



Low cost, zero carbon

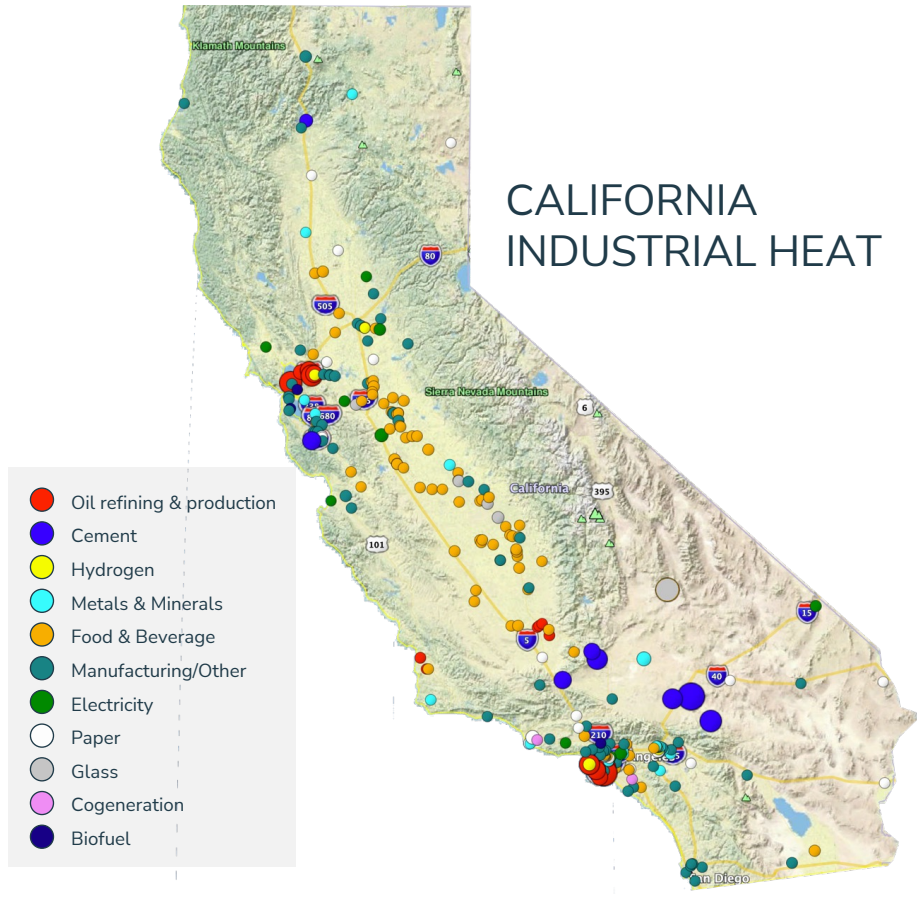
**HEAT** and SB596

OCTOBER 2022

# Rondo's cement industry partnerships



# CA uses more gas for process heat than electric power



California's carbon neutrality mandates require industry to shift to zero-carbon energy. **Fast.**

California can **decarbonize, not deindustrialize.**

**Electrification** is, for sure, the least cost pathway.

**In state renewables can replace imported fossil fuels.**

**100 GW** of new wind and solar + heat batteries is needed to deliver the heat that currently emits 70mmt CO<sub>2</sub>/yr

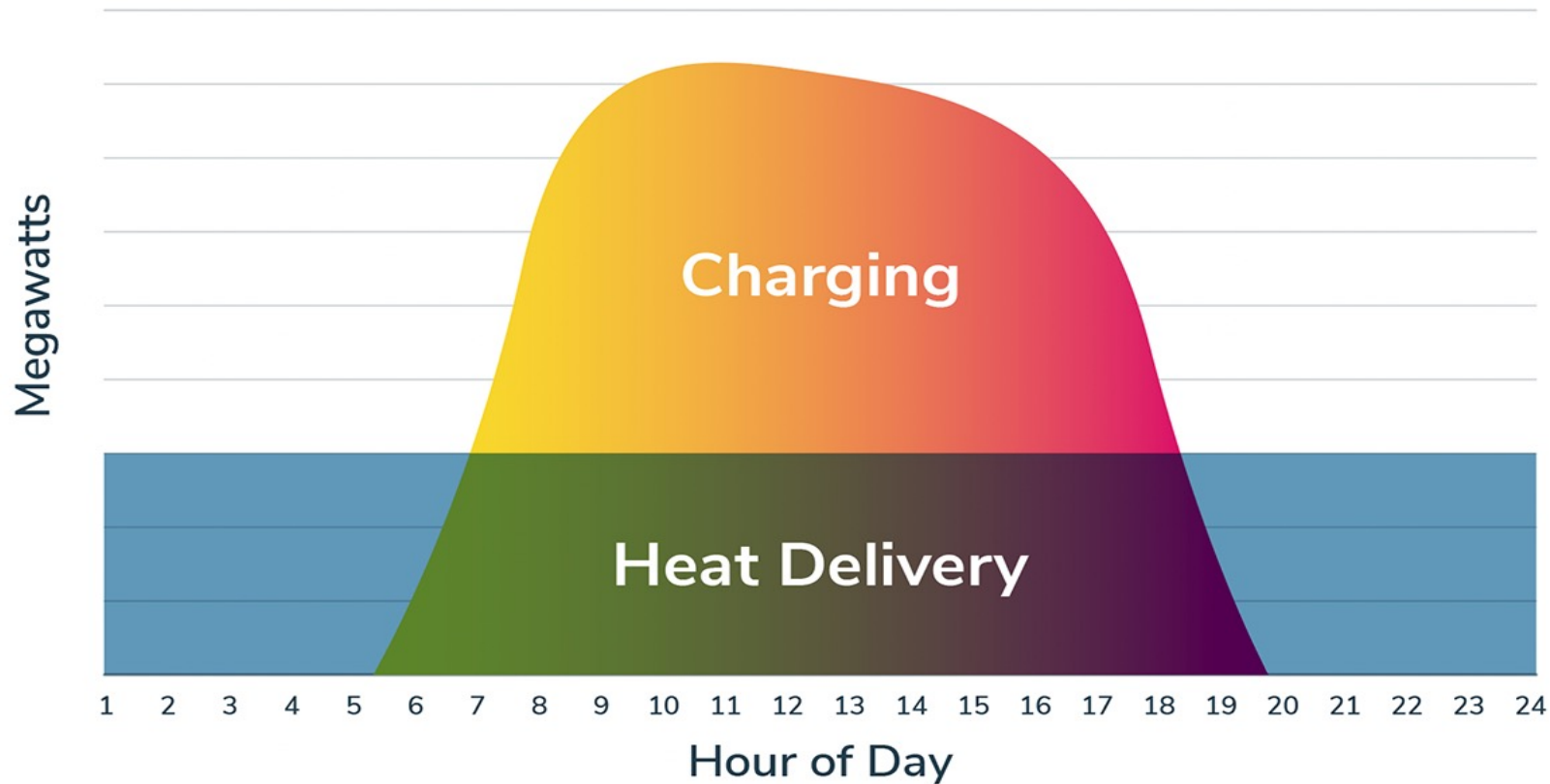




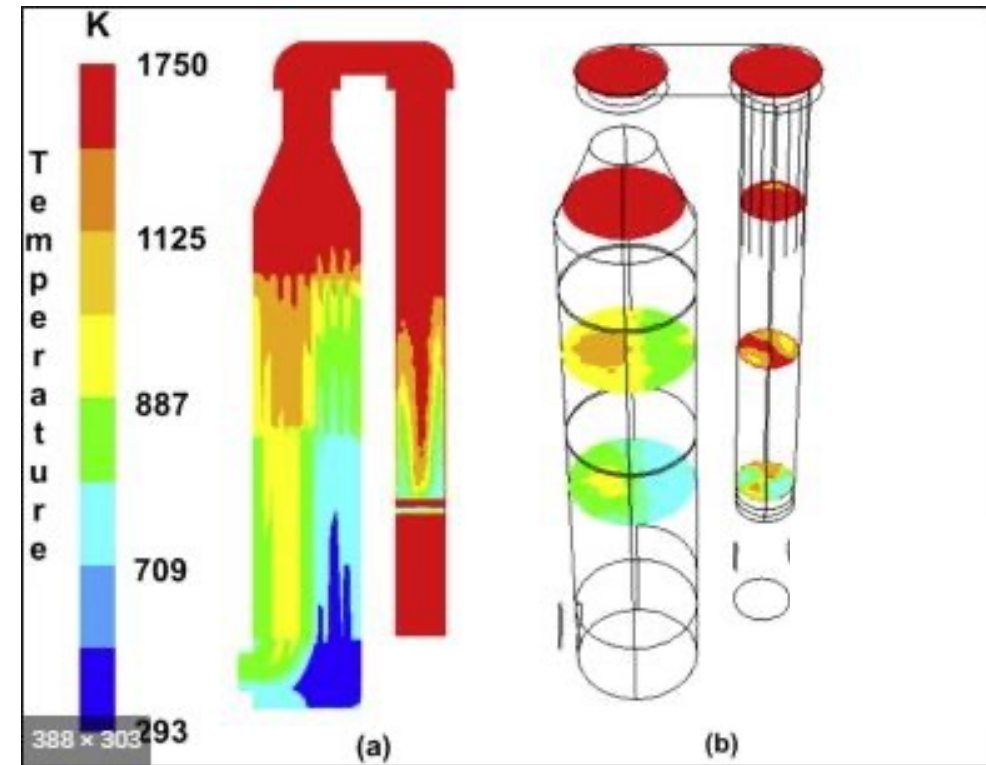
**Intermittent** wind and solar power now provide the **lowest cost energy in history**



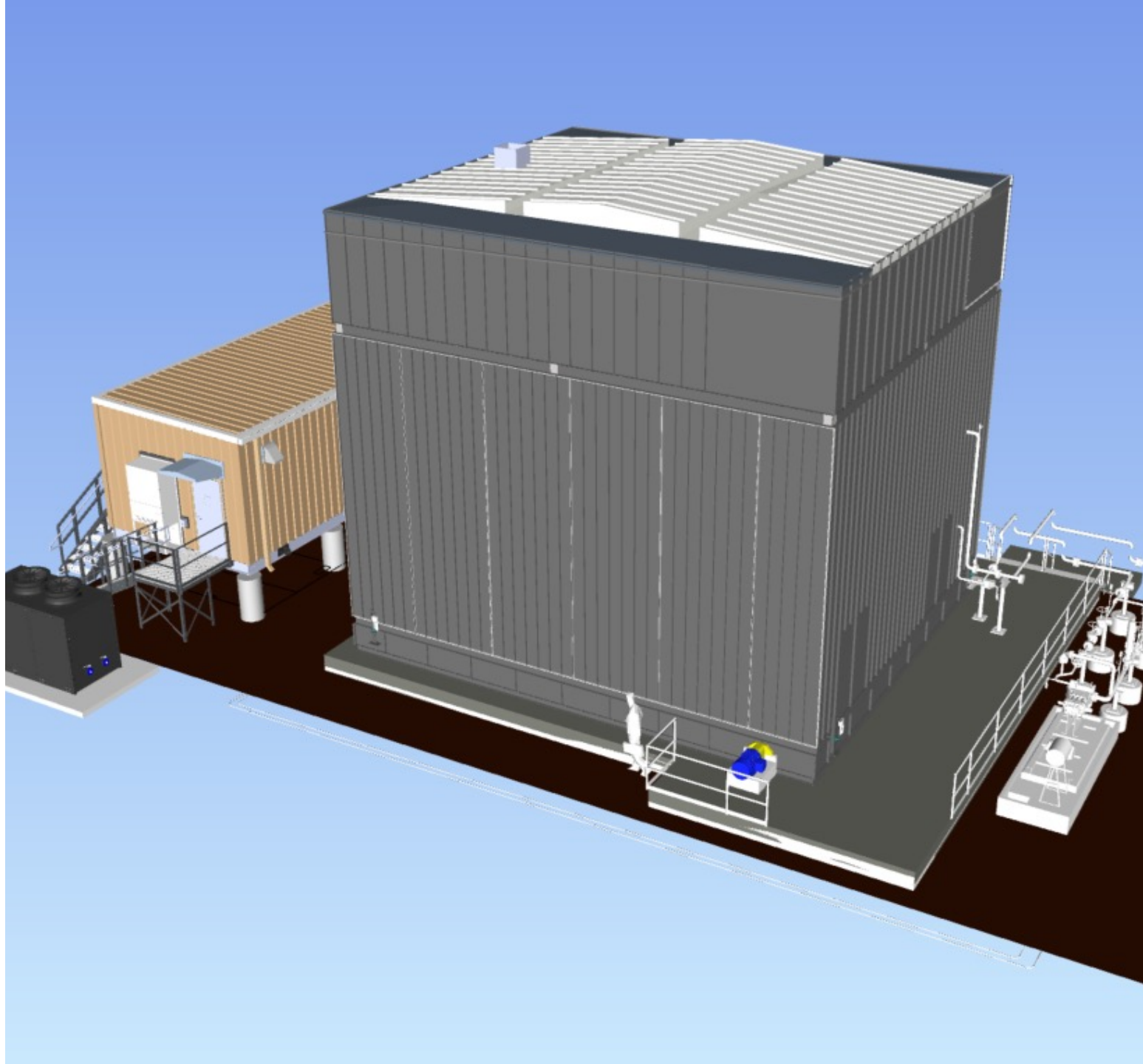
But intermittent power needs to be **stored as heat** and delivered **continuously** for industrial use



# Steel Mills Have Been **Storing Heat** for 200 Years

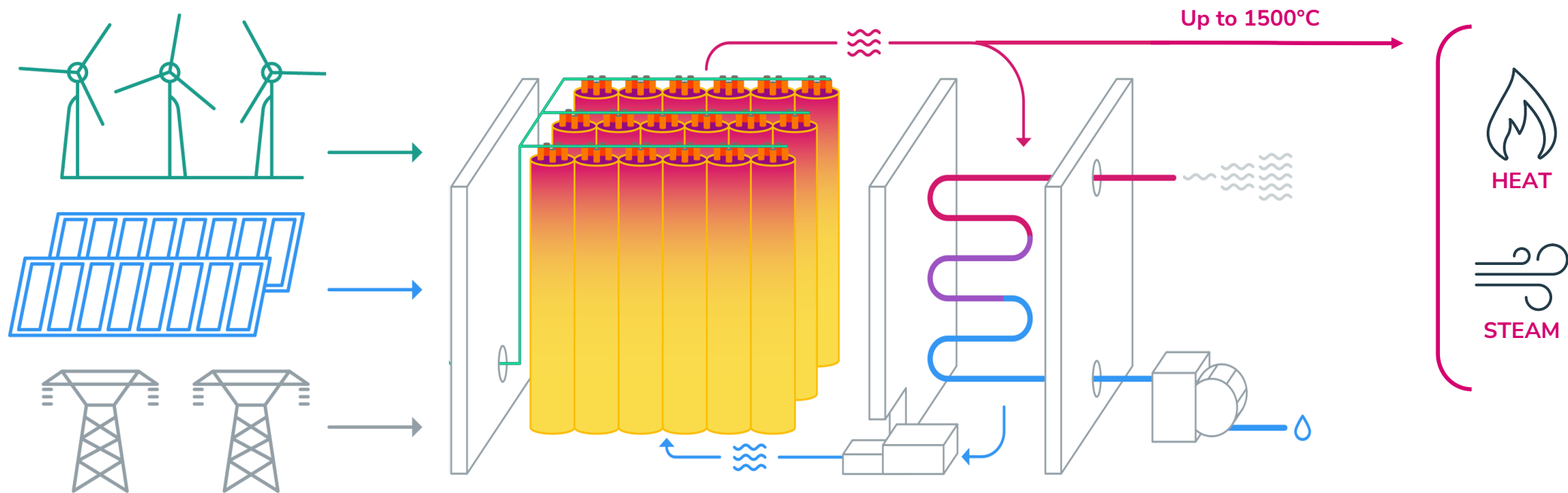


# Our solution: The Rondo Heat Battery





# The Rondo Heat Battery is a drop-in, zero-carbon replacement for industrial boilers and furnaces

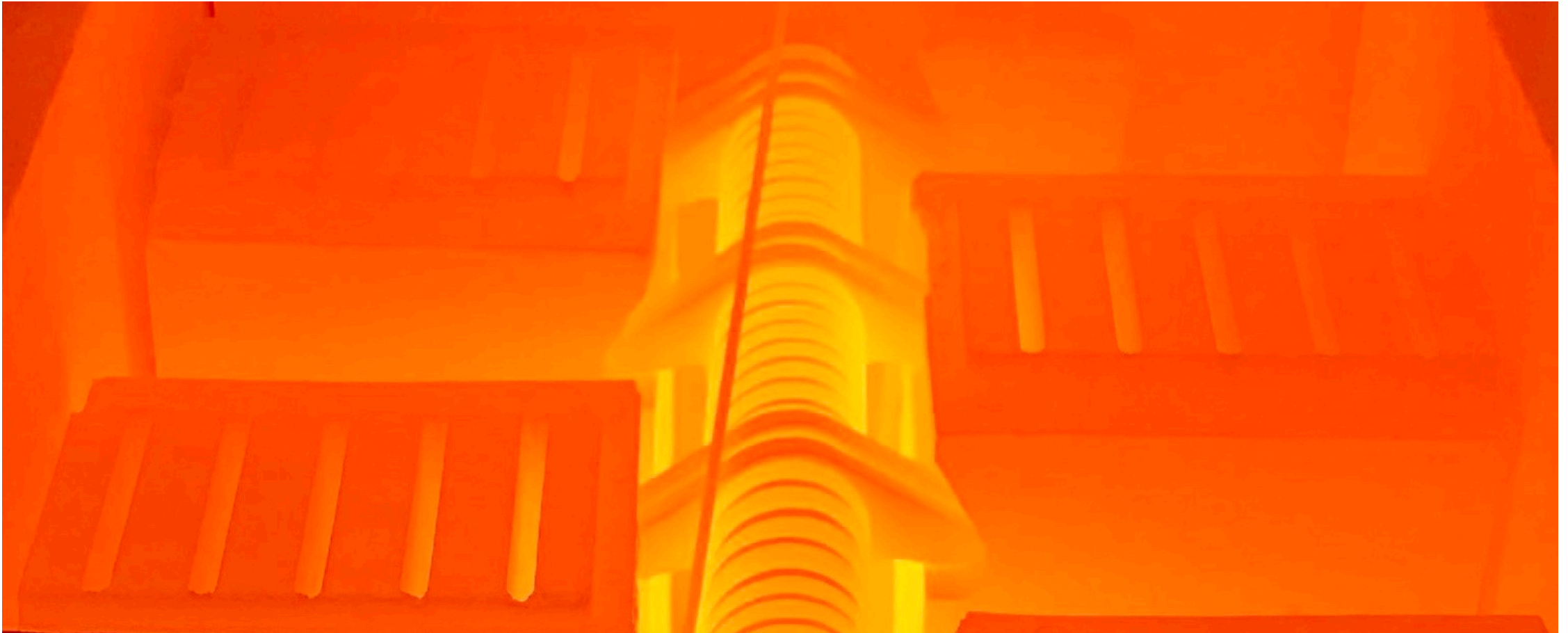


1 The Rondo Heat Battery charges with **intermittent electricity** from local wind & solar or from the grid.

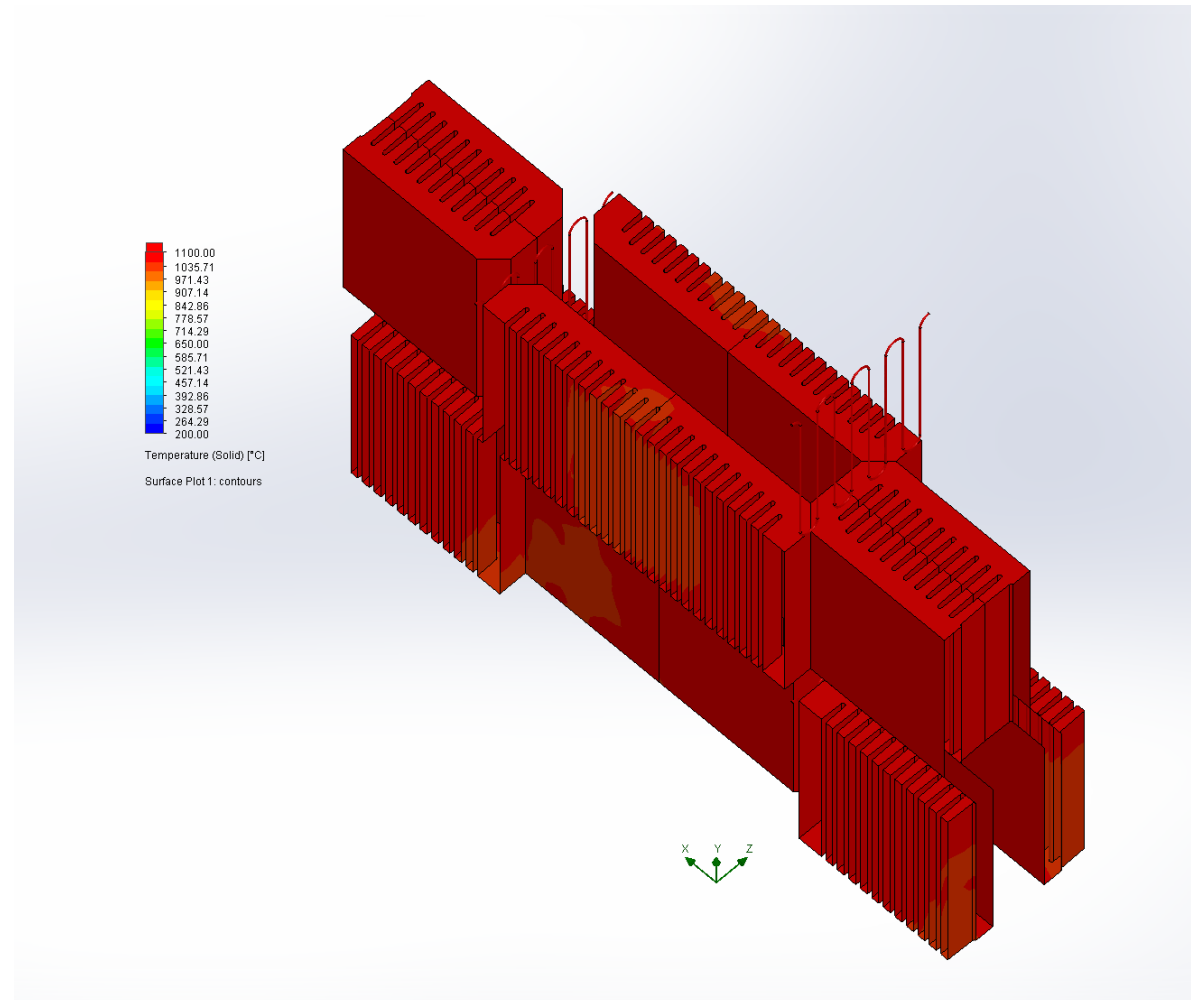
2 Electricity powers radiant heaters with zero loss. Refractory brick is rapidly, uniformly heated to **1100 - 1500 °C**, and stores heat for hours or days.

3 The battery delivers **continuous superheated air** for use as process heat, steam, or electric power at over 98% total efficiency.

Century-proven materials store electricity as **heat**.  
Superheated **brick** efficiently holds energy for **days**.



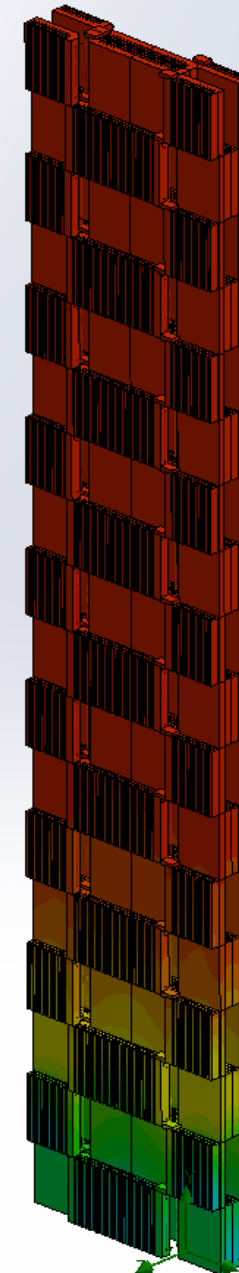
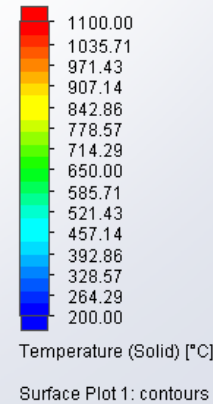
# Rondo's **breakthrough design** heats material rapidly and uniformly up to **1500°C**



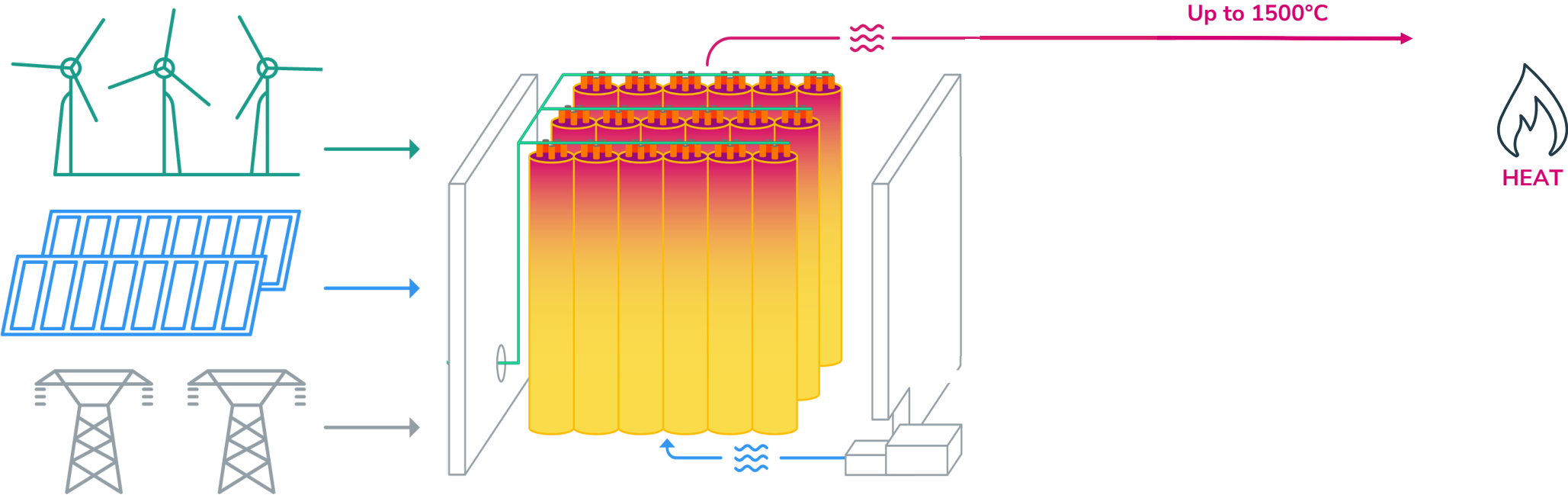


Convection flow delivers  
24x7 high temperature  
heat output

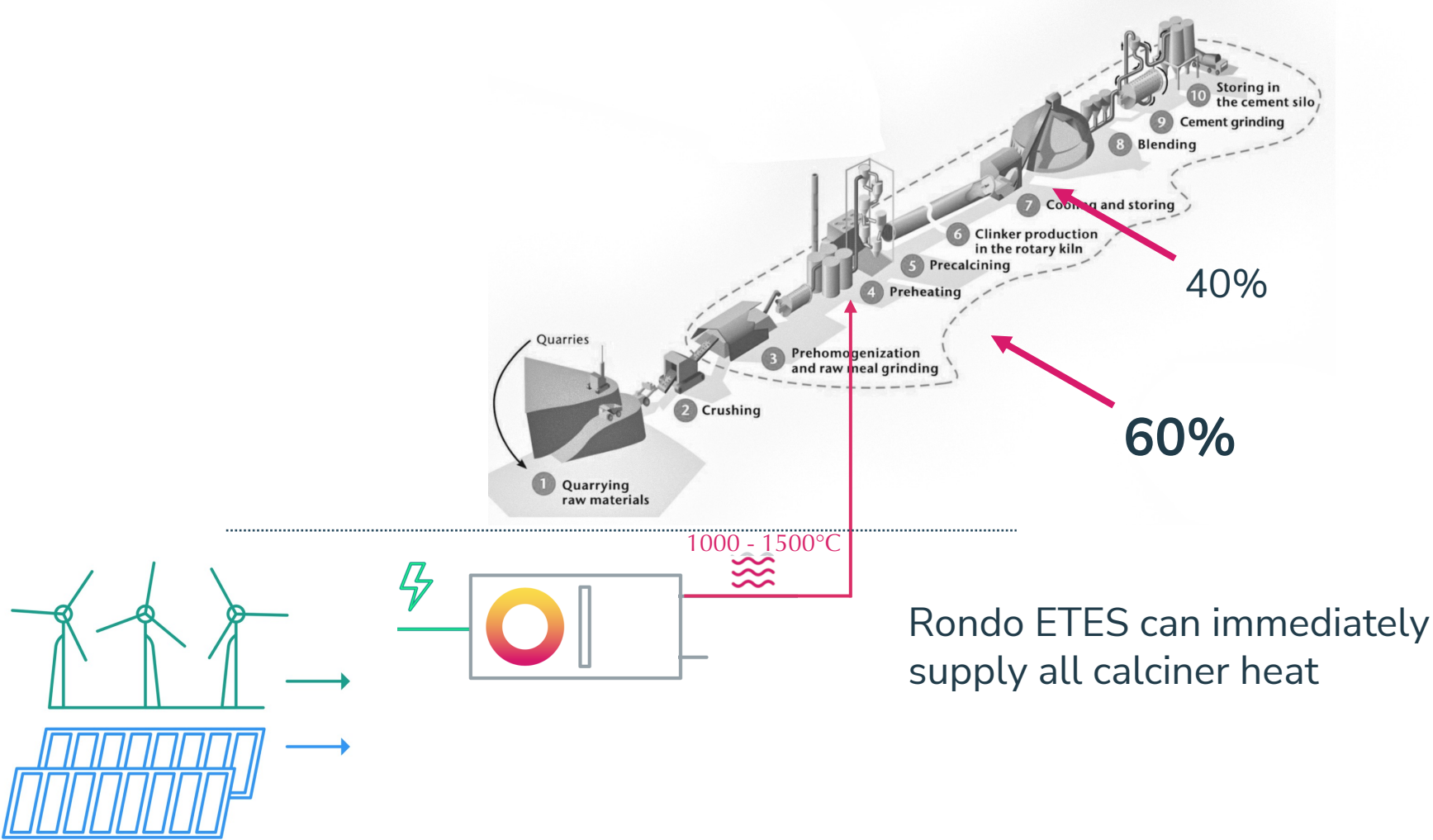
Intermittent power has  
become continuous heat.



# Continuous heat from intermittent power



# Pyroprocessing heat breakdown



Example plant. Rondo patents issued and pending including CO2 superheat cycle.





# Eliminating fossil fuel combustion: options

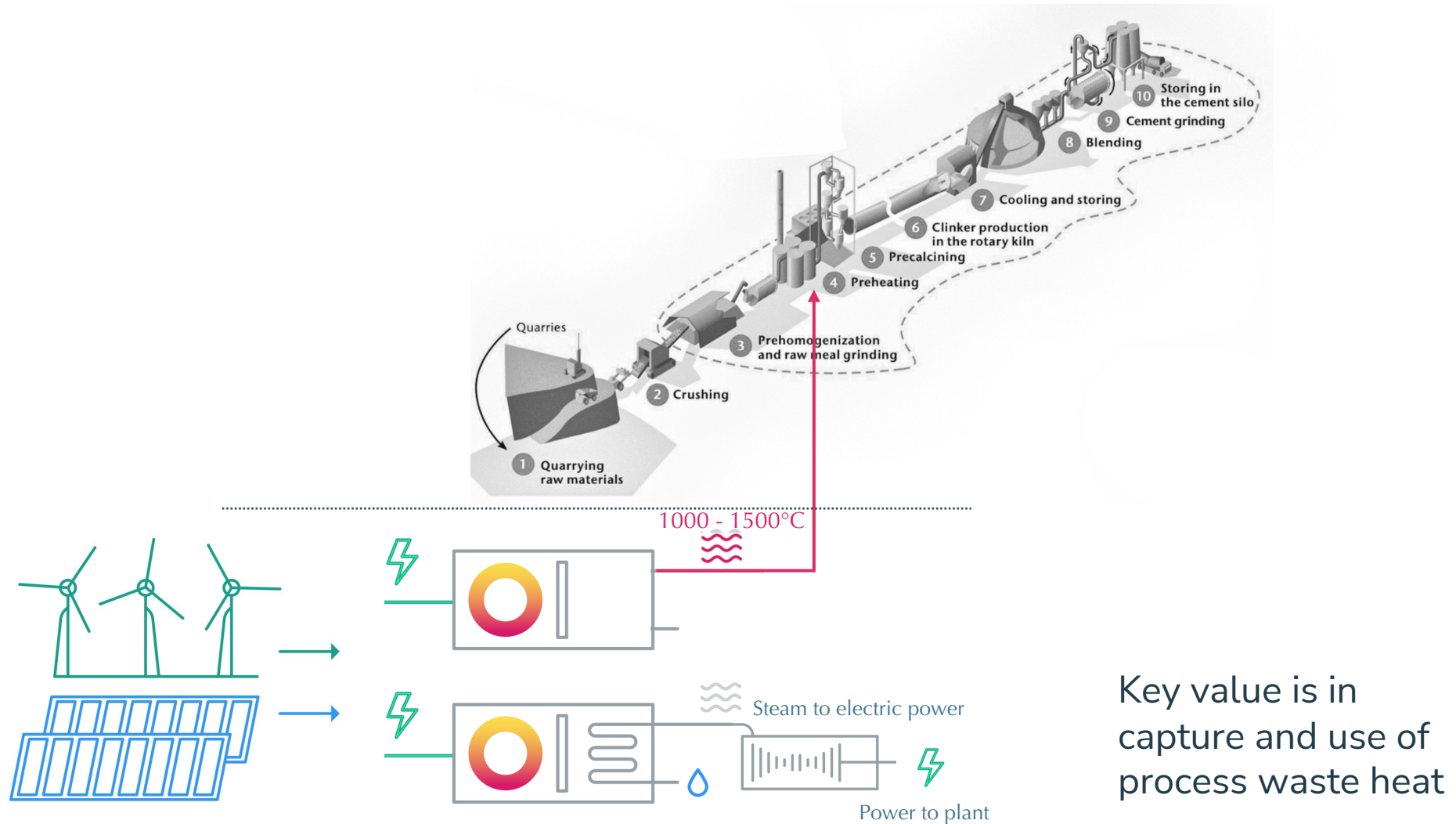
	Biofuels	Electric Kiln	Green Hydrogen	Electric Thermal Storage
<b>Supply availability</b>	<b>Very limited</b>	30% - 40% wind & solar; <b>grid limited</b>	<b>Unlimited</b> wind & solar; no grid connect	<b>Unlimited</b> wind & solar; no grid connect
<b>Efficiency</b>	80%	99%	52%	98%
<b>Renewable %</b>	100%	35%	100%	100%
<b>Temperature</b>	1800°C, full process	1500° - 1800° C, full process with equipt changes	2000°C, full process with equipt changes	1500°C now, all calcining with equipt changes; higher later
<b>Cost vs Natural Gas</b>	5x	4x	3x (pre-IRA); 1.5x	1.5x (pre-IRA); 0.8x

SPEED

SCALE



# Thermal storage can also drive power loads



Key value is in capture and use of process waste heat

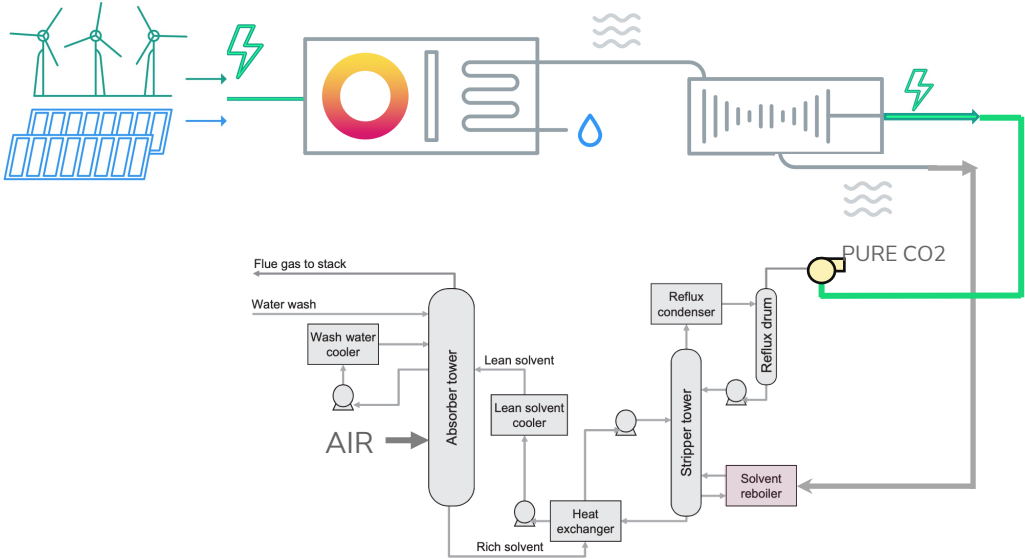
Example plant. Rondo patents issued and pending including CO2 superheat cycle.

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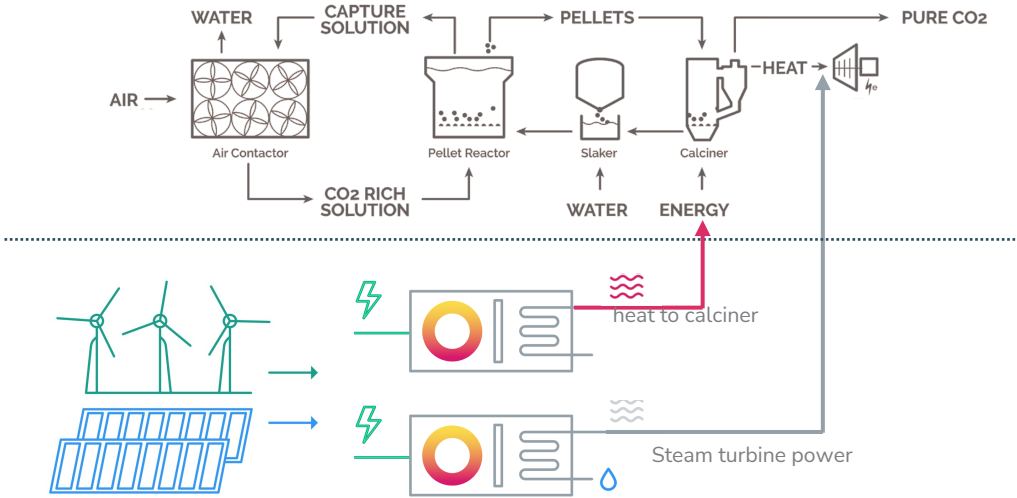


# Cogeneration driving clinker kiln carbon capture

Low temperature amine



High temperature calcium cycle



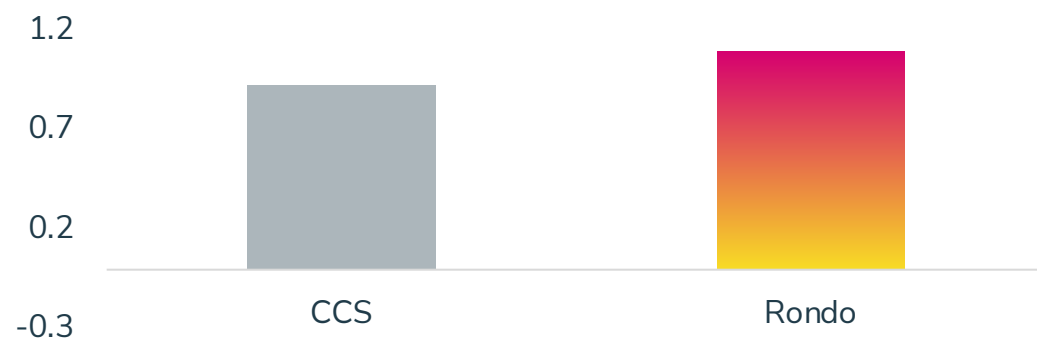
Rondo patents issued and pending.



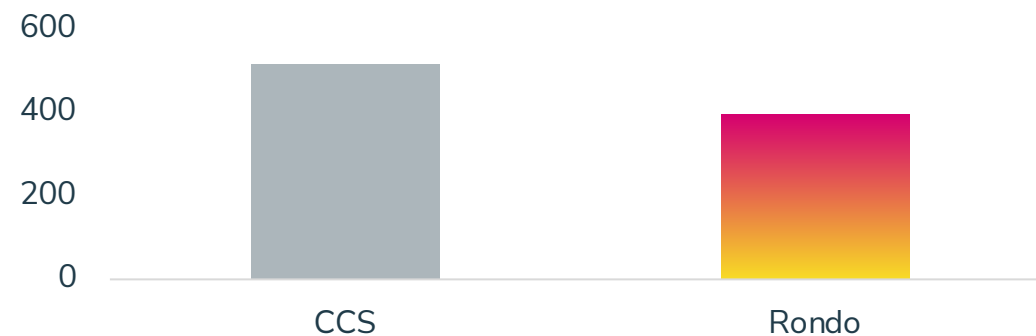


# Rondo ETES heat is higher value, lower cost than CCS for a substantial portion of emissions

VALUE CREATION INDEX

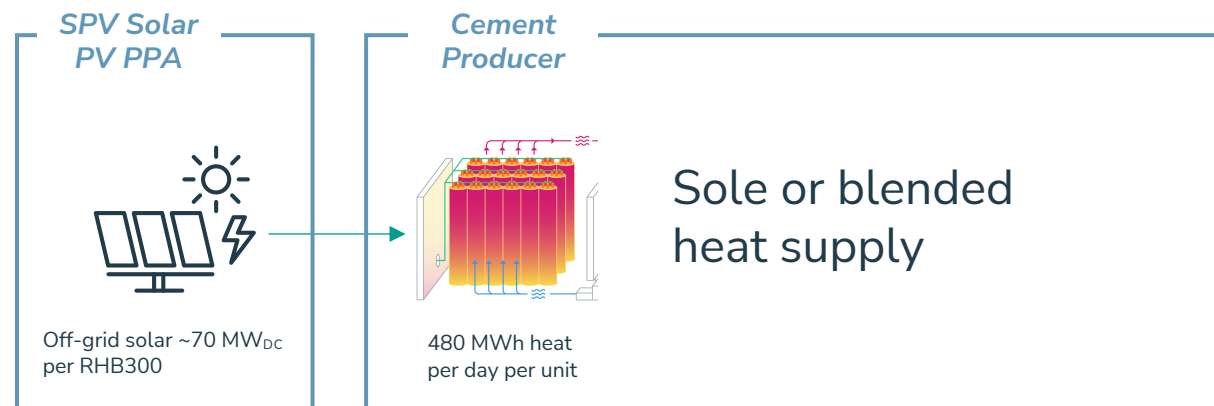


CAPITAL INVESTMENT RATIO

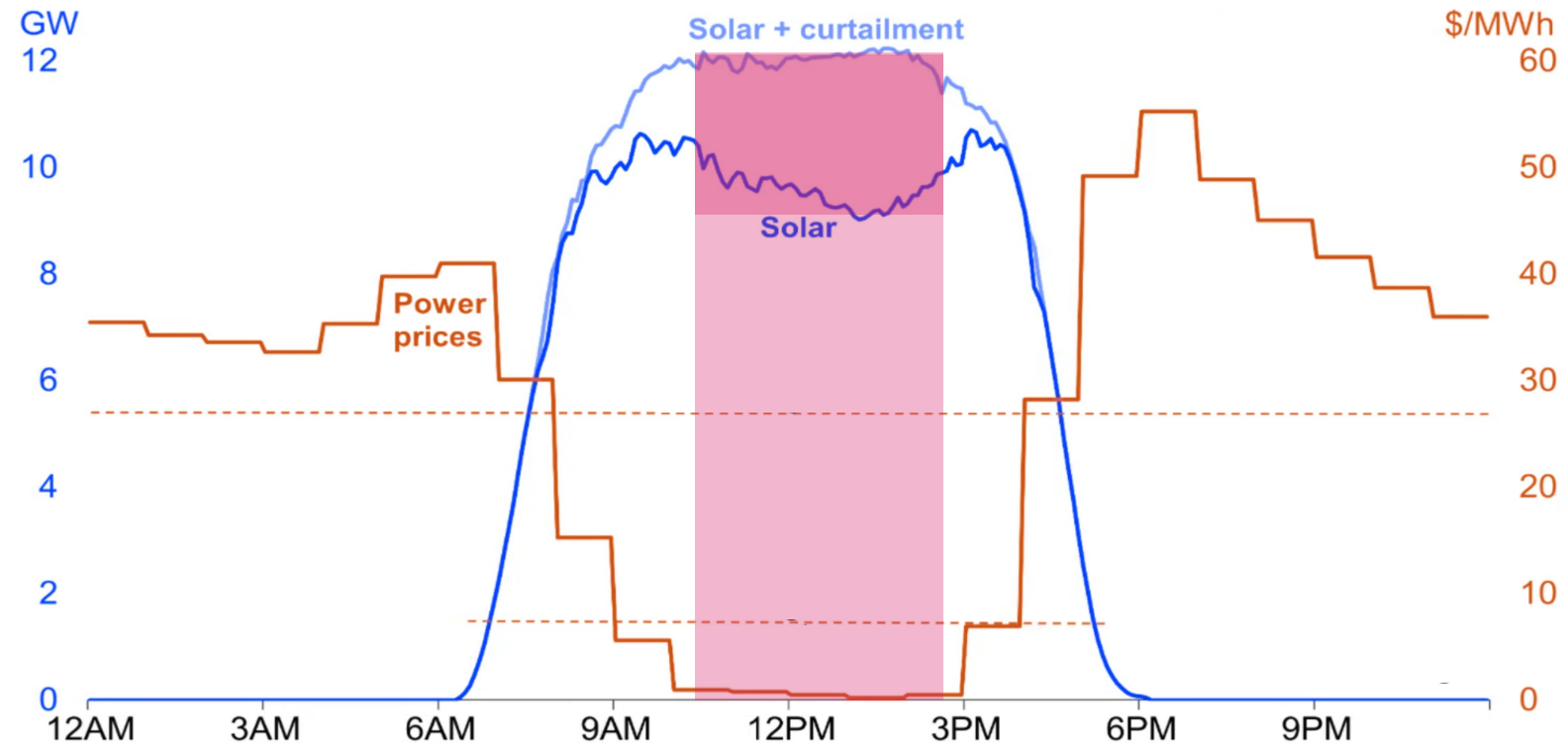


## ASSUMPTIONS

- Continuous heat from solar
- Includes latest IRA Tax Credits
- Cap and Trade forecast



# Large heat battery deployment creates grid value, expands renewables and lowers cost for all buyers

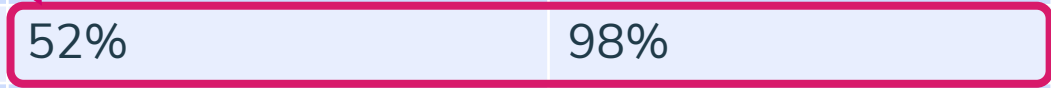
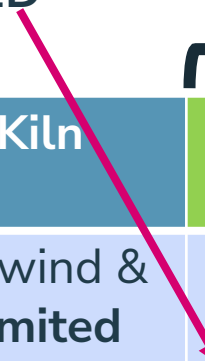


# ETES can contribute substantially to SB596 goals

	Biofuels	Electric Kiln	Green Hydrogen	Electric Thermal Energy Storage
Supply availability	Very limited	30% - 40% wind & solar; <b>grid limited</b>	Unlimited wind & solar; no grid connect	Unlimited wind & solar; no grid connect
Efficiency	80%	99%	52%	98%
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SPEED

SCALE



SB596 process is critical for **change when we need it**

Pyroprocessing facilities are built on multi-decade time scales

- **Long-term certainty** about supply, demand, economics needed

New technologies require **pilots** before investments at scale

- The foundations for large scale plants must be secure before FID

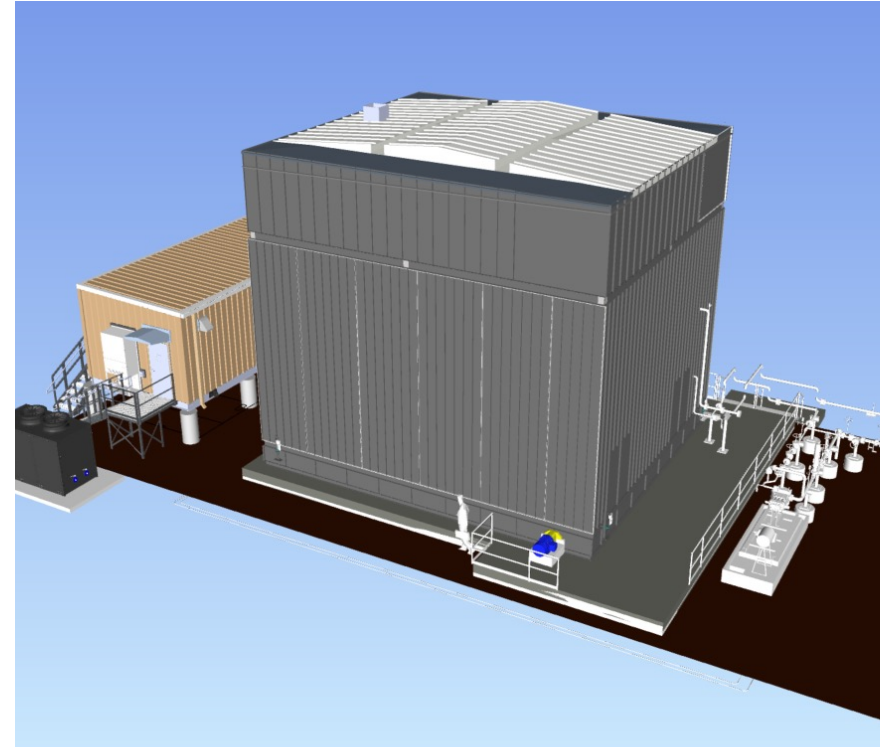
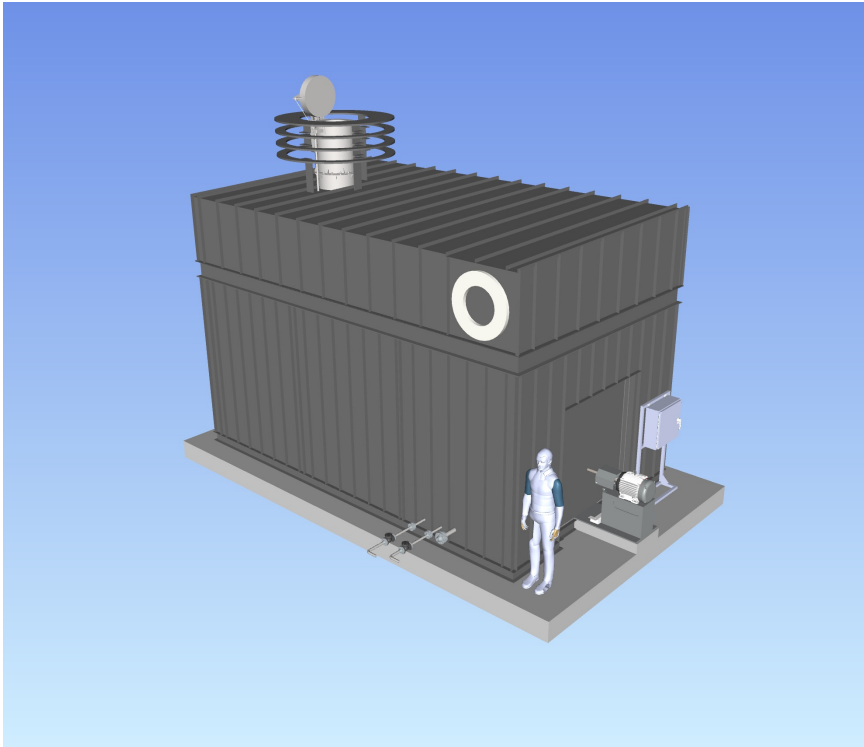
Critical **regulatory barriers exist** today that block the transition

- **ESPECIALLY THOSE AROUND ACCESS TO ZERO CARBON POWER**

SB596 implementation can drive the transition **decades sooner**



# Our first **two commercial units** are in production





John O'Donnell, CEO  
[john@rondo.com](mailto:john@rondo.com)