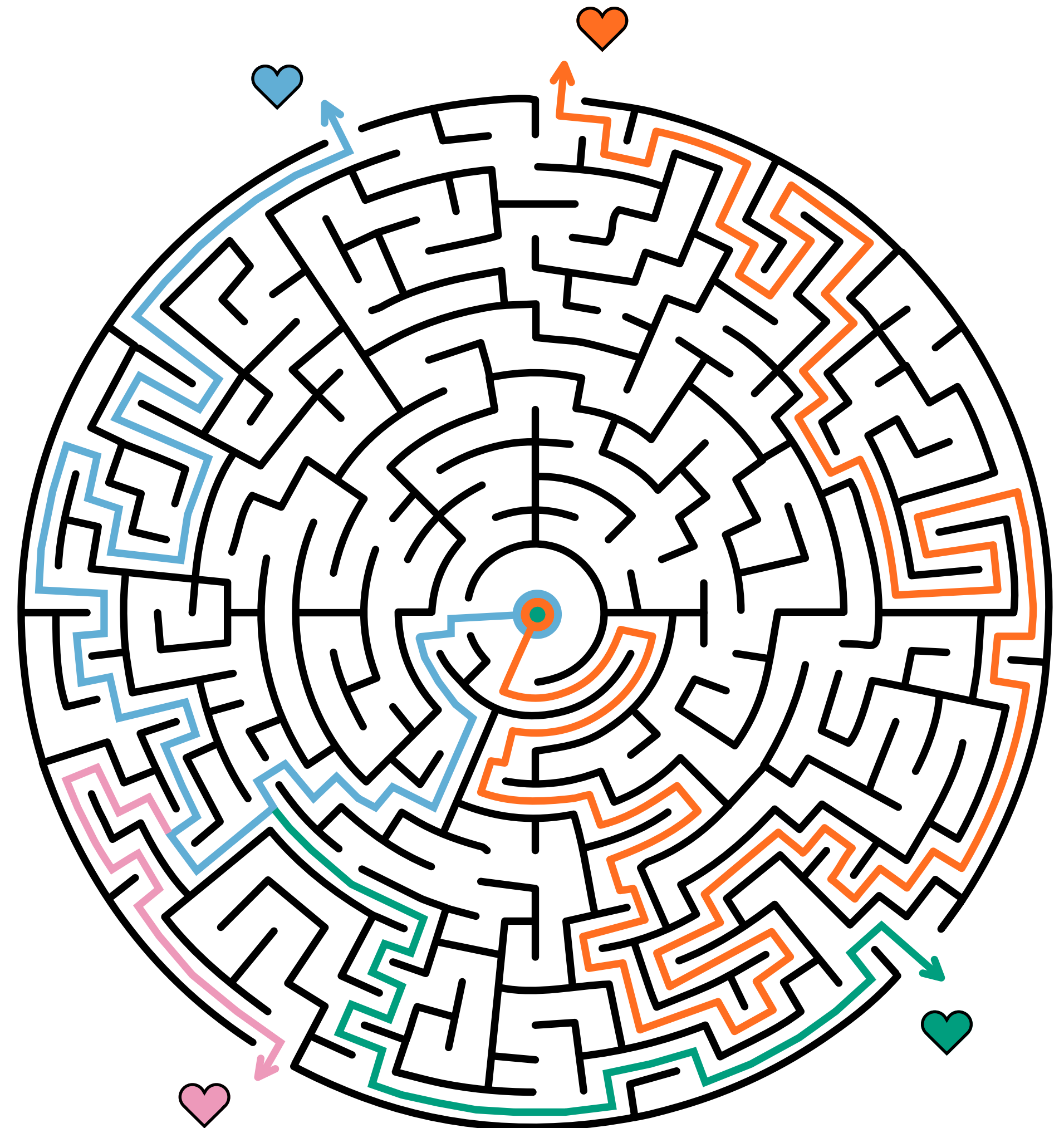


The Labyrinth of Choices

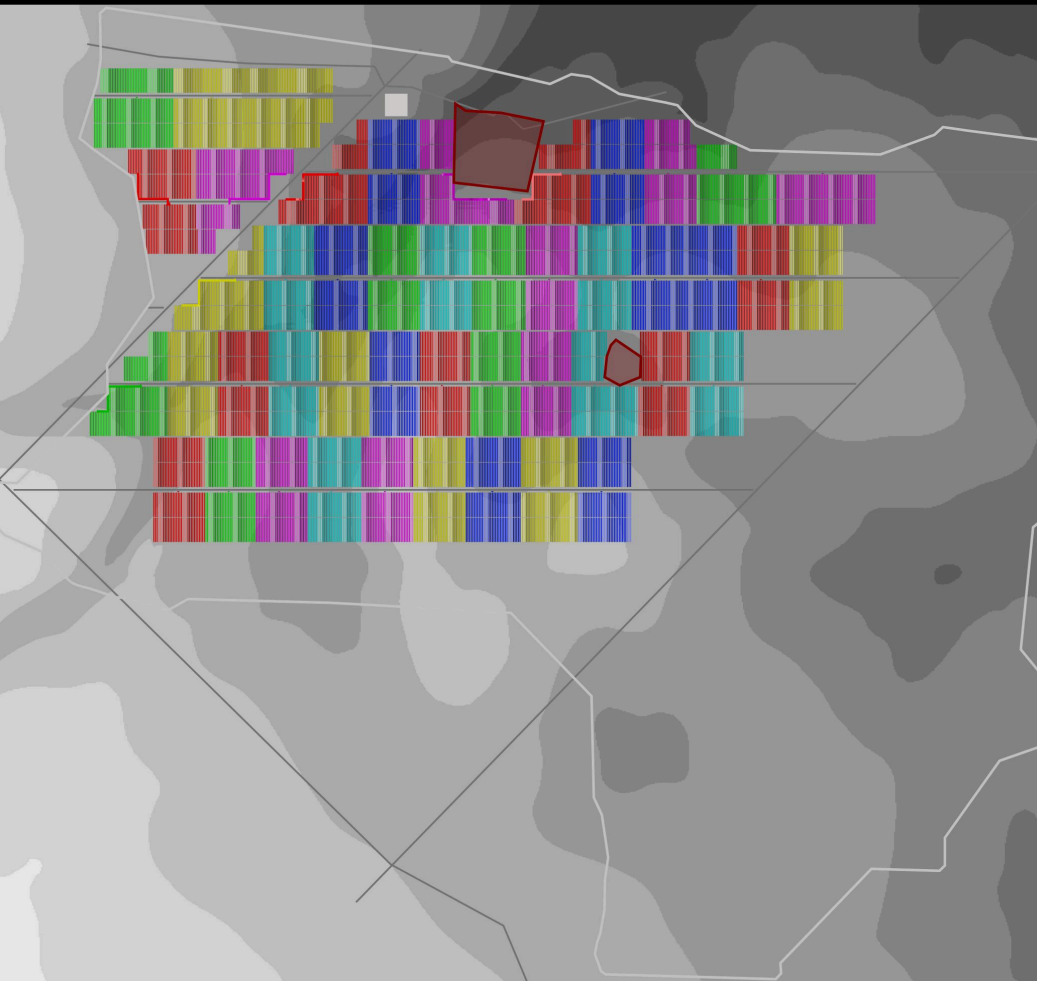
- ♥ Spatial/Access Design FIRST
- ♥ Civil BOS FIRST
- ♥ Electrical BOS FIRST
- ♥ Structural BOS FIRST

Teams often end up following the same “worn path,” repeating familiar workflows without considering that alternative routes might exist and even be better. The real goal is to quickly see the different possible routes, iterate through them, and select the path that leads to the best overall outcome.


This is exactly what new tools make possible: instead of being locked into one predictable path, you can explore multiple strategies, compare them, and adapt the process to the site itself.



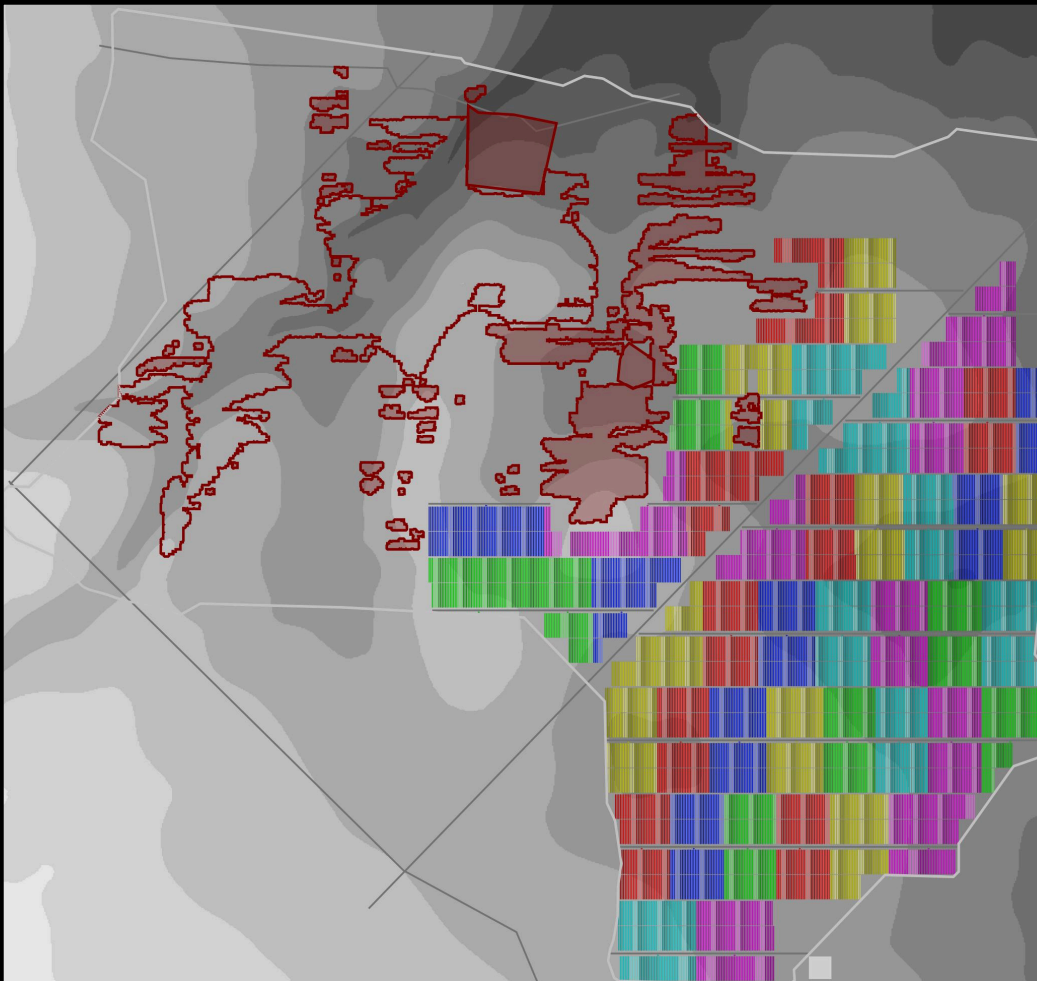
Spatial/Access Design FIRST




€206.2 MLN
0.88 €/W



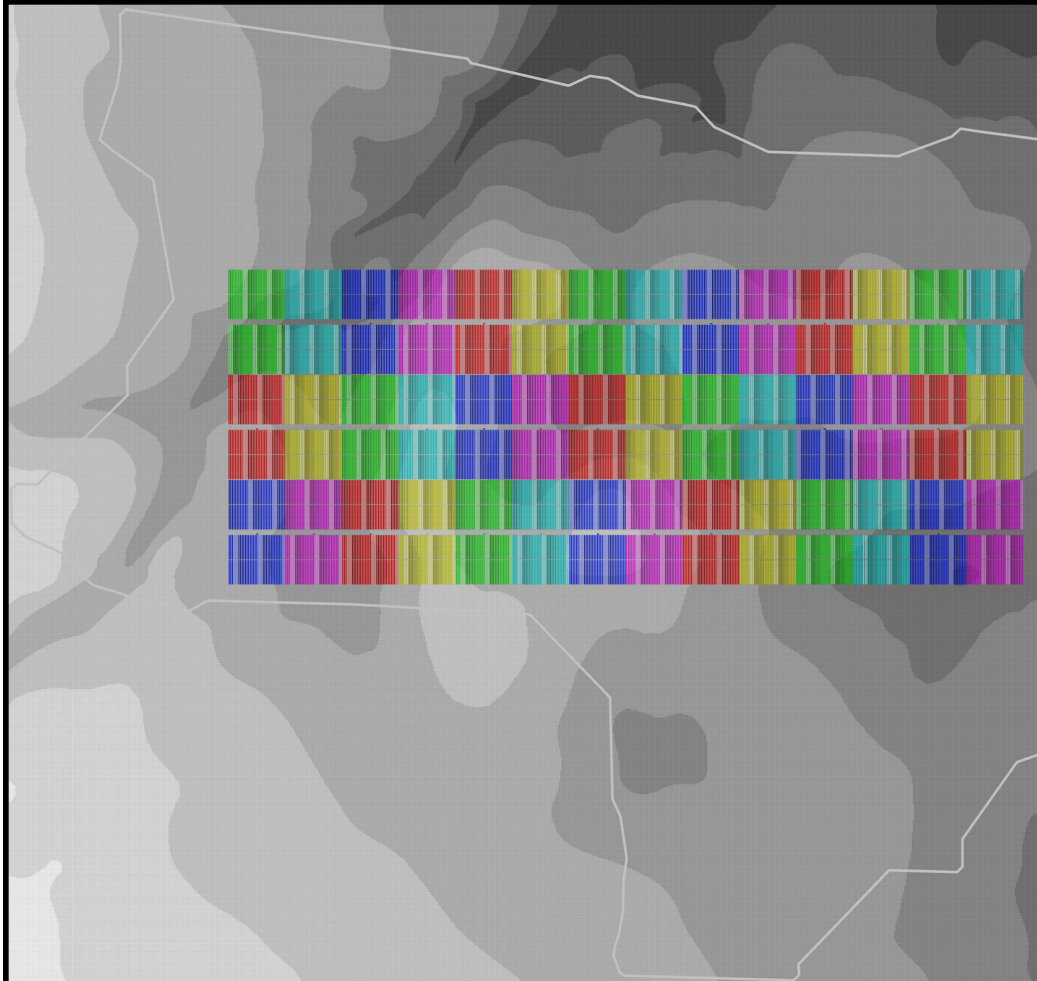
Civil BOS FIRST




€201.7 MLN
0.87 €/W




Electrical BOS FIRST




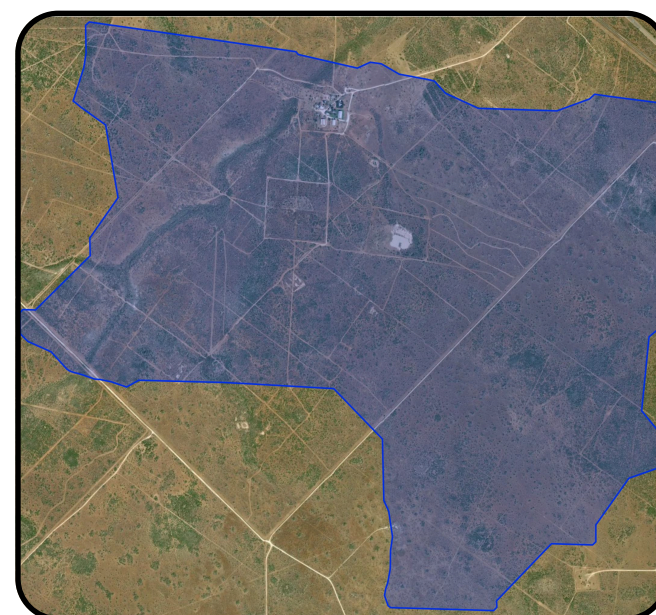
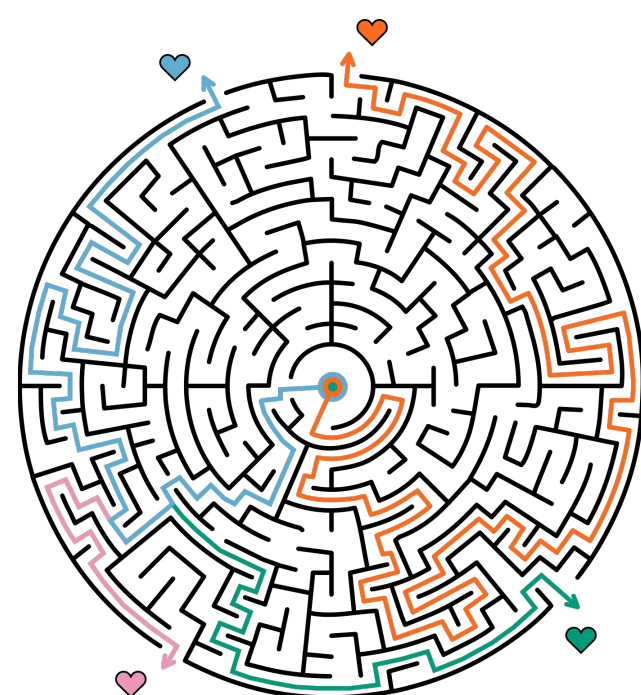
€202.0 MLN
0.87 €/W



Structural BOS FIRST

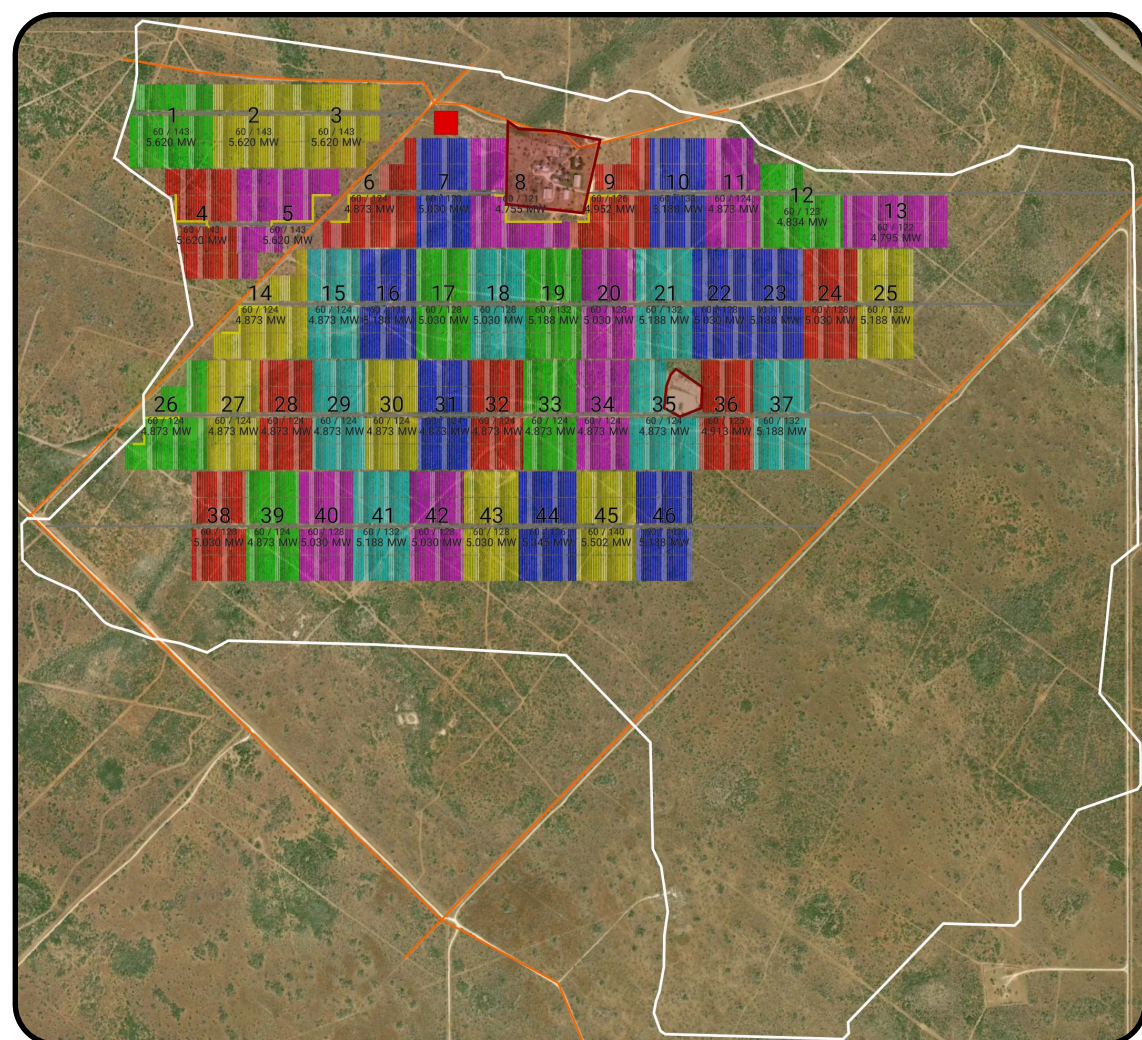


€205.4 MLN
0.89 €/W

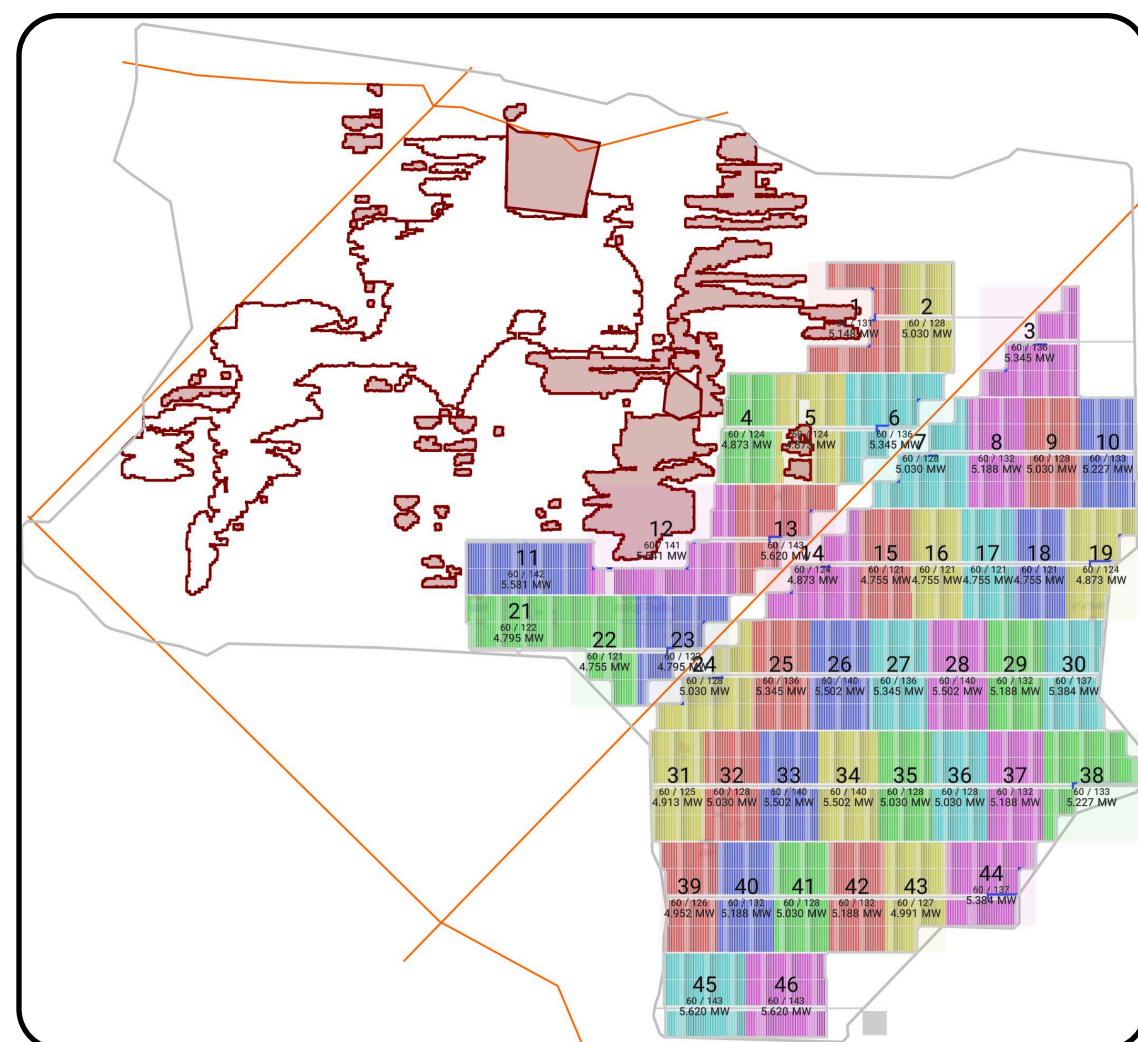
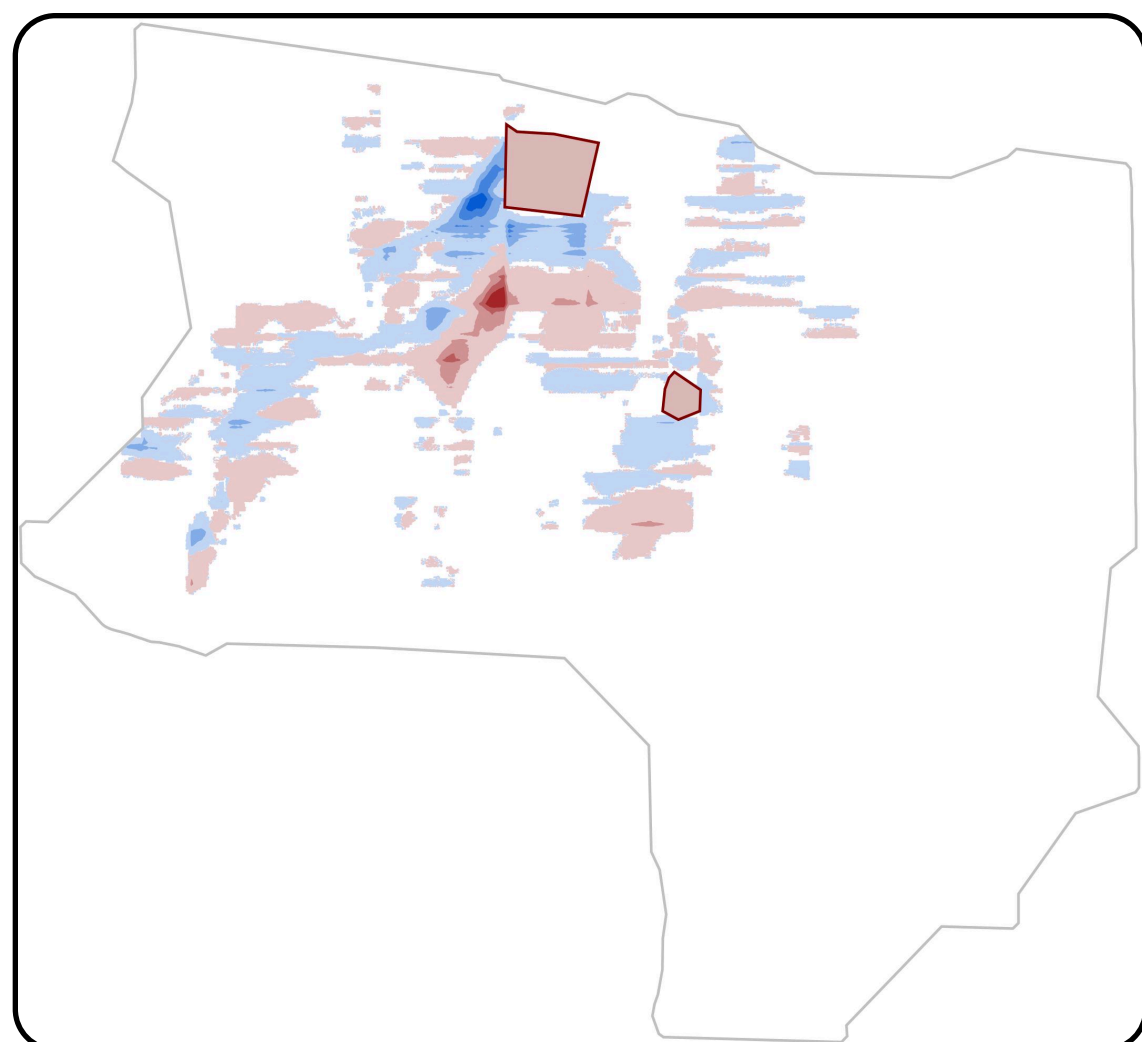
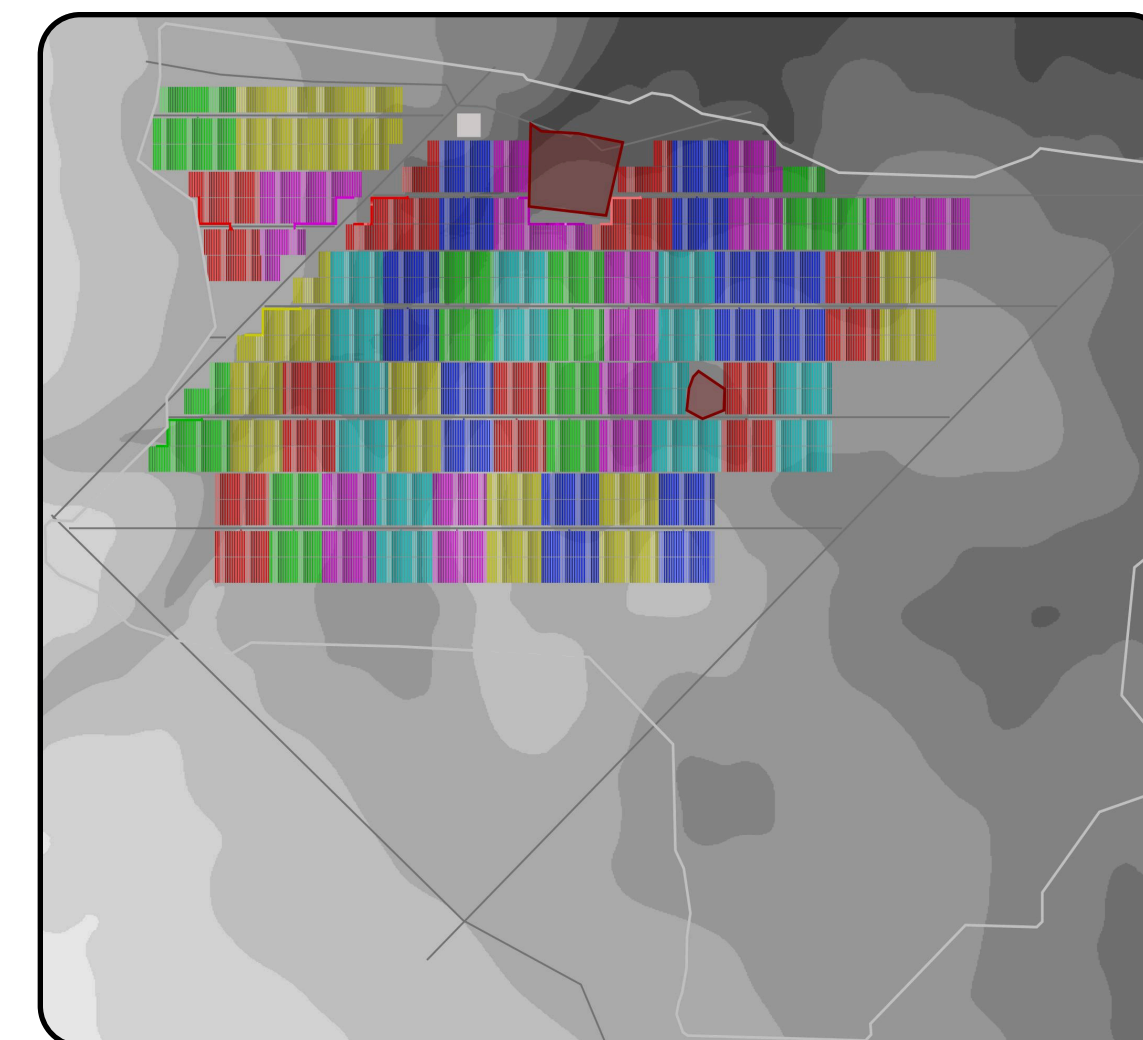
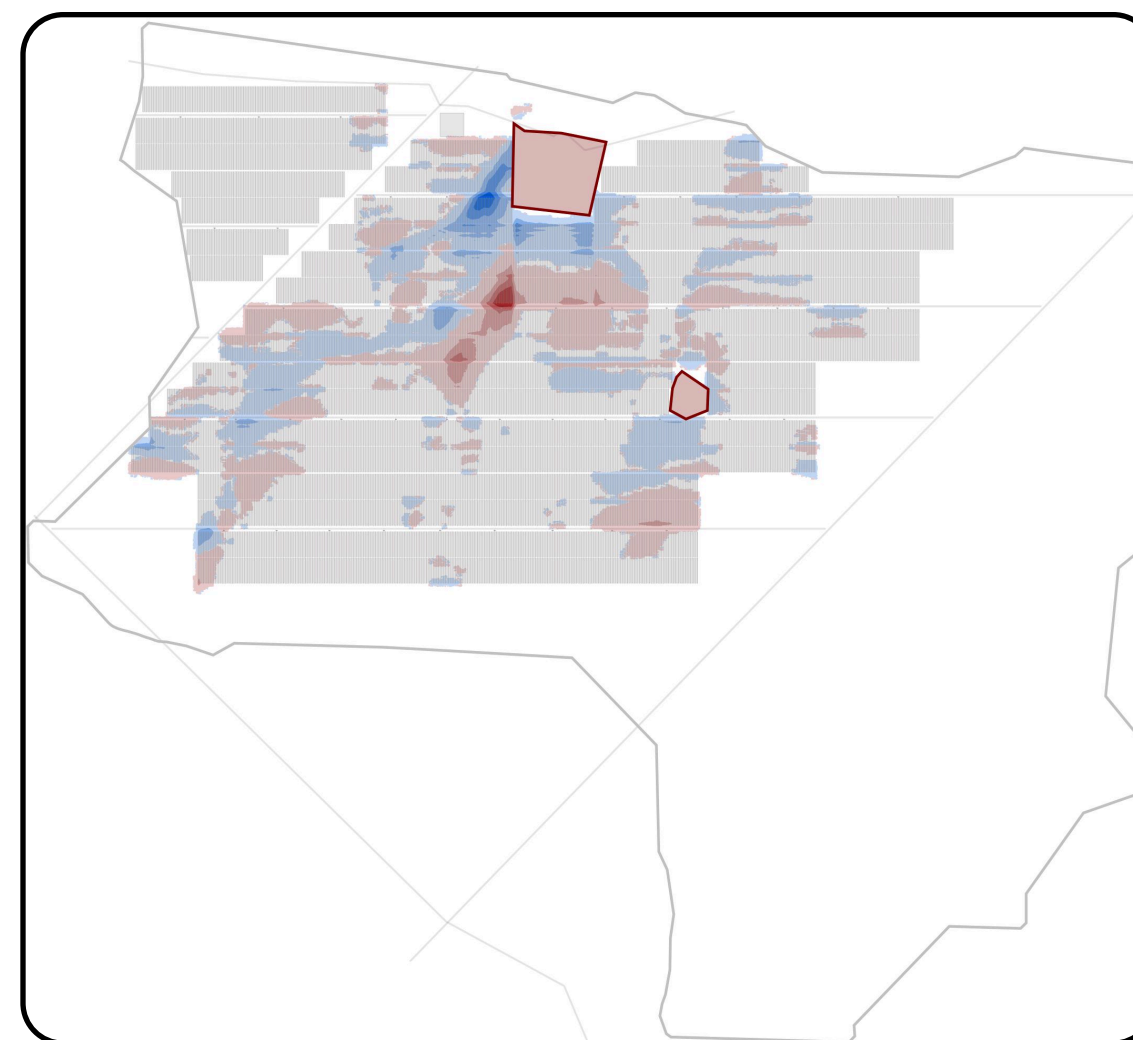
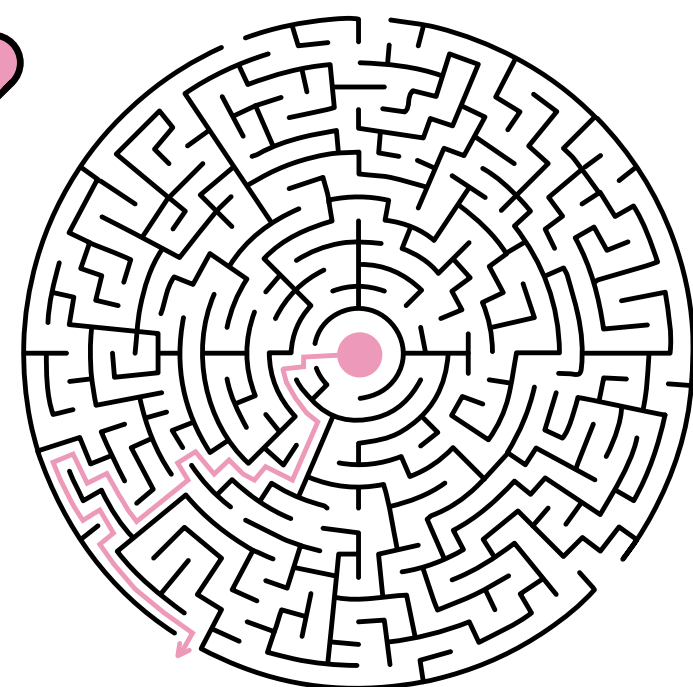



270 hectares & 230.0 MWDC

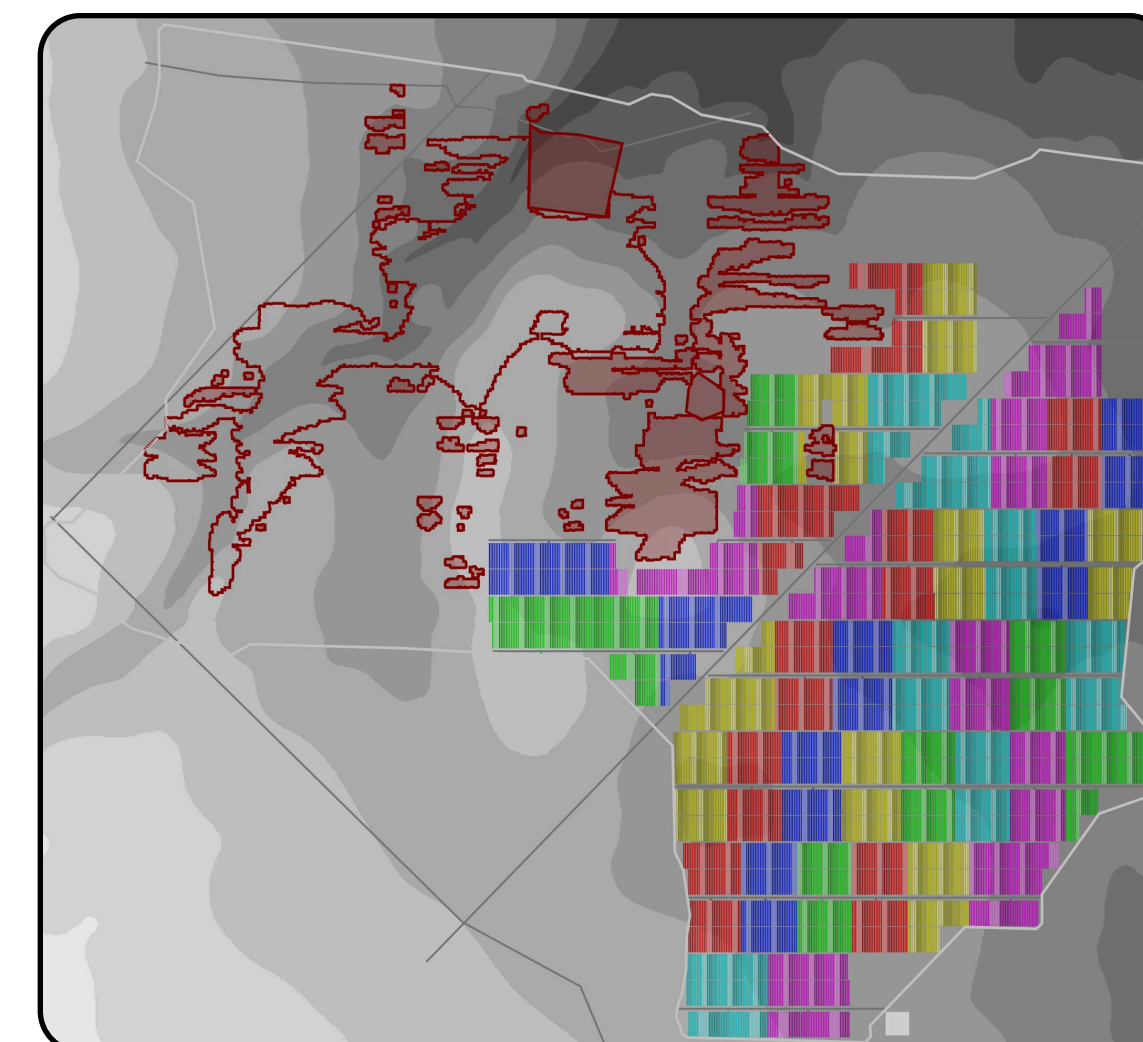
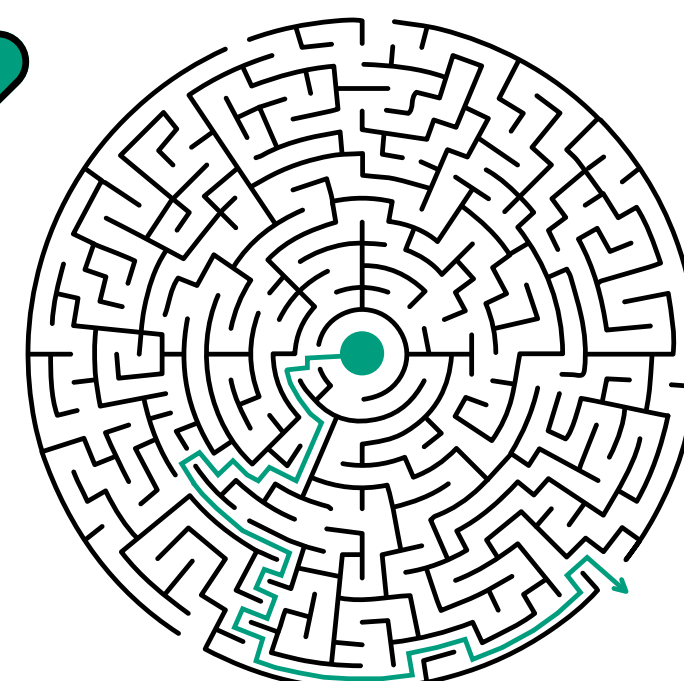
Same site, same target - but a different order of design decisions. When you change the sequence in which constraints are handled - civil before electrical, access before structure - you change the outcome

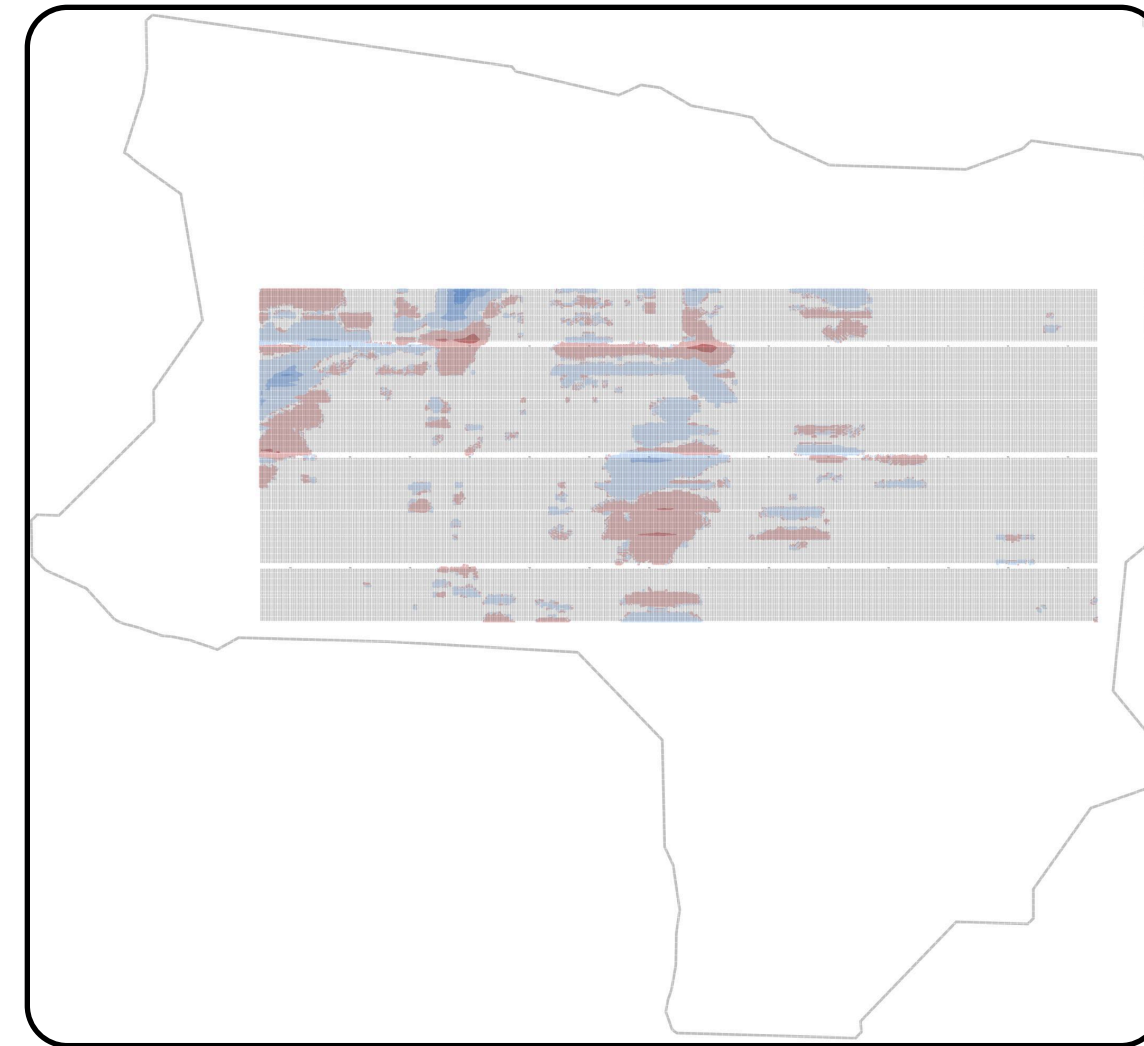
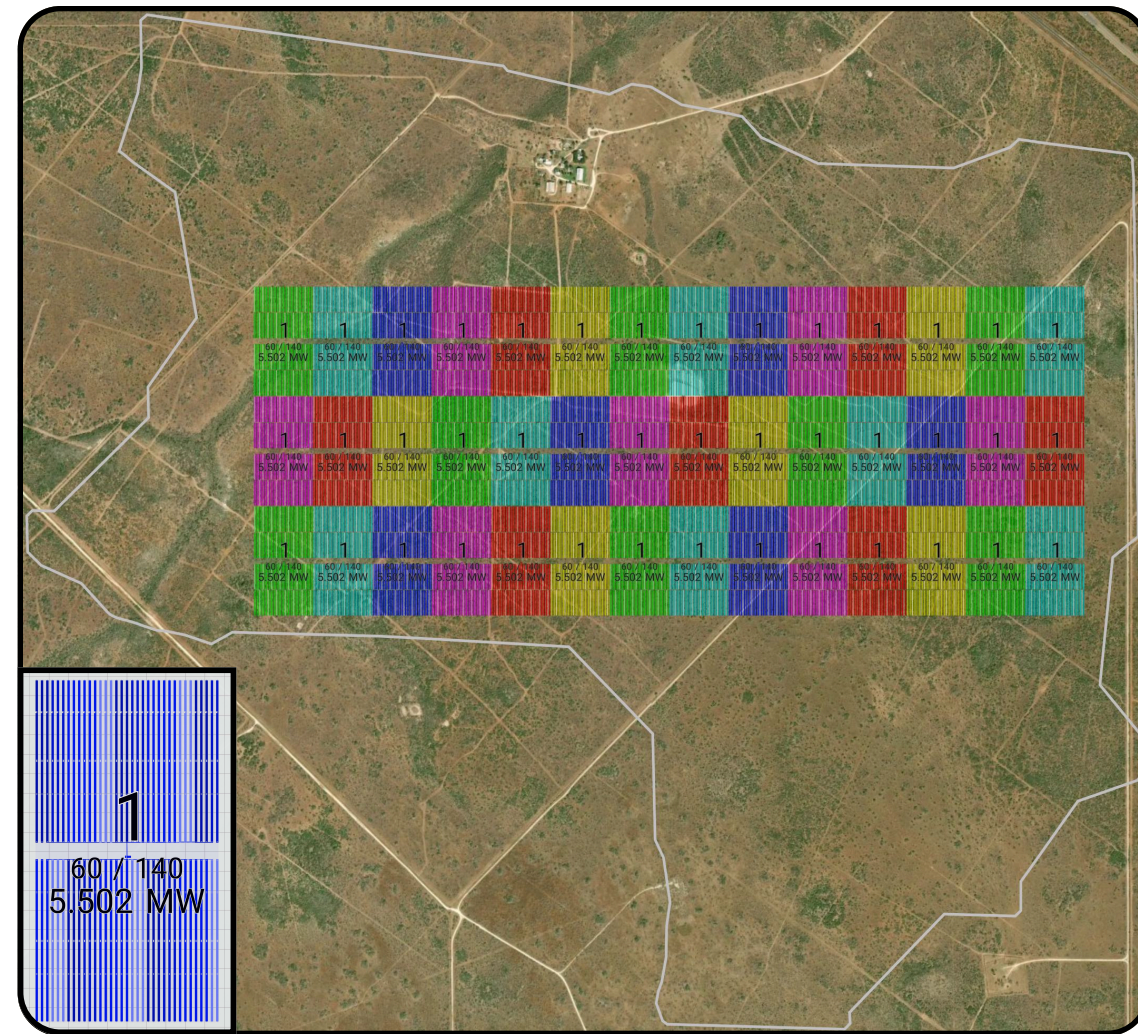


Spatial/Access Design FIRST

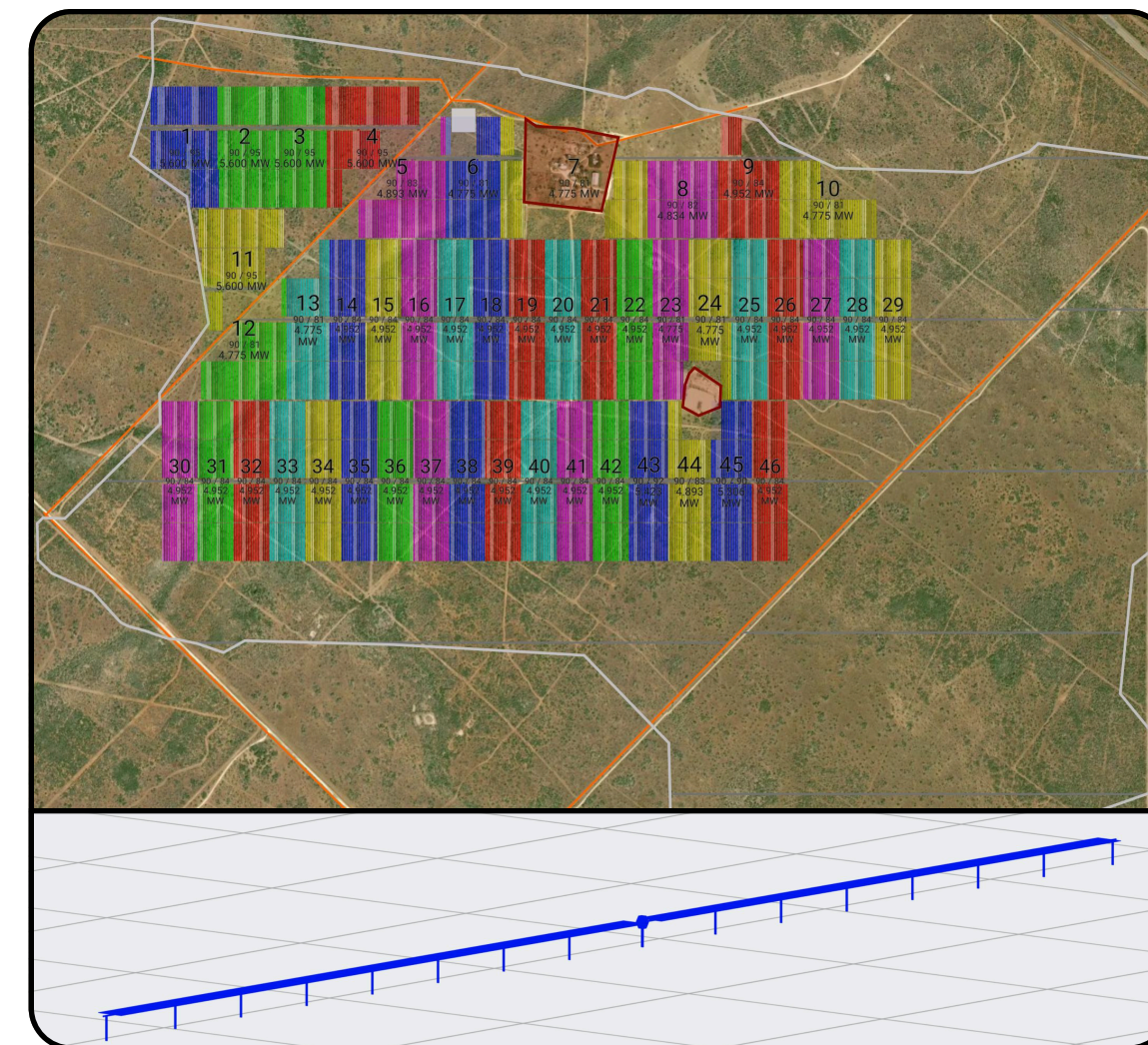
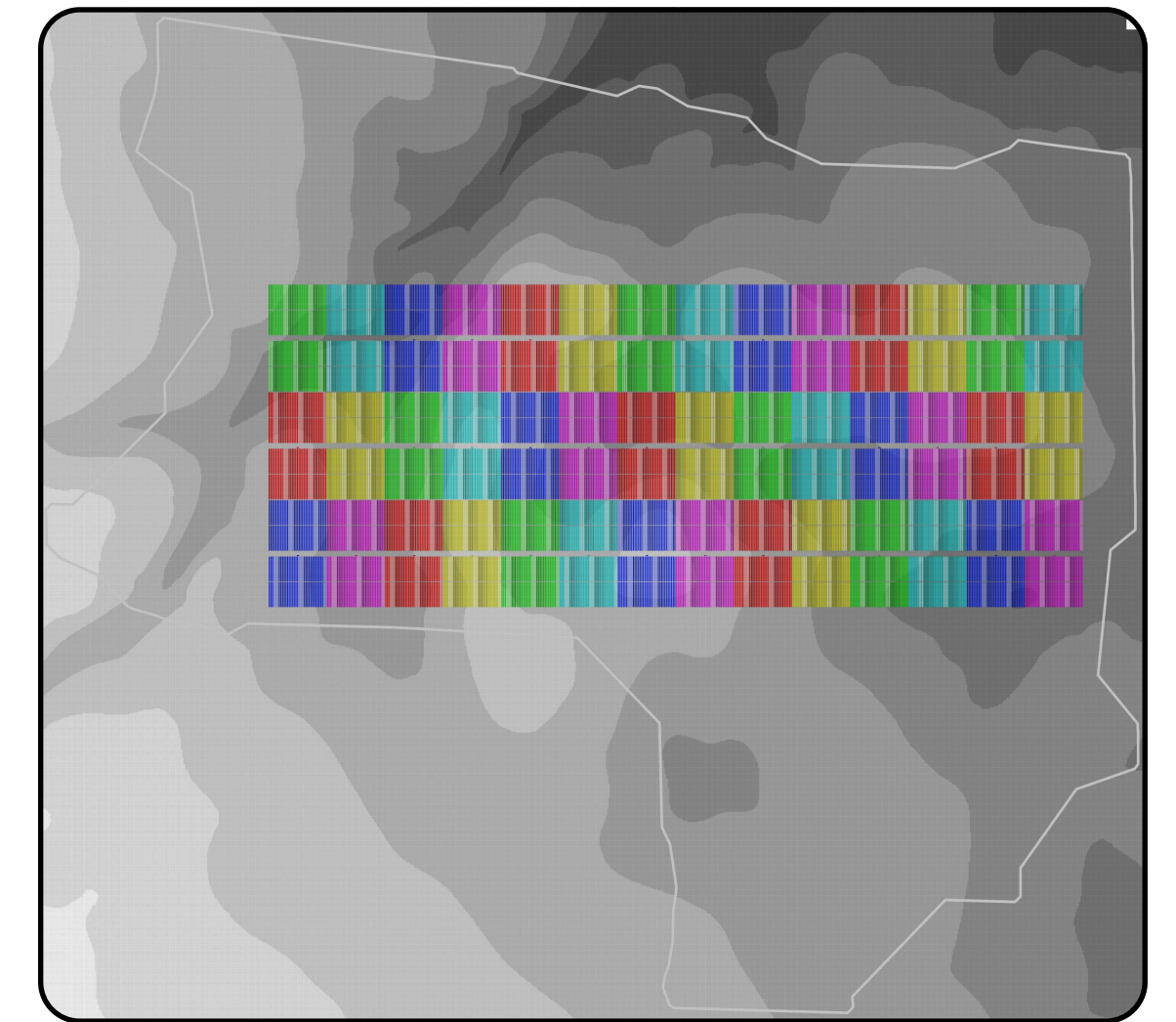
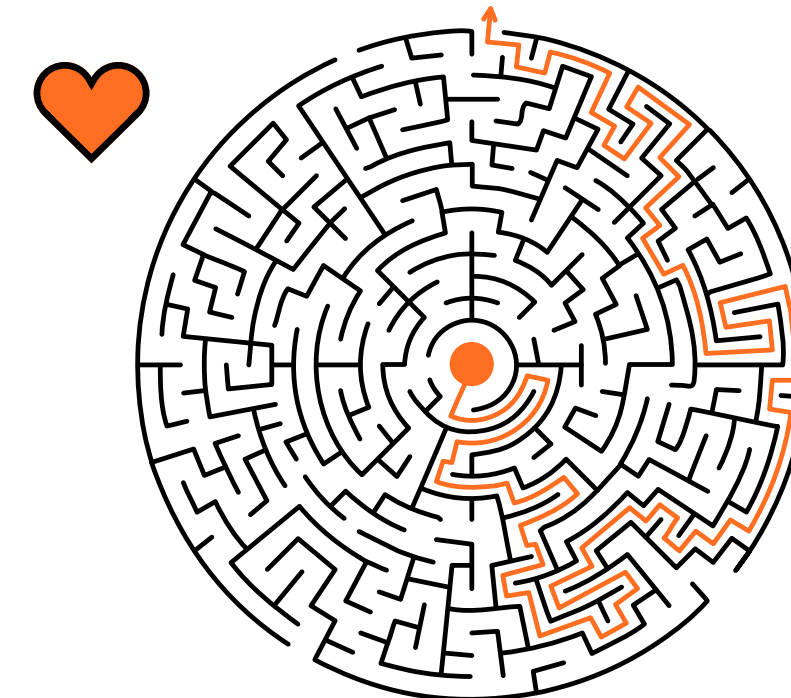


Civil BOS FIRST

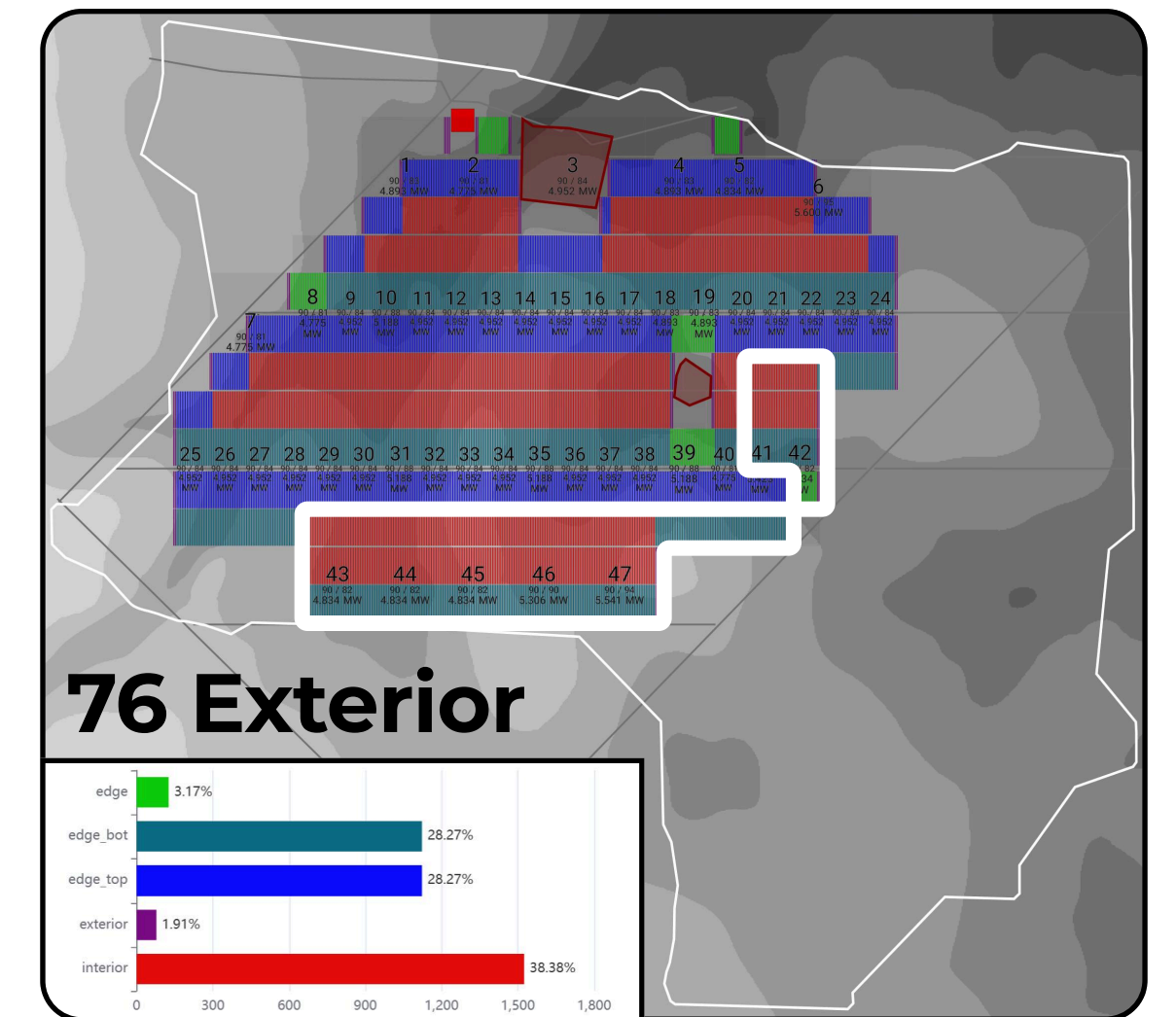
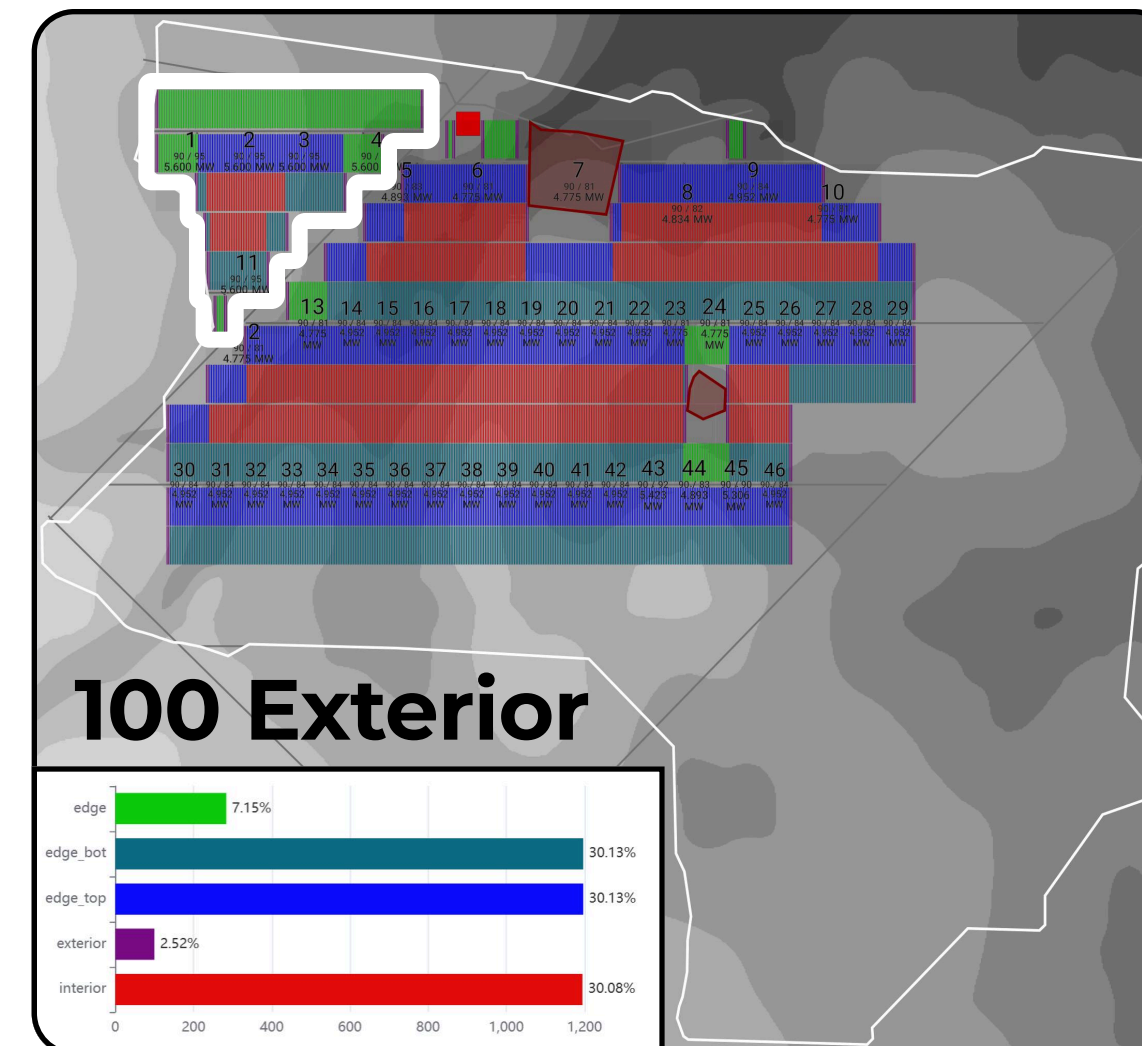
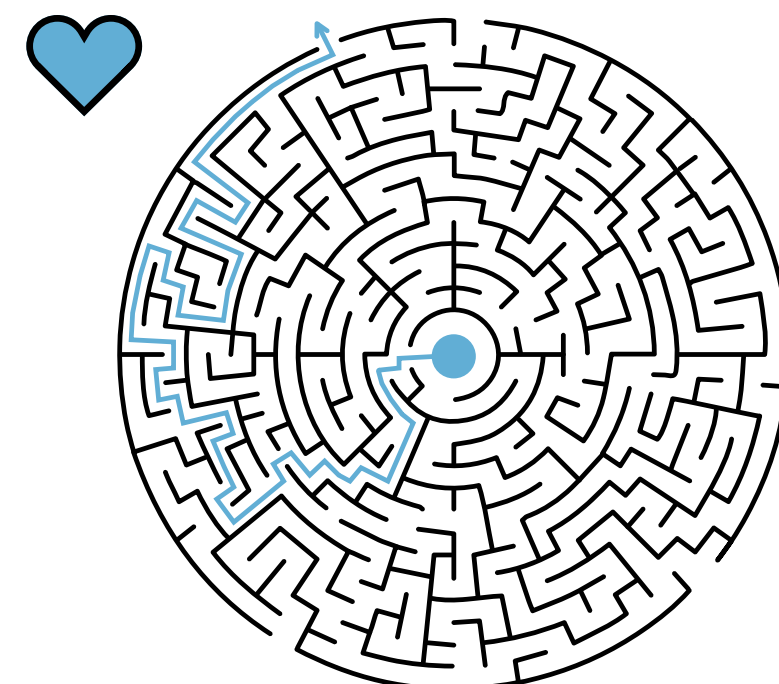




Electrical BOS FIRST

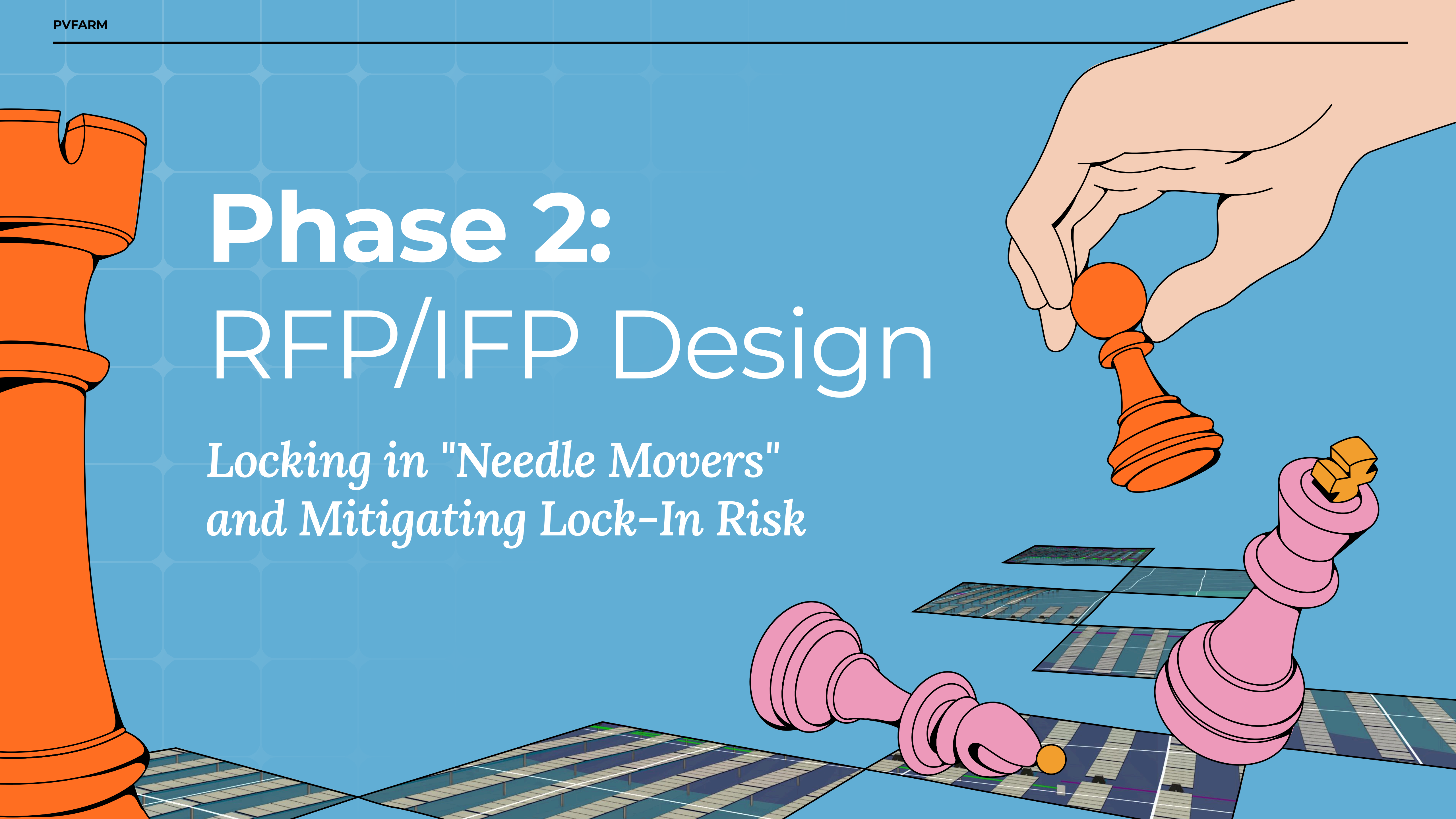


Structural BOS FIRST



Phase 2: RFP/IFP Design

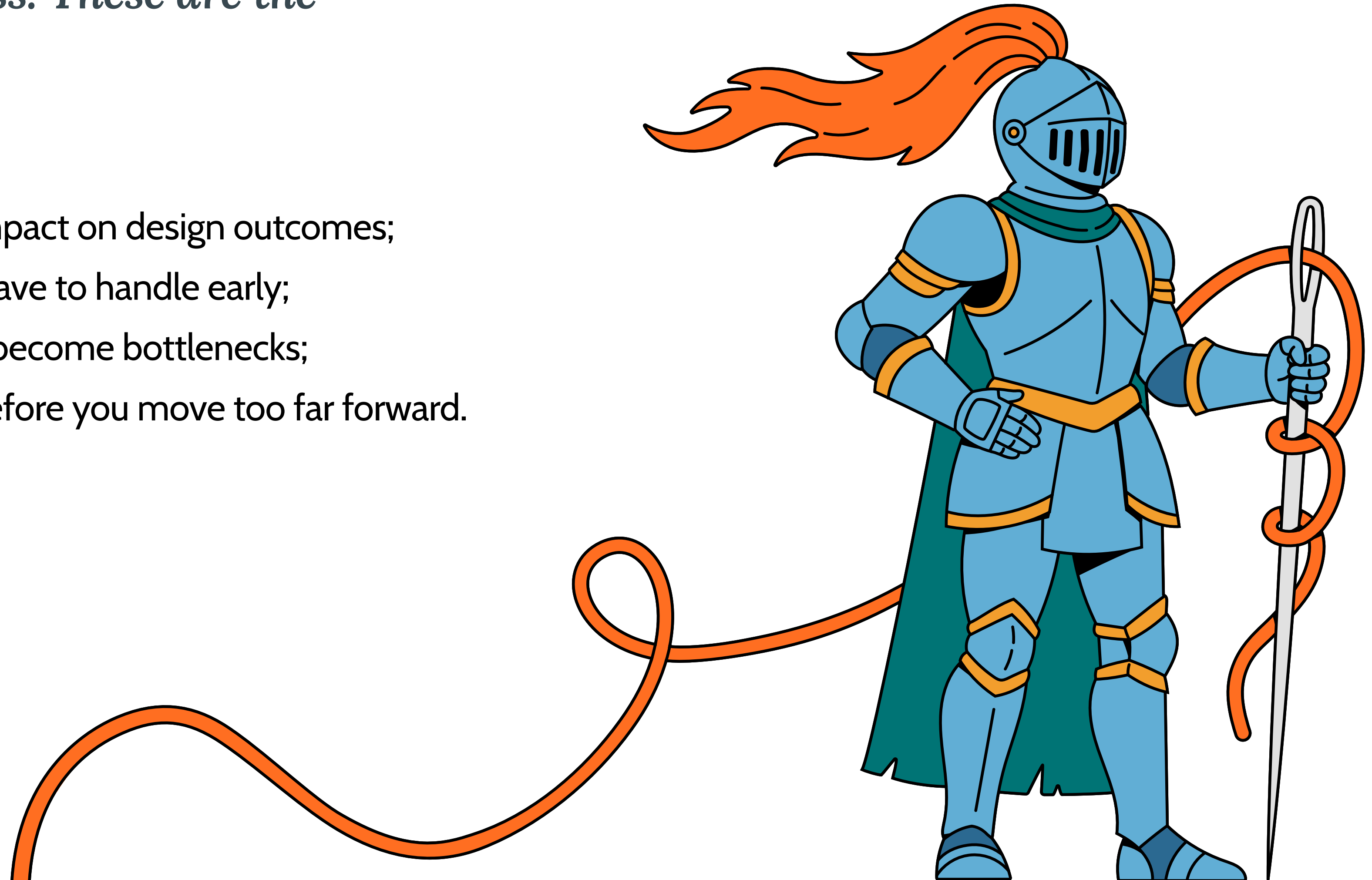
*Locking in "Needle Movers"
and Mitigating Lock-In Risk*

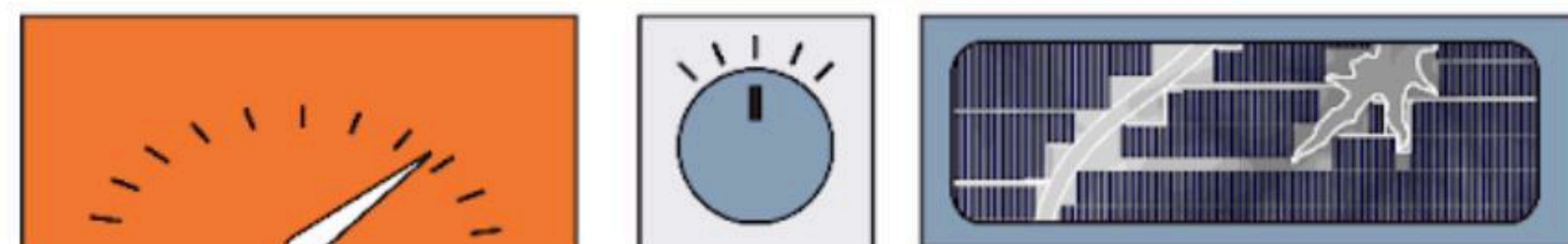
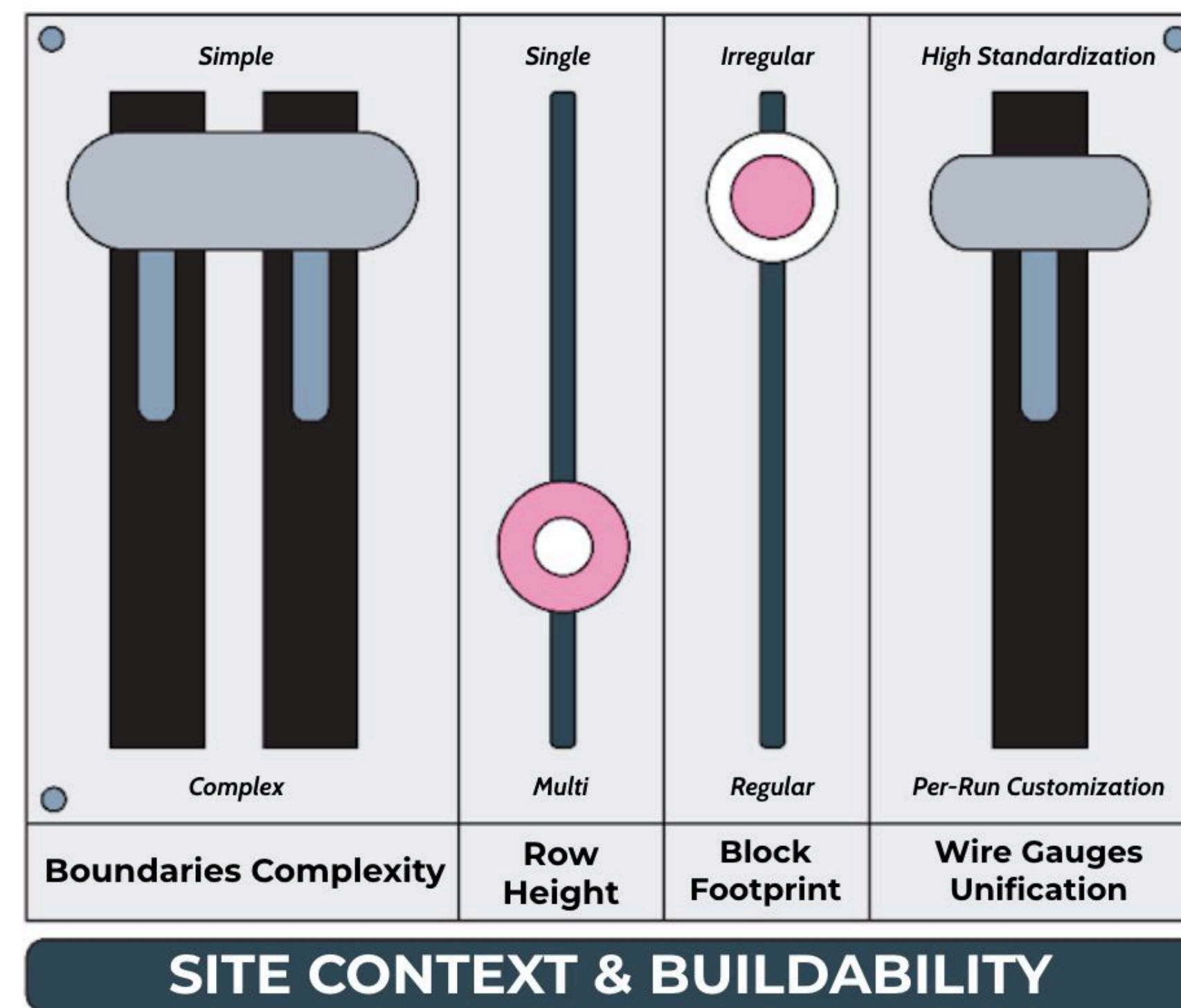
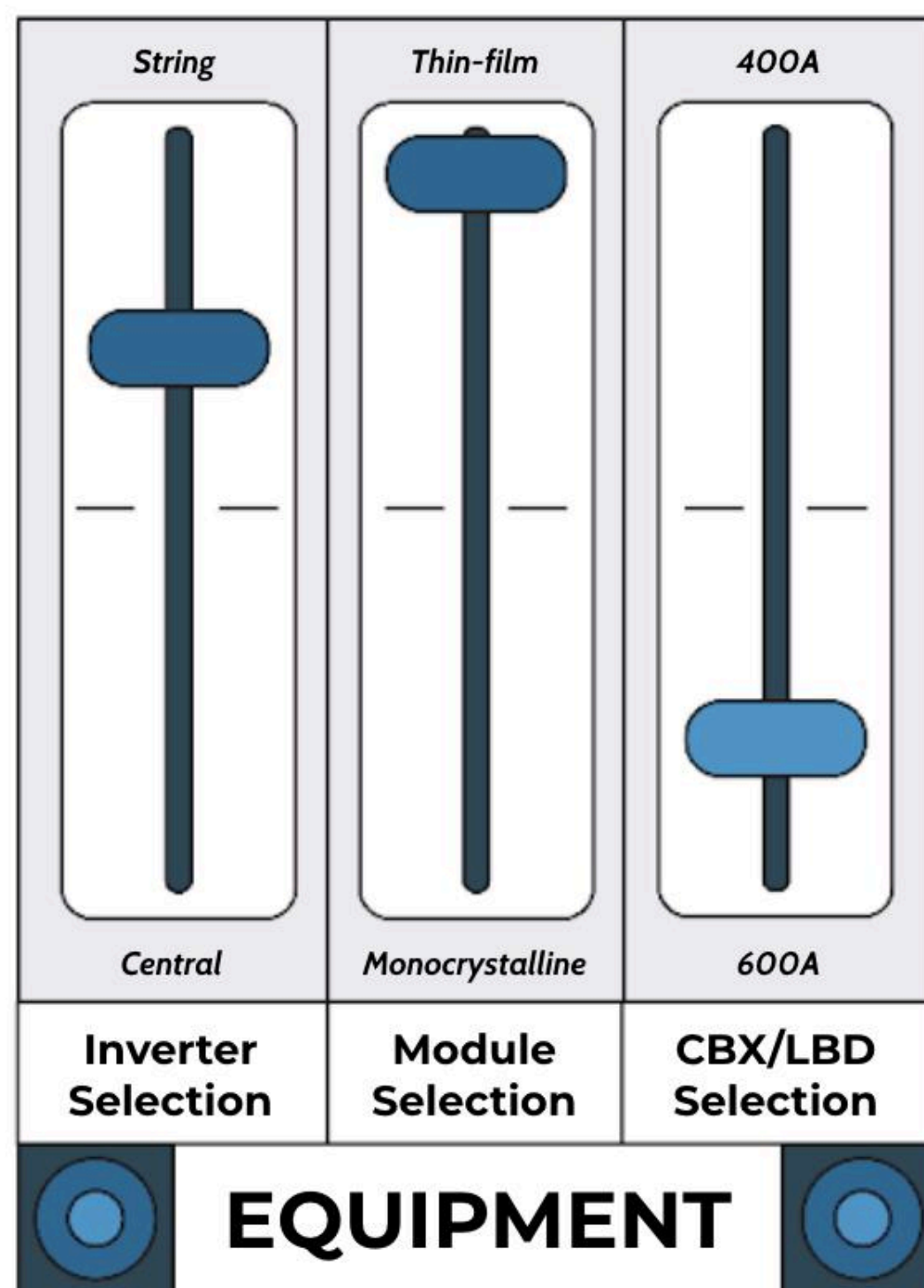
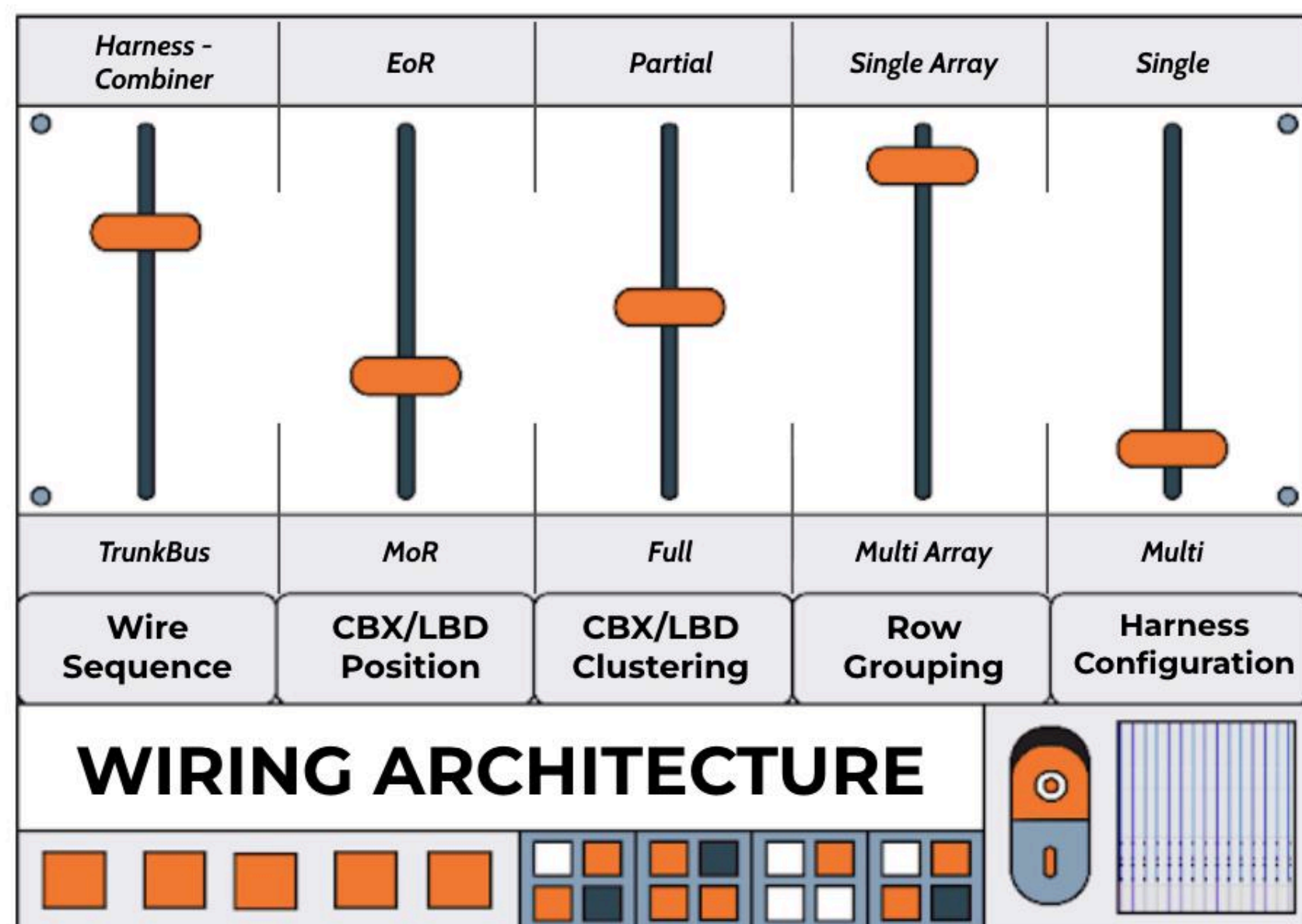
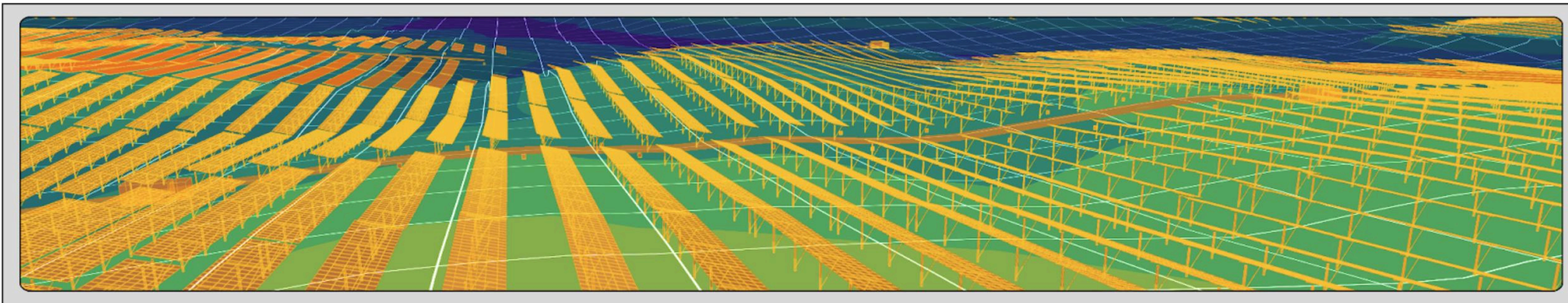


What are Needle Movers?

Every solar project has a handful of decisions that make or break success. These are the needle movers:

- the factors with the biggest impact on design outcomes;
- the risks and challenges you have to handle early;
- the handover points that can become bottlenecks;
- the strategies worth testing before you move too far forward.

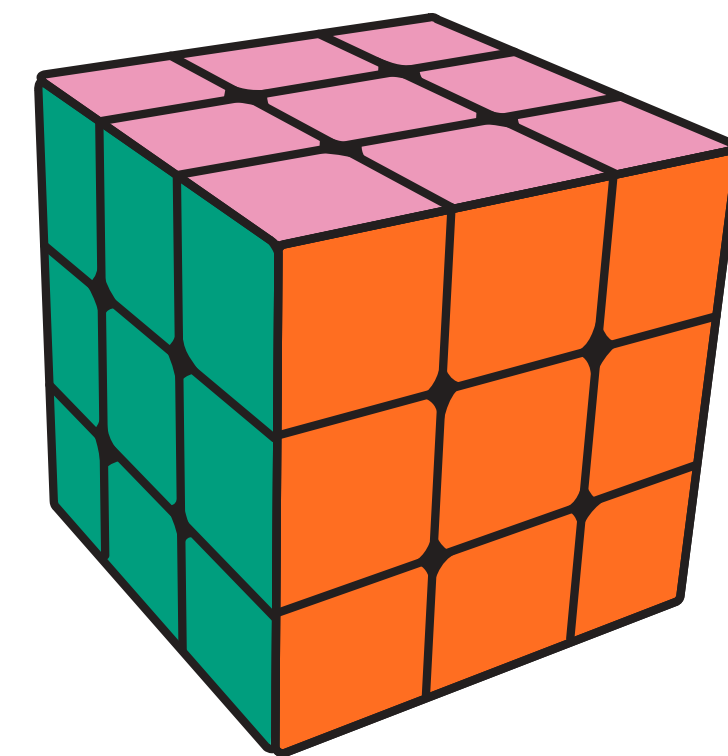
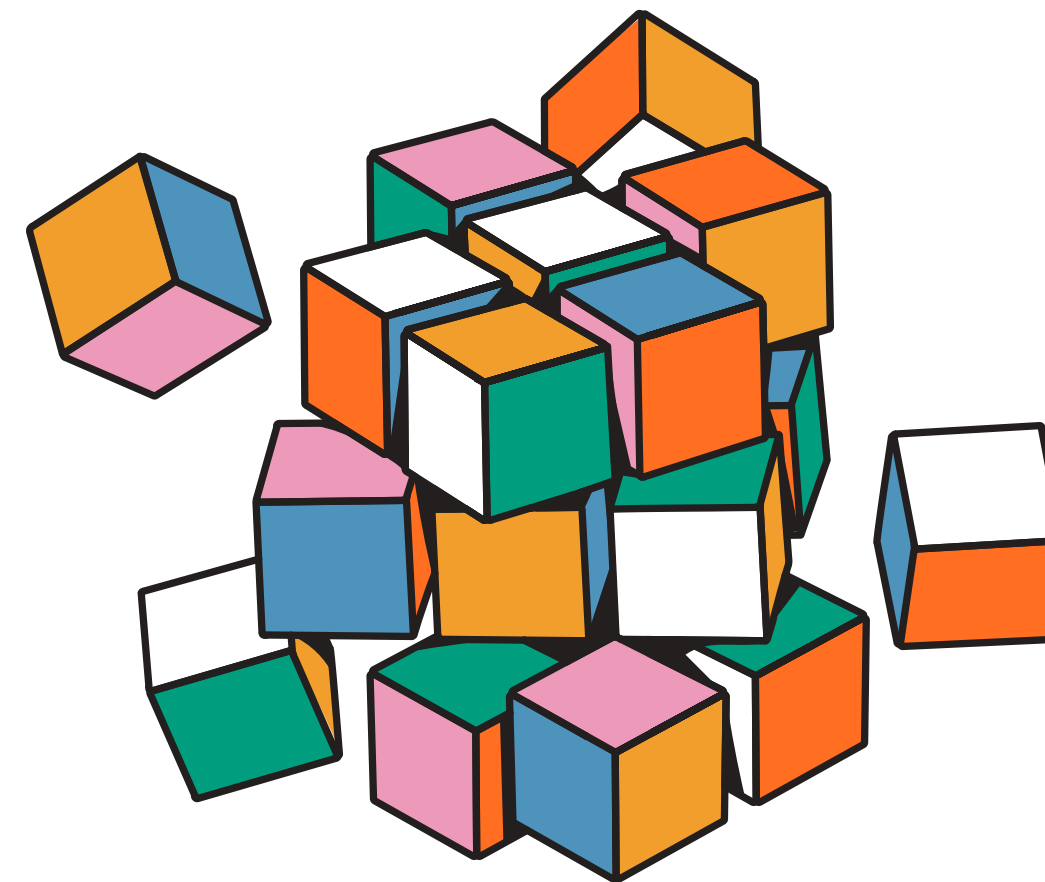




Controlled Comparison Method

Strengthens decision-making by avoiding misleading correlations

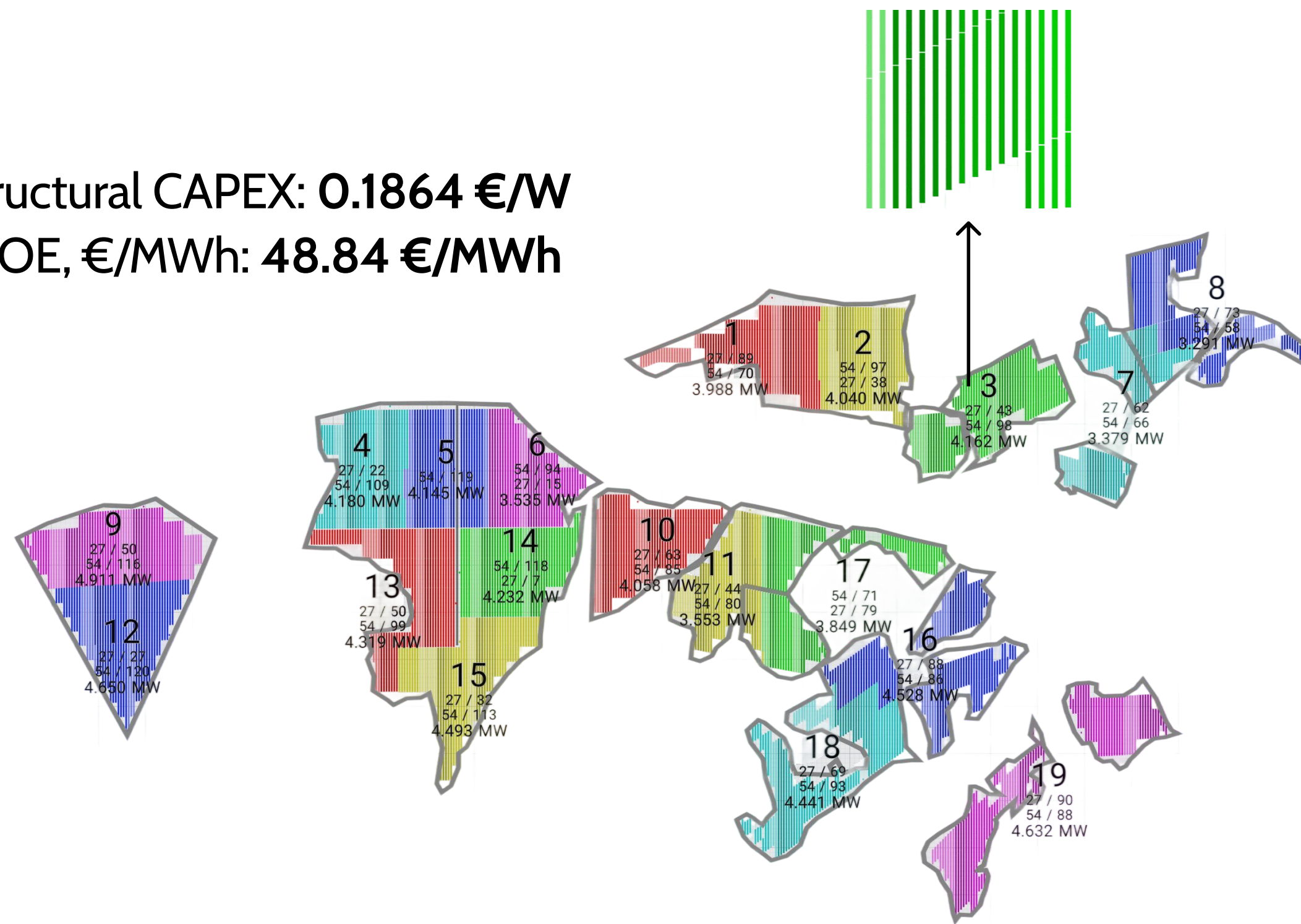
1. Lock all other variables and run best vs worst (or A vs B) scenarios for that parameter.
2. Normalize the result to €/W or € impact per MW.
3. Measure impact.



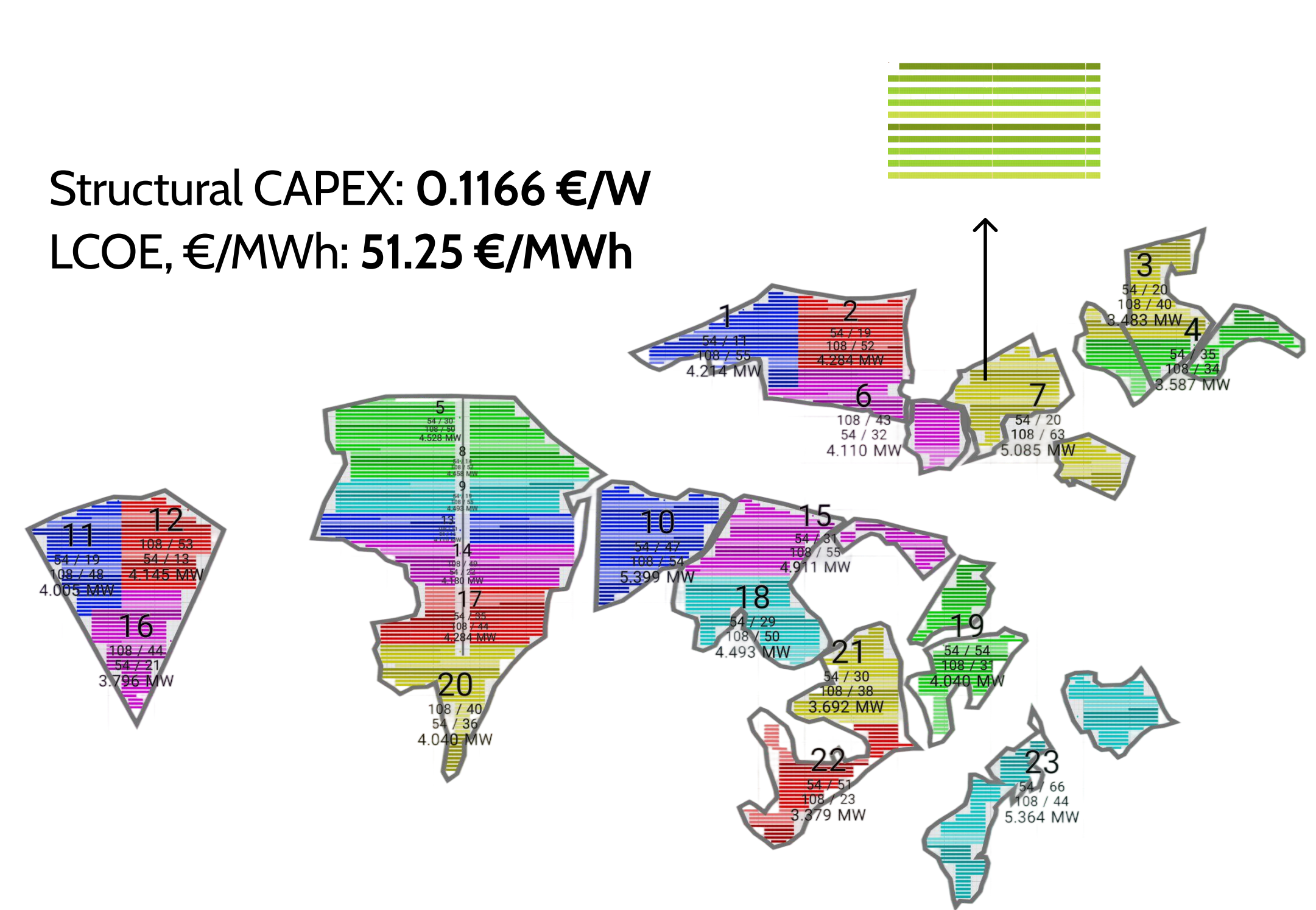
Structure Type

1P SAT vs 2P FT

Structural CAPEX: 0.1864 €/W
 LCOE, €/MWh: 48.84 €/MWh



Structural CAPEX: 0.1166 €/W
 LCOE, €/MWh: 51.25 €/MWh

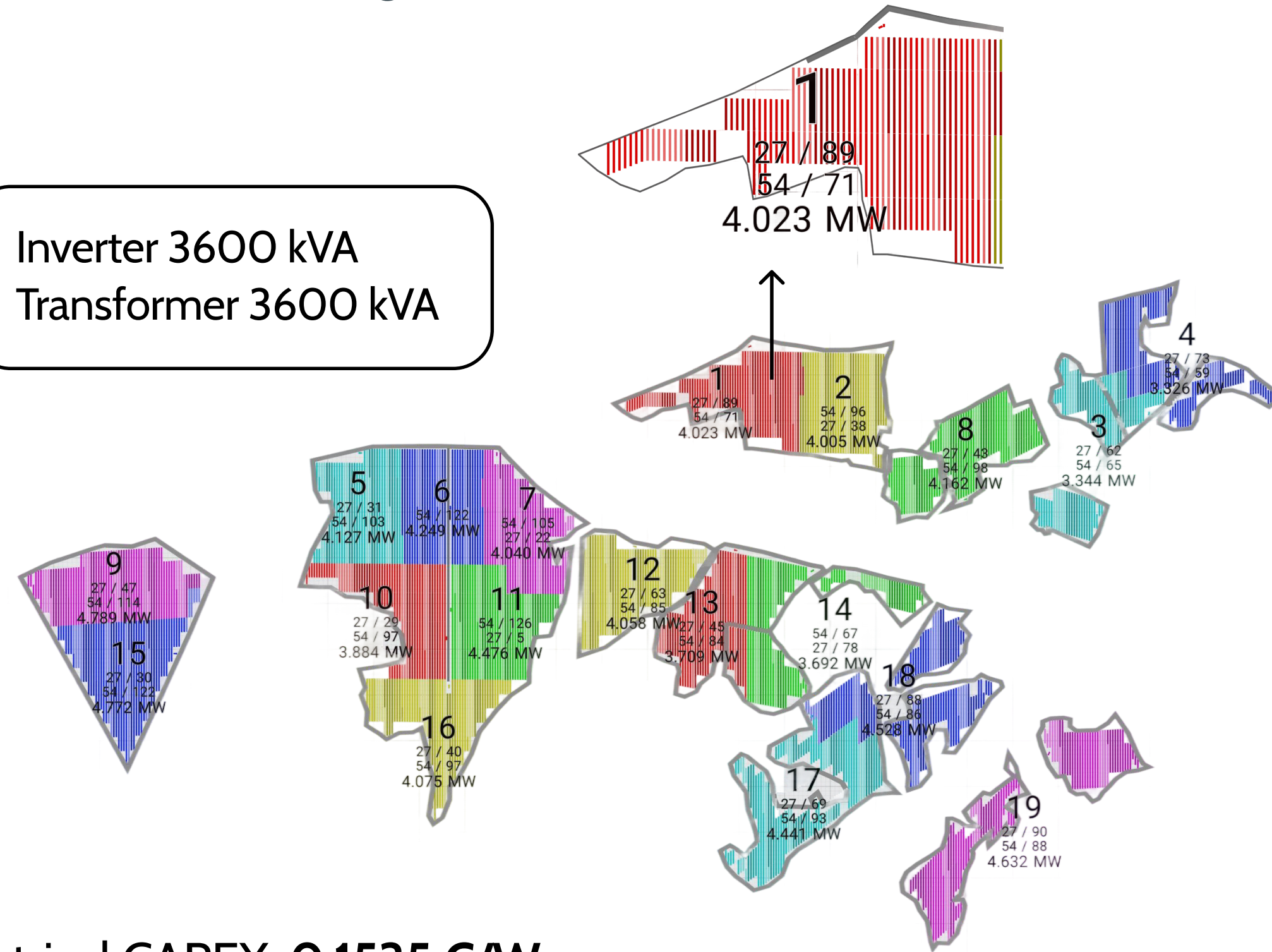


Saved €4.2M in structural cost for 2P FT, and yet LCOE is 2.1 €/MWh higher. Why?

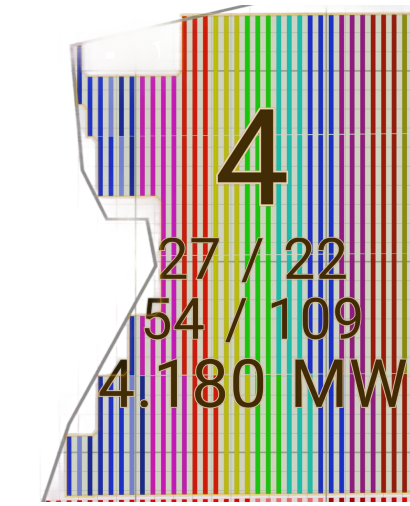
Inverter Type

Central vs String

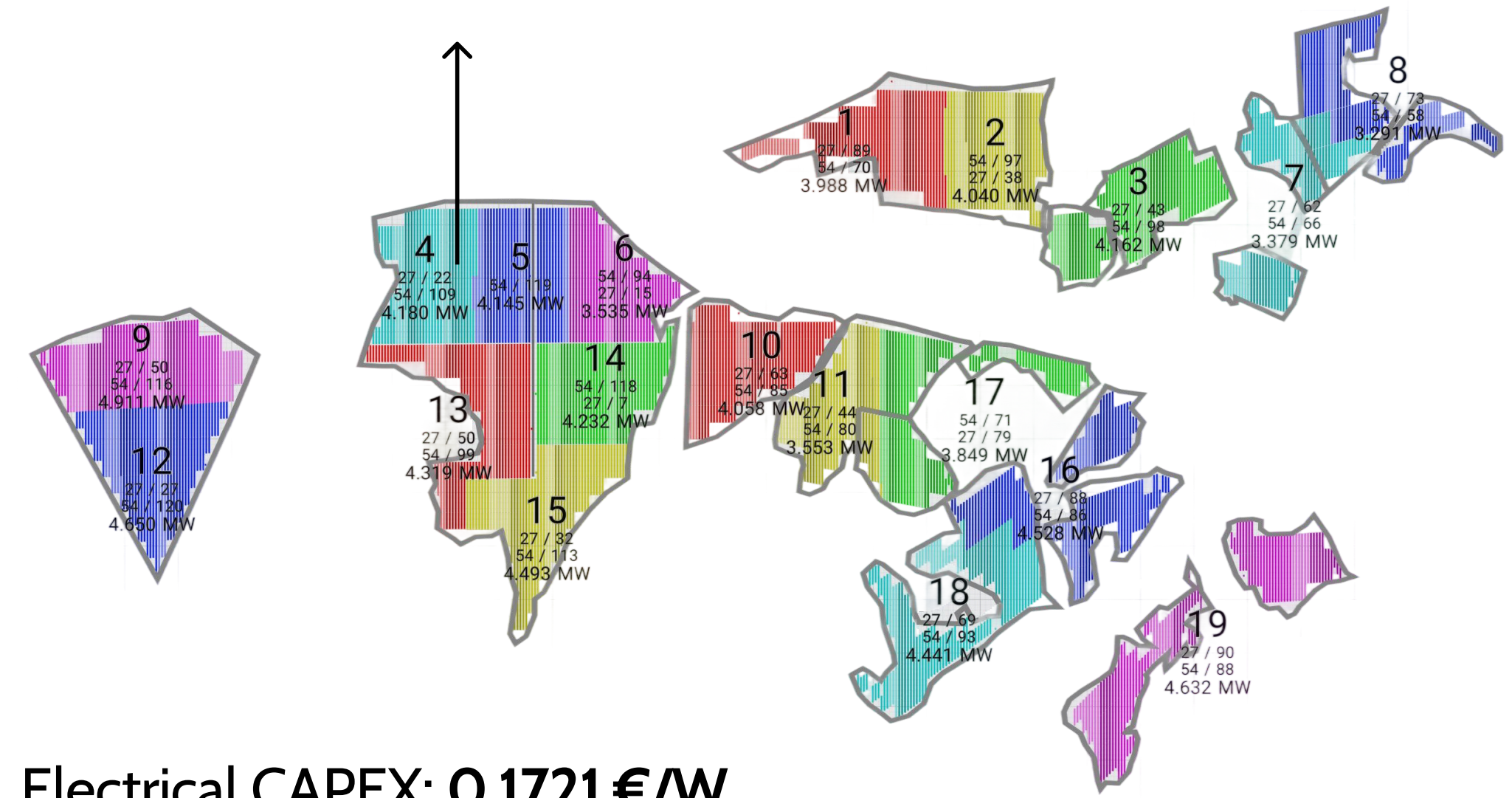
Inverter 3600 kVA
Transformer 3600 kVA



Electrical CAPEX: **0.1535 €/W**
LCOE, €/MWh: **47.06 €/MWh**



Inverter 350 kVA
Transformer 3600 kVA



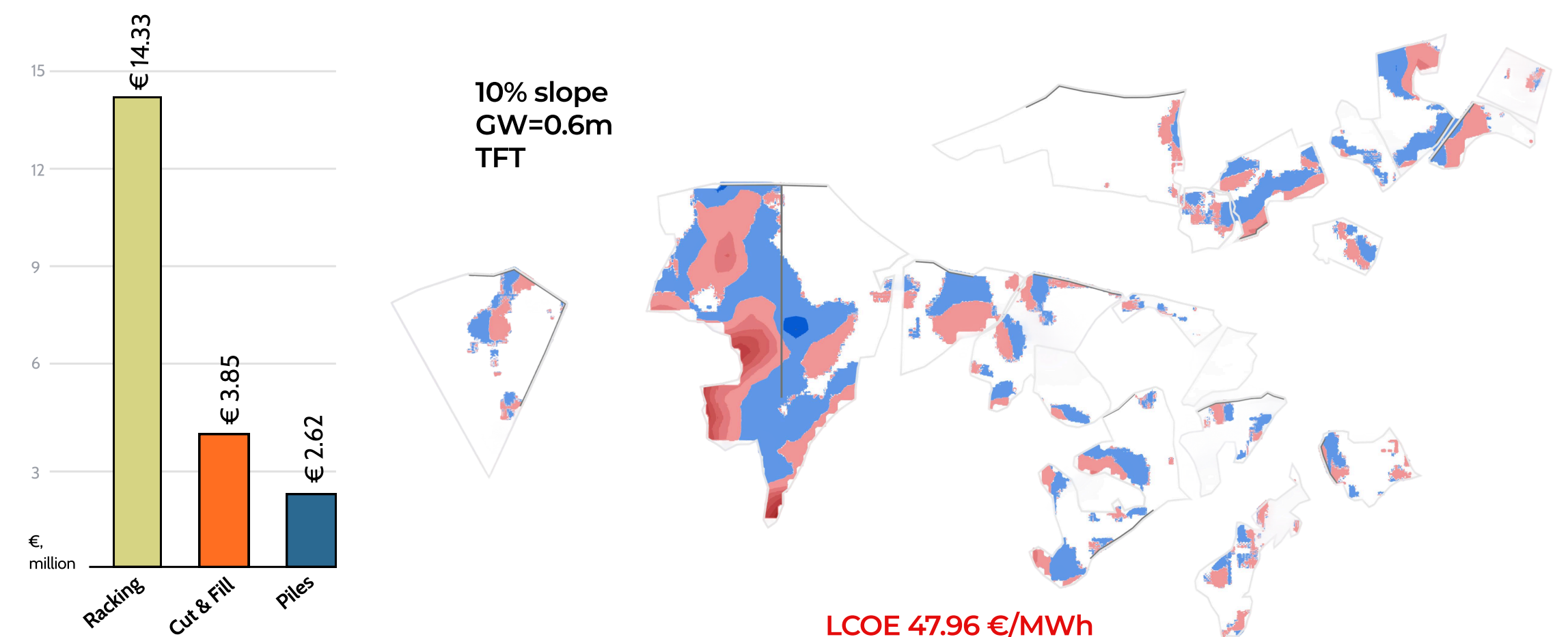
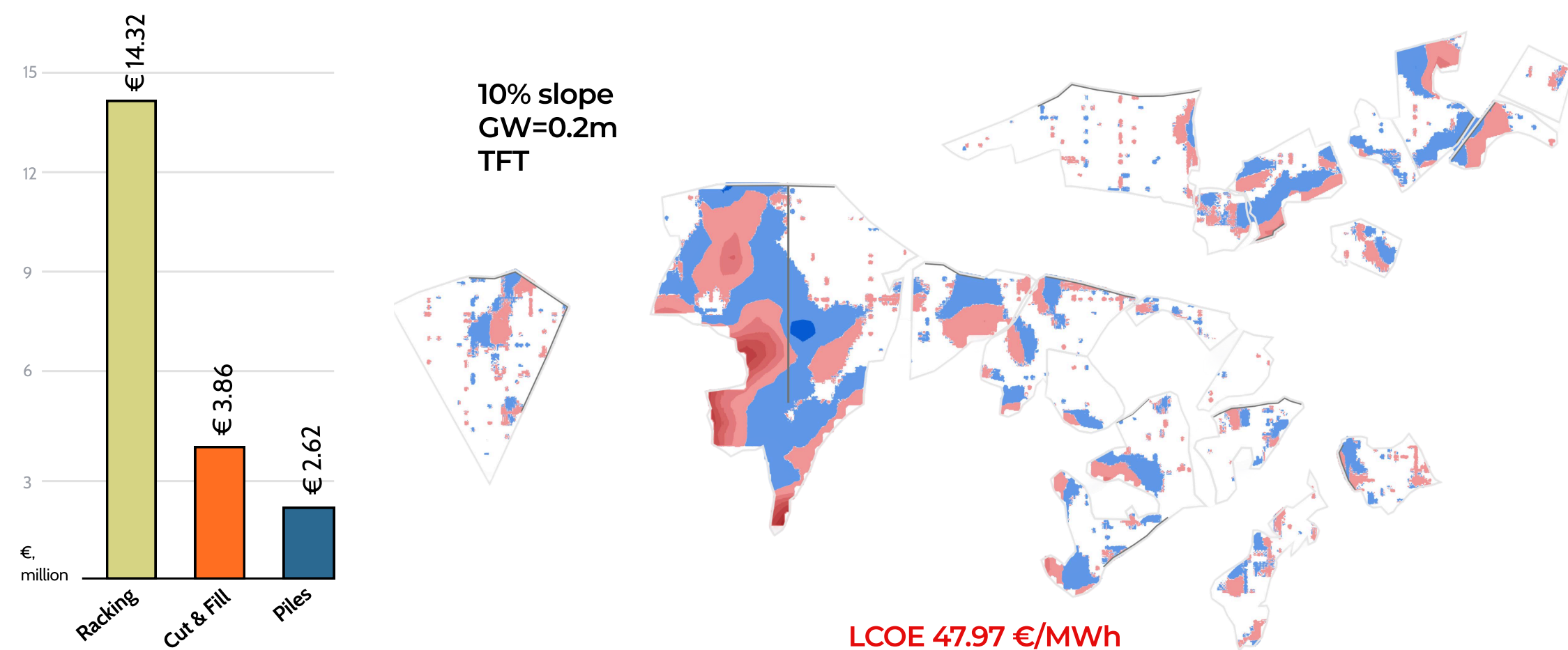
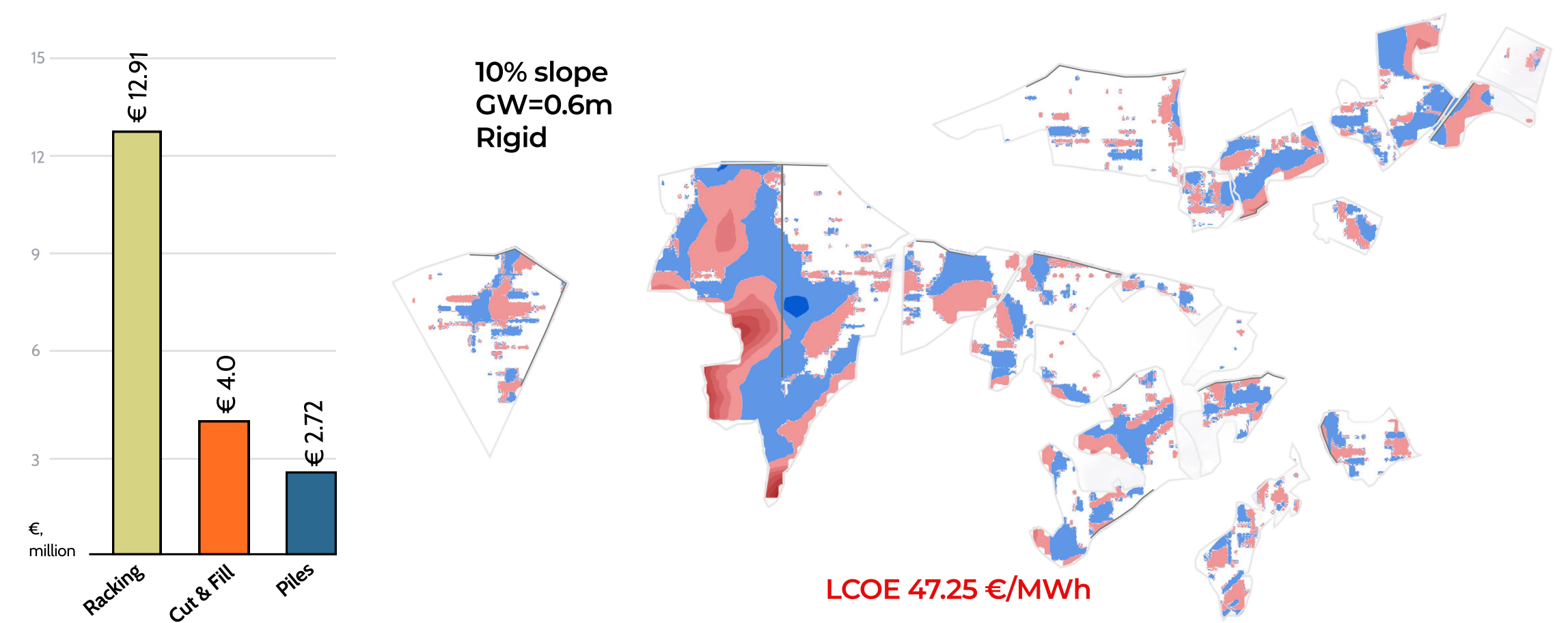
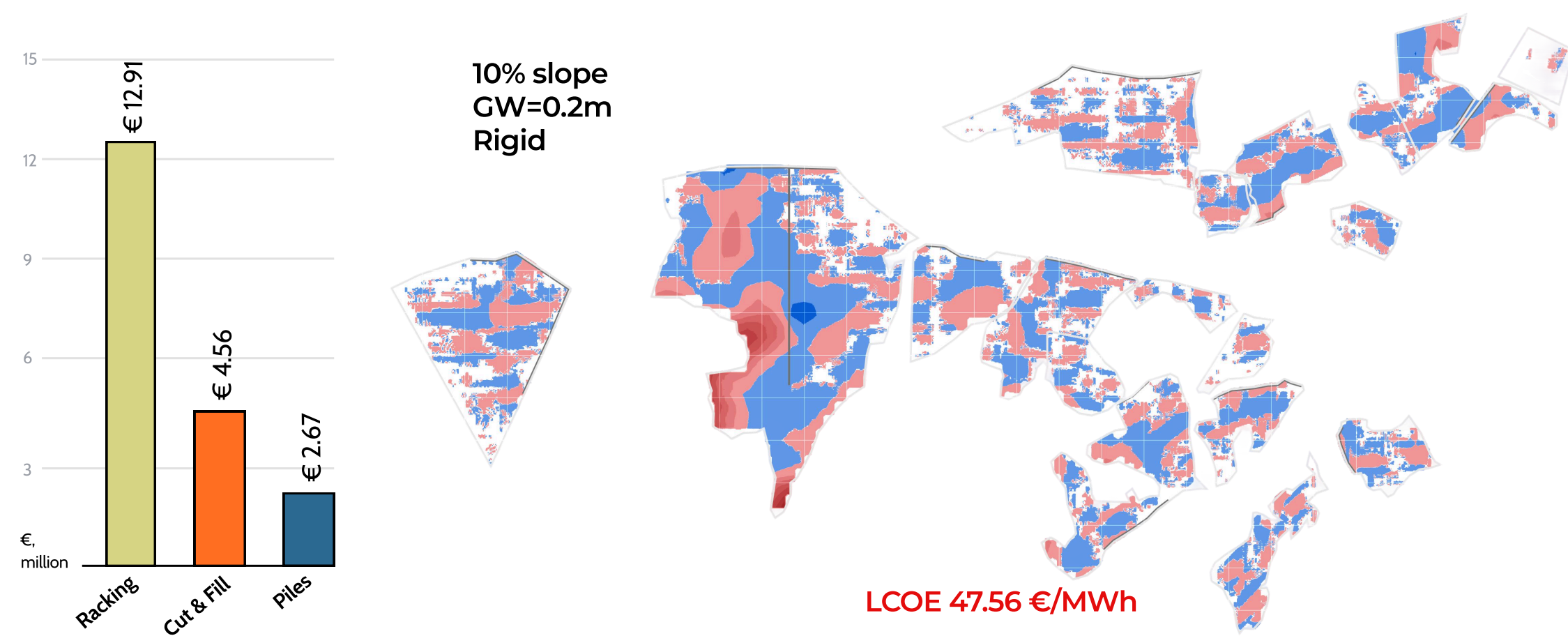
Electrical CAPEX: **0.1721 €/W**
LCOE, €/MWh: **48.84 €/MWh**

Using Central Inverters lowers EBOS cost by **10.83%** ; **€1.46M** saved

Grading Strategy

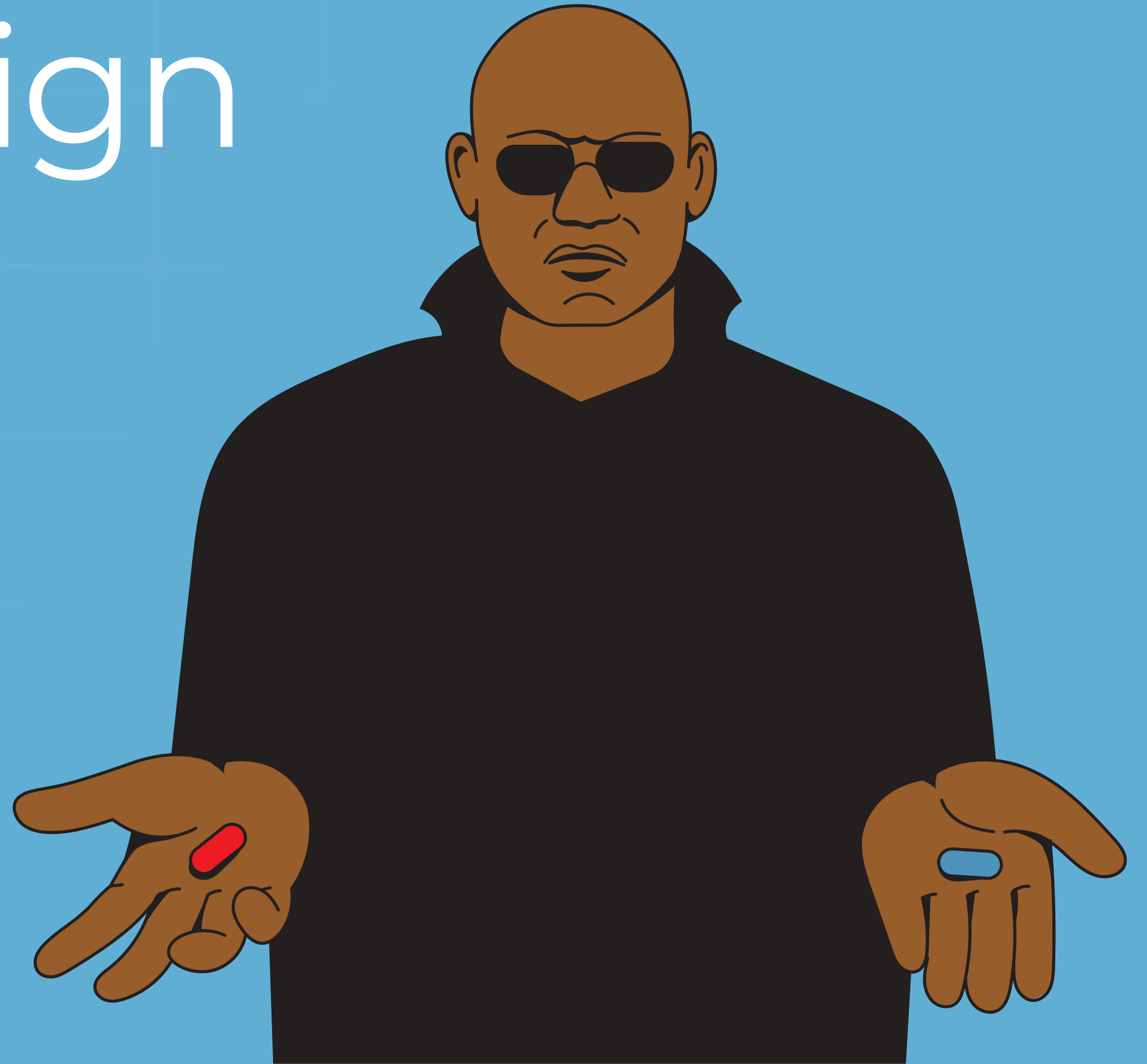
Grading Window & Undulation

Do Terrain-following trackers save cost on grading? Yes, but..



Defining Design Lock-In Risk

*Emphasizes the early anchor
decision vs. late-flex items.*



Lock-in Risk

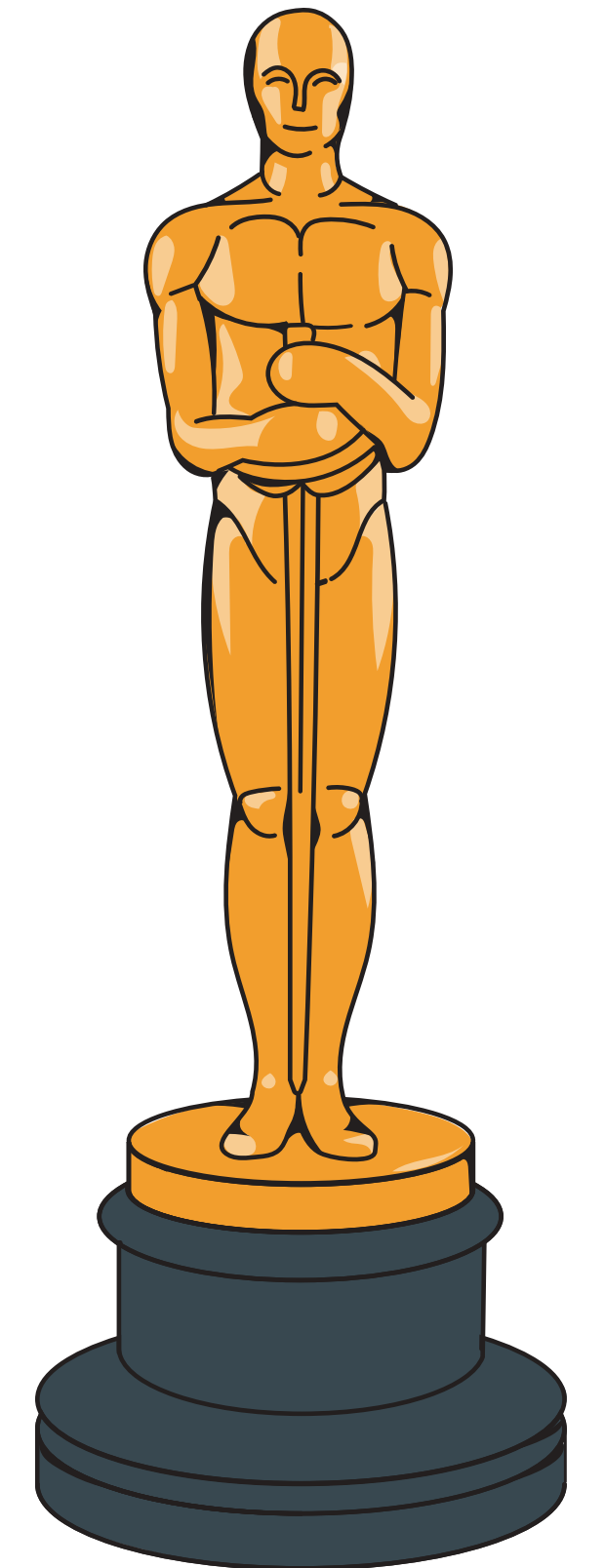
		<i>Design parameters</i>	<i>Feasibility</i>	<i>Conceptual/ Preliminary</i>	<i>RFP Design</i>	<i>Detailed design</i>	<i>Value</i>
Equipment	Inverter Type	0	1	0	0	3	
	Inverter Power	0	0	1	0	2	
	Module Selection	1	0	0	0	4	
	CBX/LBD Selection	0	0	1	0	2	
Wiring	CBX/LBD Position	0	0	1	0	2	
	Row Grouping	0	0	0	1	1	
Civil & Structural	Grading Strategy	0	0	1	0	2	
	Racking Selection	0	1	0	0	3	
	Undulation	0	0	1	0	2	
Site Context & Buildability	Boundaries Complexity	1	0	0	0	4	
	Wire Gauges Unification	0	0	0	1	1	
	Block Footprint	0	0	1	0	2	
	Row Height	0	1	0	0	3	

Cross-System Interaction

	Energy	Layout	Civil & Structural	Electrical	Procurement	<i>Value</i>
Inverter Type	1	1	0	1	1	4
Inverter Power	1	1	0	1	1	4
Module Selection	1	1	0	1	1	4
CBX/LBD Selection	0	0	0	1	1	2
CBX/LBD Position	0	0	0	1	0	1
Row Grouping	0	0	0	1	1	2
Grading Strategy	0	1	1	0	0	2
Racking Selection	1	1	1	1	1	5
Undulation	0	0	1	0	1	2
Boundaries Complexity	0	1	0	0	0	1
Wire Gauges Unification	1	0	0	1	1	3
Block Footprint	0	1	0	0	0	1
Row Height	0	1	0	0	0	1

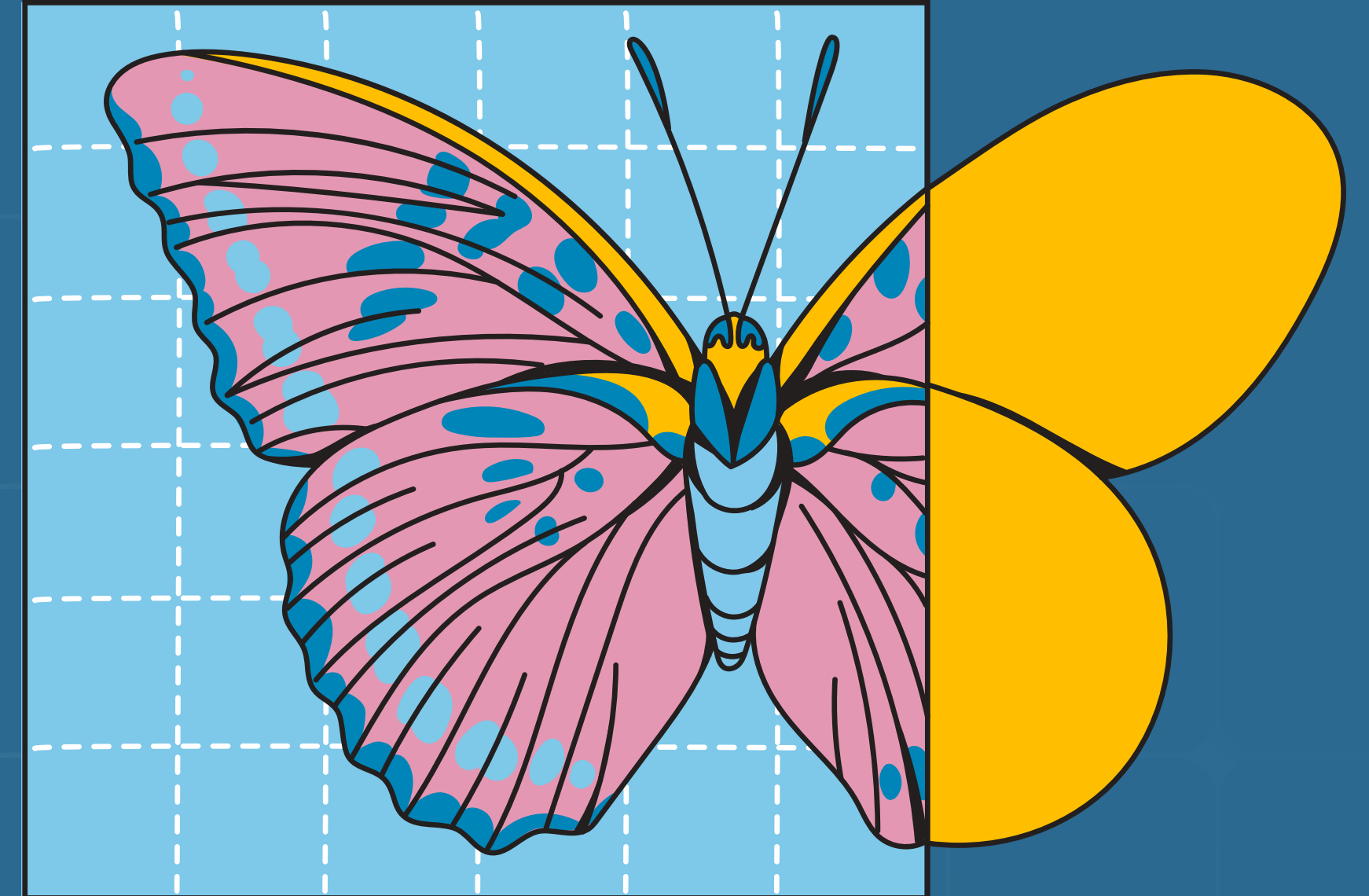
Scored Parameter List

<i>Electrical Parameters</i>	<i>Cost Impact</i>	<i>Lock-In-Risk</i>	<i>System Interaction</i>	<i>Total Score</i>
Module Selection	5	4	4	13
Racking Selection	4	3	5	12
Inverter Type	3	3	3	9
Inverter Power	2	2	4	8
Grading Strategy	3	2	2	7
Boundaries Complexity	2	4	1	7
Undulation	2	2	2	6
Row Grouping	3	1	2	6
CBX/LBD Selection	1	2	2	5
CBX/LBD Position	2	2	1	5
Wire Gauges Unification	1	1	3	5
Row Height	1	3	1	5
Block Footprint	1	2	1	4



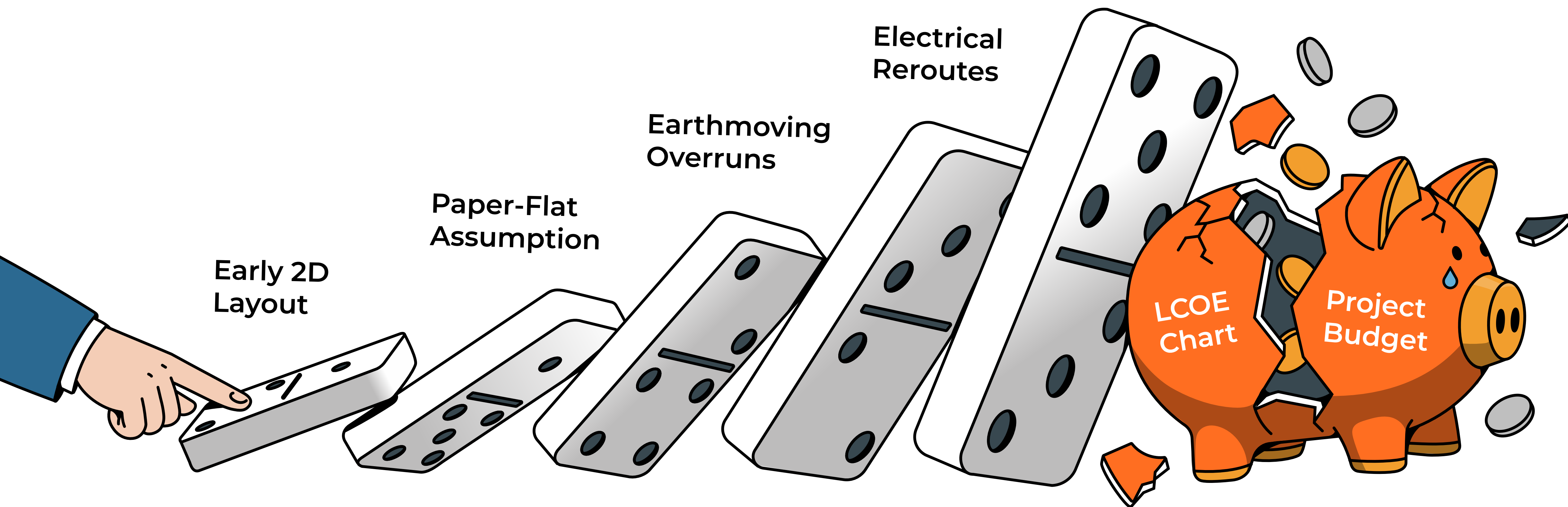
Phase 3: Detailed Design / IFC

*Consequence of early decisions
and Granular Optimization*



Consequence of Early Decisions

Early silos leads to Late-stage chaos



The Construction & O&M Reality



No more crisis management but...

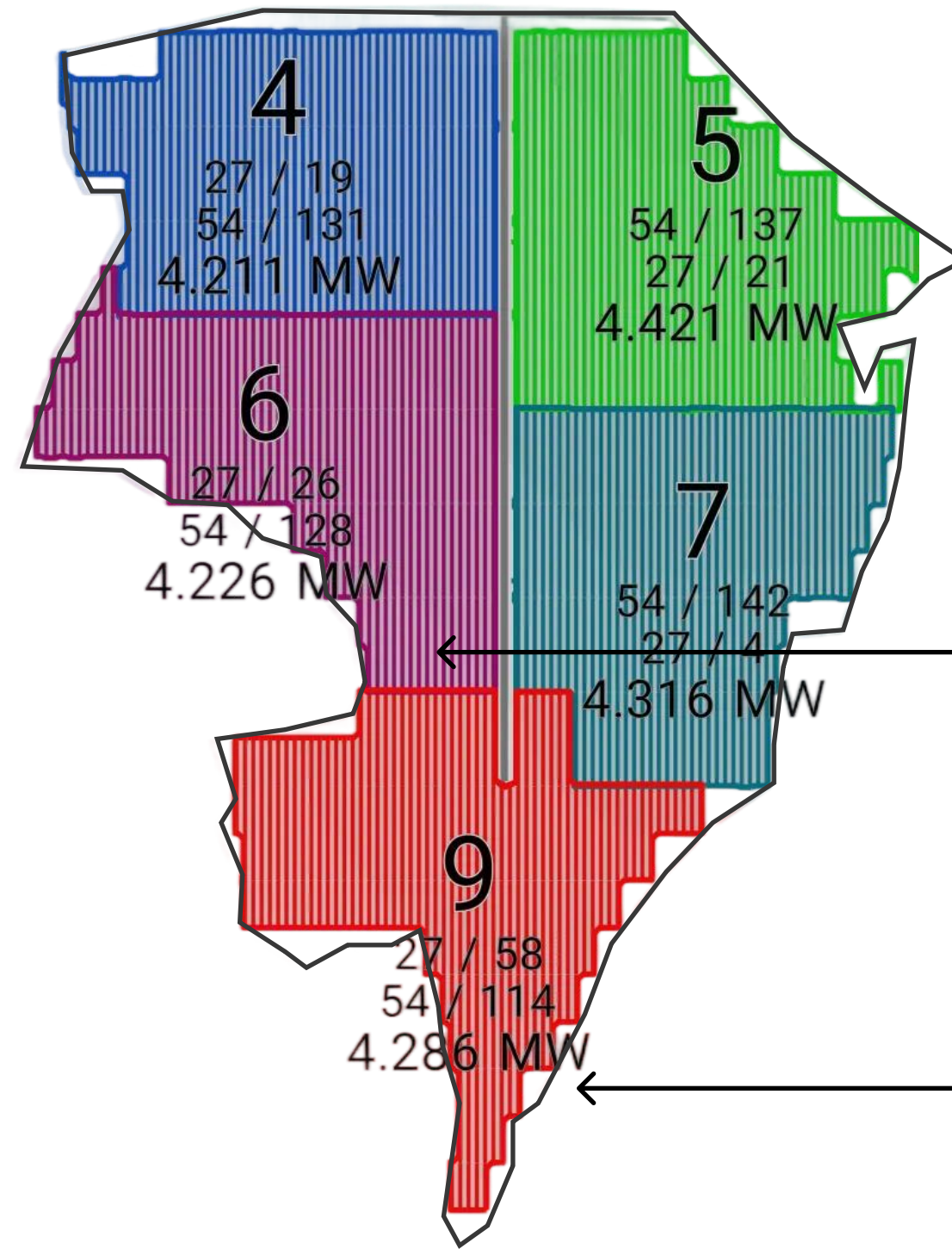
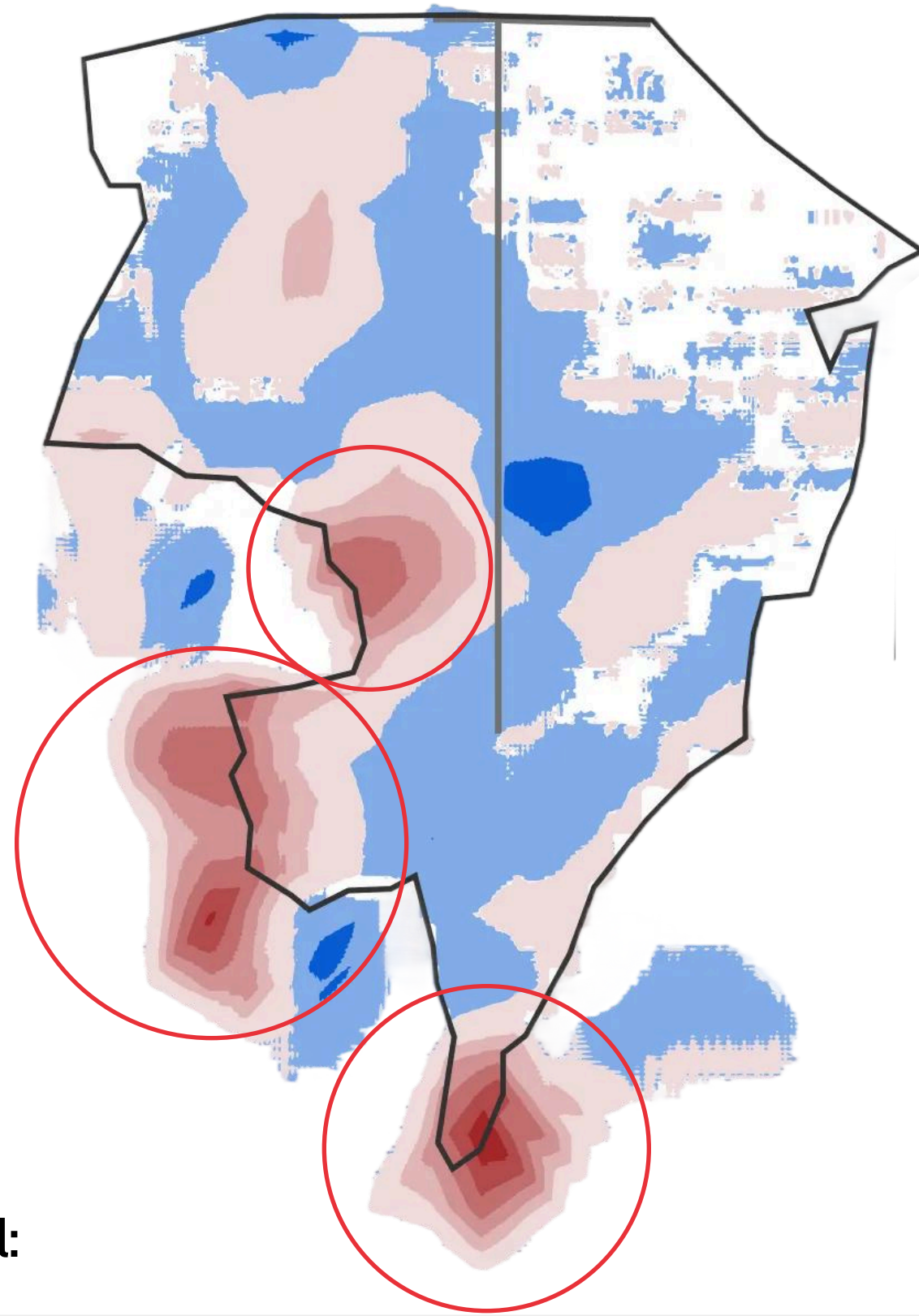
Granular Optimization

that secures true build-ability



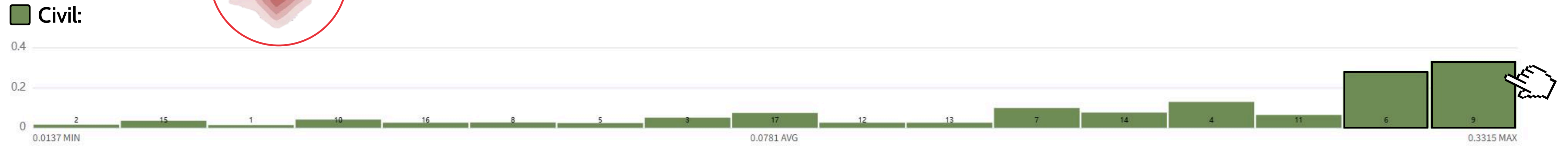
Granular Civil Cost Map

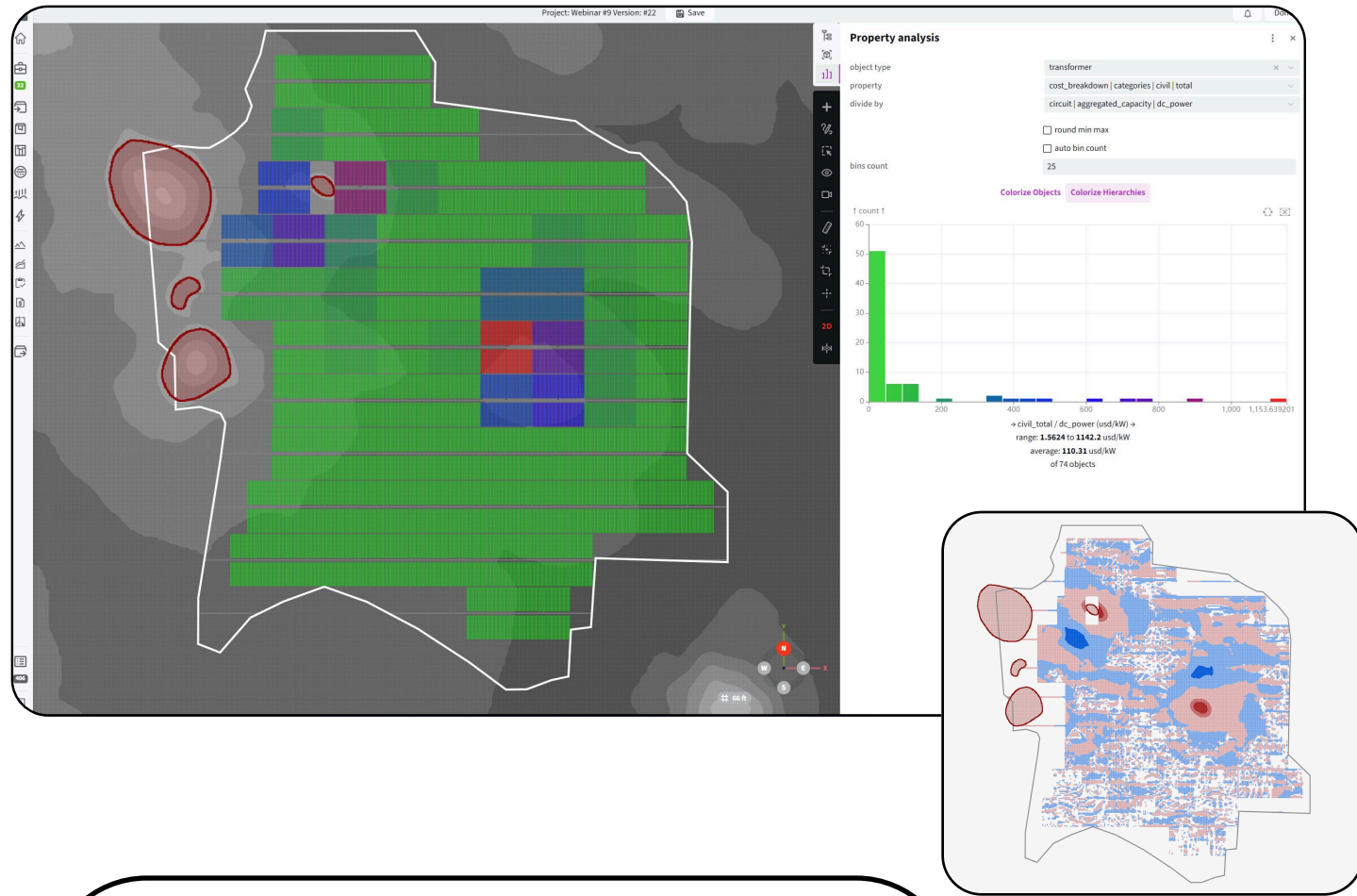
WHY is Civil expensive in these blocks?



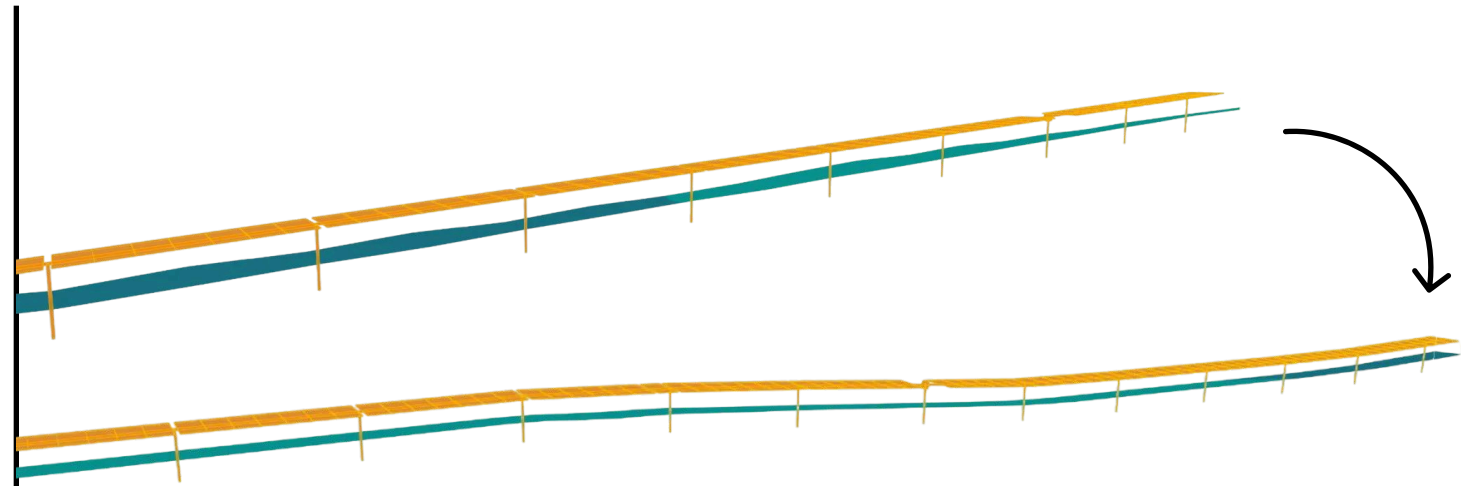
Grading: €/W 0.2658
 Roads: €/W 0.0134
 Total: €/W 0.2792
 Block: 6

Grading: €/W 0.3176
 Roads: €/W 0.0139
 Total: €/W 0.3315
 Block: 9



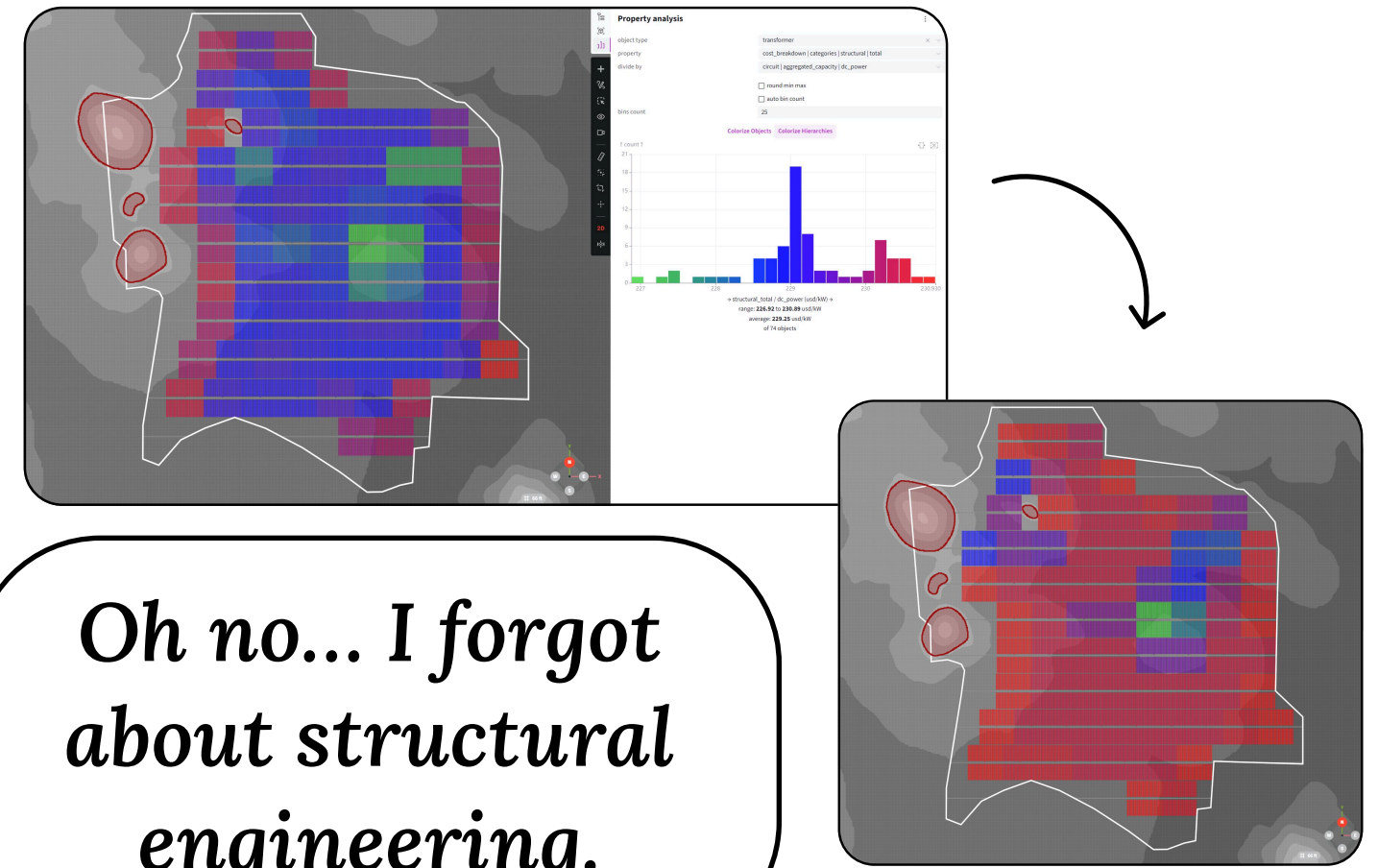


Civil is €6.3M,
need to chip it down!



Let's switch rigid trackers
to terrain-following

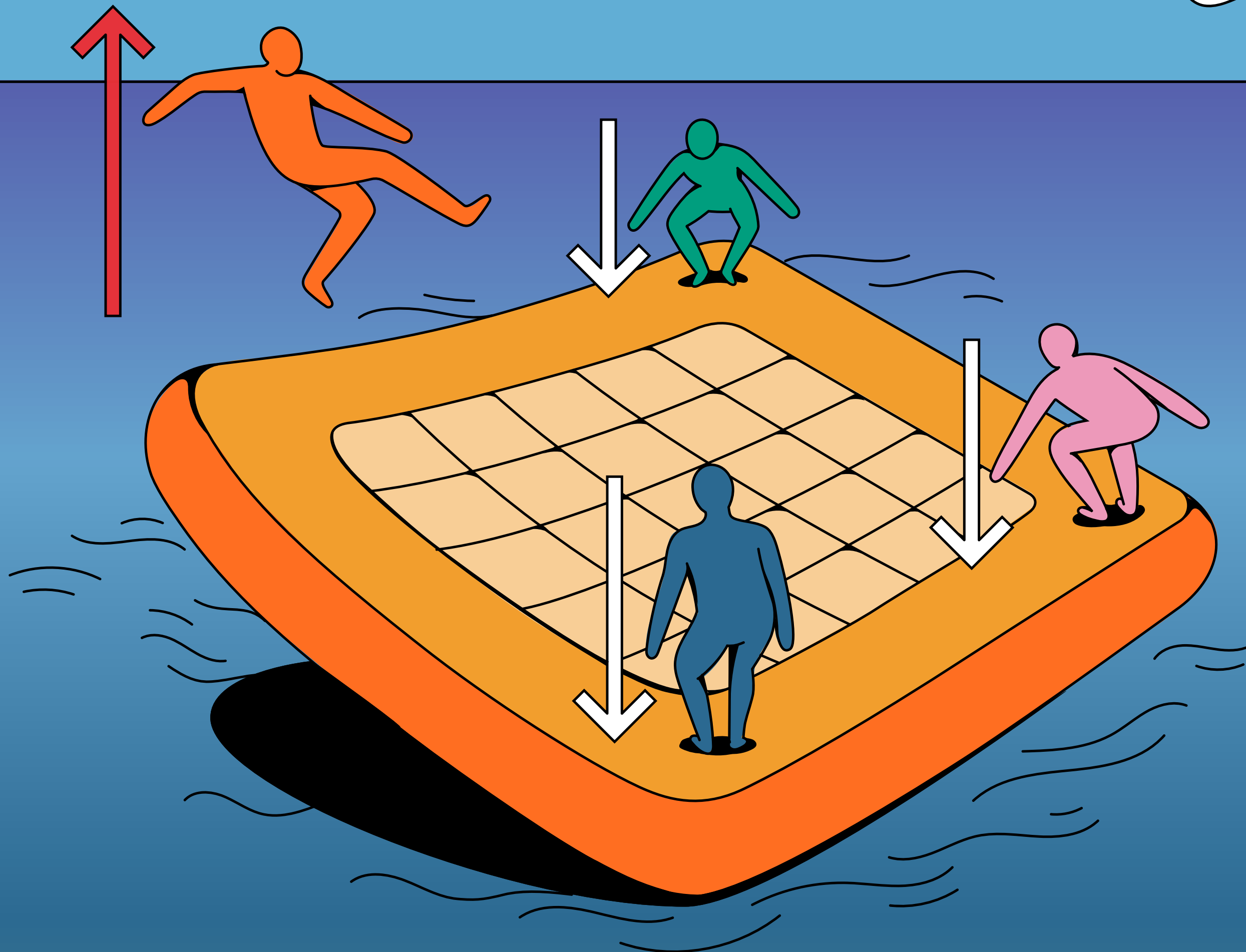
Wow, amazing!
Down to €5.6M.



Oh no... I forgot
about structural
engineering.

Was €15.5M but
now it's €16.9M





Waterbed Effect

*Push one metric down, another rises.
It's all connected*

How to manage it?

- More detail early
- Awareness of gaps
- Ability to foresee trade-offs

Closing Thought

Smart Tools and Equal Communication





Thank you!

Any questions?

