Partners in Project Green

A Program of Toronto and Region Conservation Authority

Energy Leaders Consortium

Heat Battery Technology with Jeremy Keller from Rondo Energy

October 26th, 2023

We respectfully acknowledge that we are situated on the Traditional Territories and Treaty Lands, in particular those of the Mississaugas of the Credit First Nation, as well as the Anishinaabe of the Williams Treaty First Nations, the Huron Wendat, the Haudenosaunee, and the Metis Nation.

As stewards of land and water resources within the Greater Toronto Region, Toronto and Region Conservation Authority appreciates and respects the history and diversity of the land and is grateful to have the opportunity to work and meet on this territory.

Additional Resources

- yrnature.ca/acknowledging_land
- edgeofthebush.ca
- native-land.ca
- Text 1-855-917-5263 with your City and Province to learn whose traditional territory you're on
(standard text messaging rates may apply)

A Collaborative Space for All

Proposed Operative Values for ELC meetings:

1. Balance airtime to hear from as many voices as possible
2. Be curious and challenge our own assumptions and biases
3. Be open to building on each other's suggestions or taking the conversation in another direction

Agenda

Time	Activity
1:00pm – 1:15pm	Introduction by PPG
1:15pm – 1:45pm	Heat Battery Technology – Rondo Energy
1:45pm – 2:00pm	Q & A and Discussion Period

Introduction

Participant Introductions

- To introduce ourselves to presenters, special guests, or for new ELC members
  - Please turn on your camera if you can
  - Name
  - Position
  - Organization

Upcoming ELC Sessions & PPG Events

Date	Topic
Tues, Nov 7th 8:30am-12:00pm	**Site Visit** – Presentations by ZAS Architects, CAGBC, Region of Peel and a guided tour of the new Head Office building
Wed, Nov 22nd 7:30am-10:00am	**GreenBiz Caledon Climate Partnership** - Workshop 1 Identifying GHG Reduction Opportunities at Your Facility (for businesses with facilities located in the municipality of Caledon)
Tues, Nov 28th 8:00am-11:30am	**Mississauga Climate Leaders Program** - Workshop 1: Identifying GHG Reduction Opportunities (for businesses with facilities located in the municipality of Mississauga)
Thurs, Dec 7th 1:00pm-2:30pm	**Roundtable Discussion and year-end reporting**

Please contact Julia Kole if you are interested in hosting an ELC Site Visits, presenting at a Member Roundtable, or have suggestions for future learning sessions.

Updates and Reminders

- **ELC Member Reporting for 2023**
  - 2023 savings for electricity, natural gas, and water projects/ upgrades
  - Tracking helps us celebrate our impact as a consortium of energy leaders!
  - Complete and return spreadsheet by Dec 31, 2023*

Example of tracking form:

Energy Conservation Measure Description	Utility	Annual Consumption Savings		Monetary Savings ($)
			kWh	
			m3	
			L	
			kW	

*If more time needed to collect information, please let Matt know as soon as possible.

Updates and Reminders

- Save on Energy recently re-introduced the **EBCx program** for commercial or institutional buildings
  - https://saveonenergy.ca/For-Business-and-Industry/Programs-and-incentives/Existing-Building-Commissioning-Program
- Potential funding rounds for **Industrial Energy Efficiency Program**. Please let Matt know if this program is of interest.
- **Save on Energy Retrofit program**
  - Increase in non-lighting incentives (Oct 30, 2023)
  - **Instant Discounts** program for lighting launching Dec 18, 2023 (*at this point lighting incentives no longer available in Retrofit program*)

Updates and Reminders

- Save on Energy presents: **The Road to Implementing ISO 50001**
  - Nov 21, 2023 from 10:30am – 12:00pm
  - In this webinar you will:
    - Learn what is involved in ISO 50001, including best practices and what commitments are required.
    - Evaluate whether ISO 50001 certification is right for your organization.
    - Develop a plan to work towards ISO 50001 in a way that makes sense for you.
- **Register for this session today!**

Updates and Reminders

- Complimentary tickets for PPG Members to attend Sustainable Waterloo Region's Scope 3: GHG Reporting Across the Corporate Value Chain on Nov 2nd
- Register for the event, apply passcode "**SWRVIP**" for free tickets
- https://www.sustainablewaterlooregion.ca/event/scope-3-ghg-reporting-across-the-corporate-value-chain/

Updates and Reminders

- **Funding opportunities through Centennial College:**
  - **Green mobility**- anything EV, autonomous, hydrogen fuel cell (we have around $1 mil/year over 3 years) for applied research projects
  - **Subsidized Energy audits**- 67% covered by the grant, report is accepted for green/eco designations
  - NSERC Energy IE grant for software, prototyping, testing
  - NRCan any green educational, outreach, demonstration (at the school of transportation).

Today's Speaker

Jeremy Keller

P.E., SVP of Business Development, Rondo Energy

Jeremy brings a high level of expertise in taking energy projects from ideation through deployment, including evaluation of facility energy data, financial modeling and technical scope development.

Before joining Rondo, Jeremy spent 10 years with leading renewable energy and energy efficiency company Ameresco, where he developed and delivered hundreds of projects for commercial and industrial businesses. He is a licensed mechanical engineer in the State of Washington with expertise in the design and technical applications of energy storage, solar photovoltaics, microgrids, renewable natural gas and HVAC systems.

Jeremy earned an MBA from Oregon State University, and bachelor's degrees in Mechanical Engineering and Physics from the University of Washington.

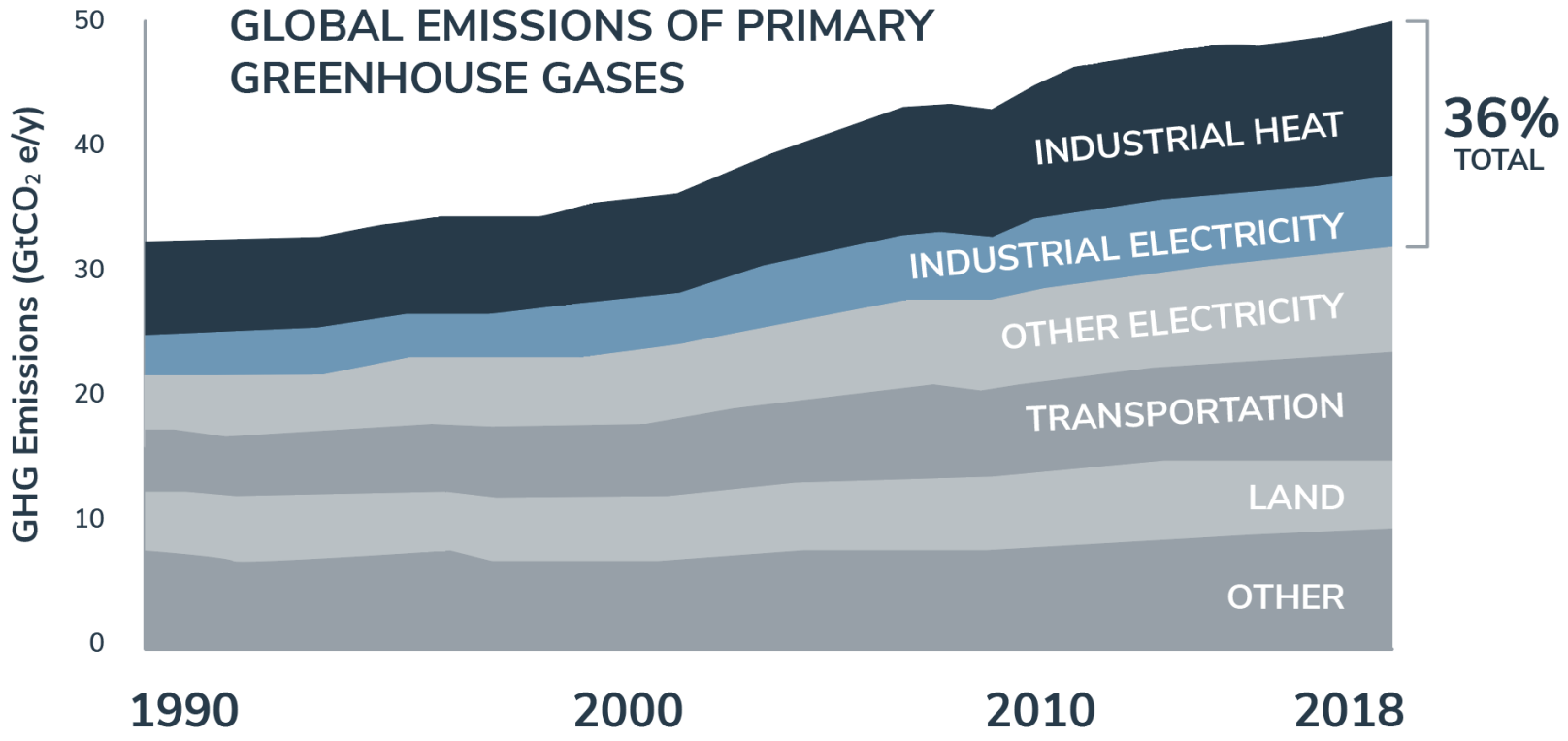
JK

Rondo Energy

RONDO™

Rondo Heat Batteries

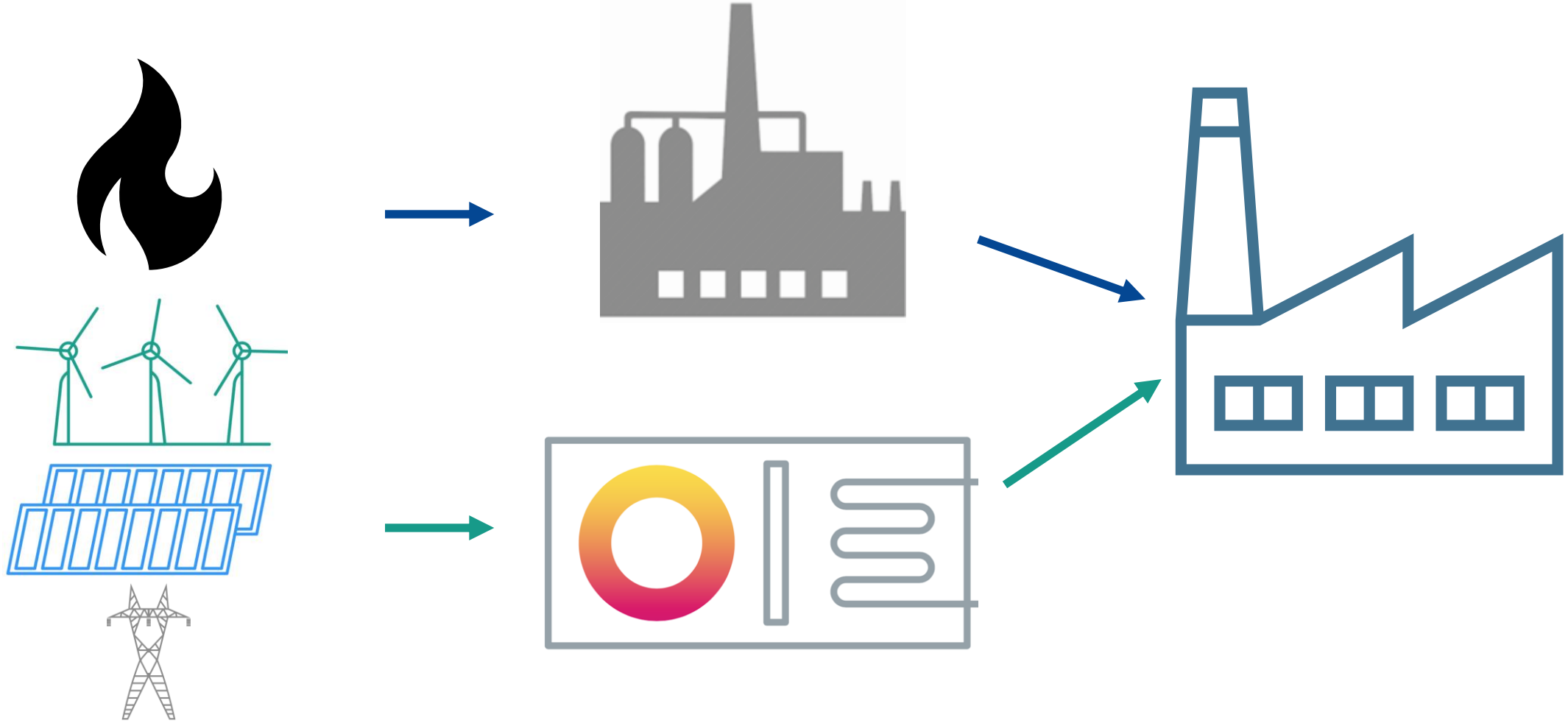
Industrial energy is the largest portion of global CO_2



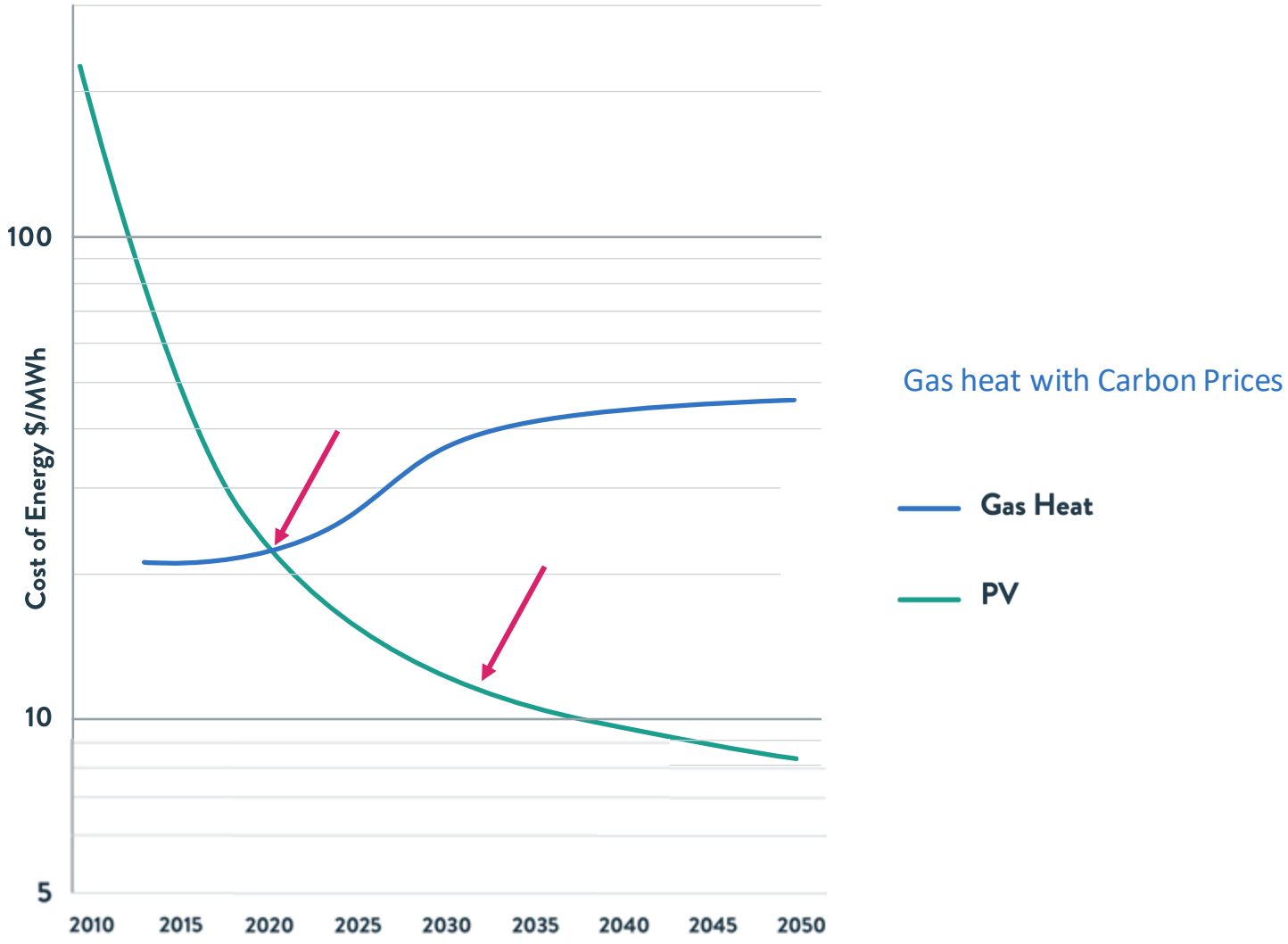
ClimateWorks Foundation

RONDO

Rondo's breakthrough economically replaces fossil gas with renewable electricity

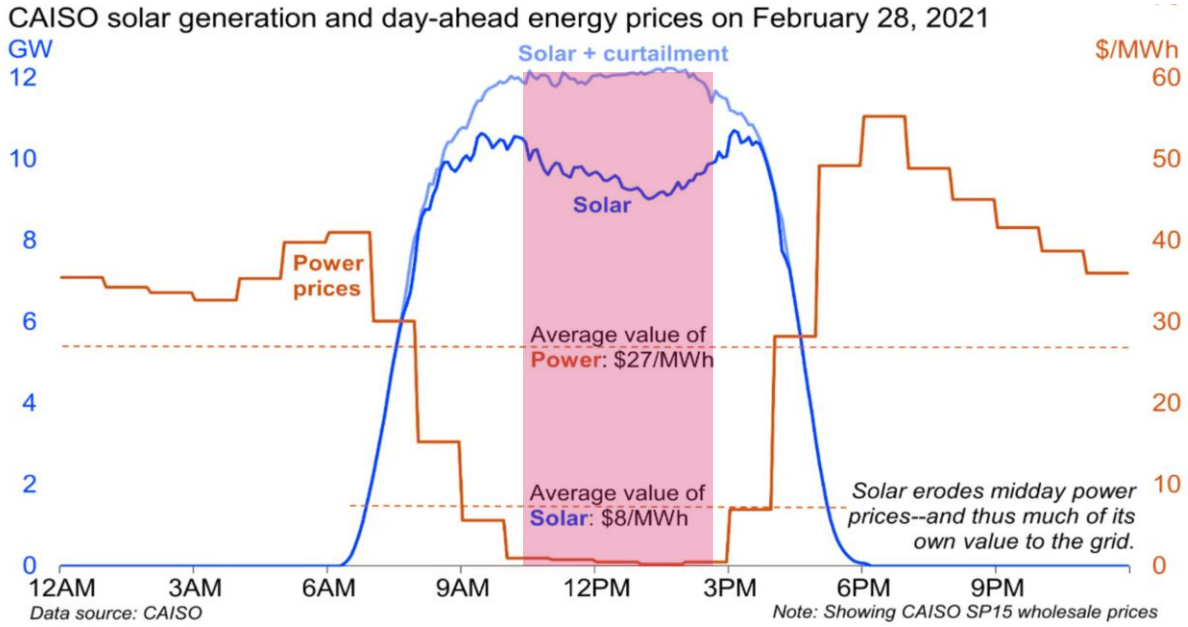


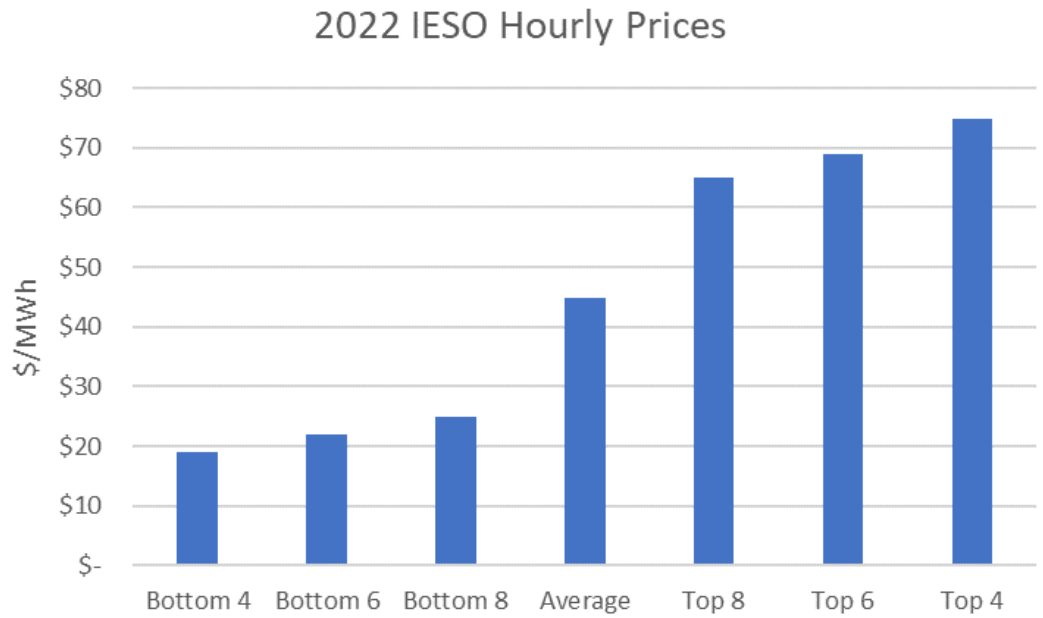
Renewable electricity is now lower cost than gas



RONDO

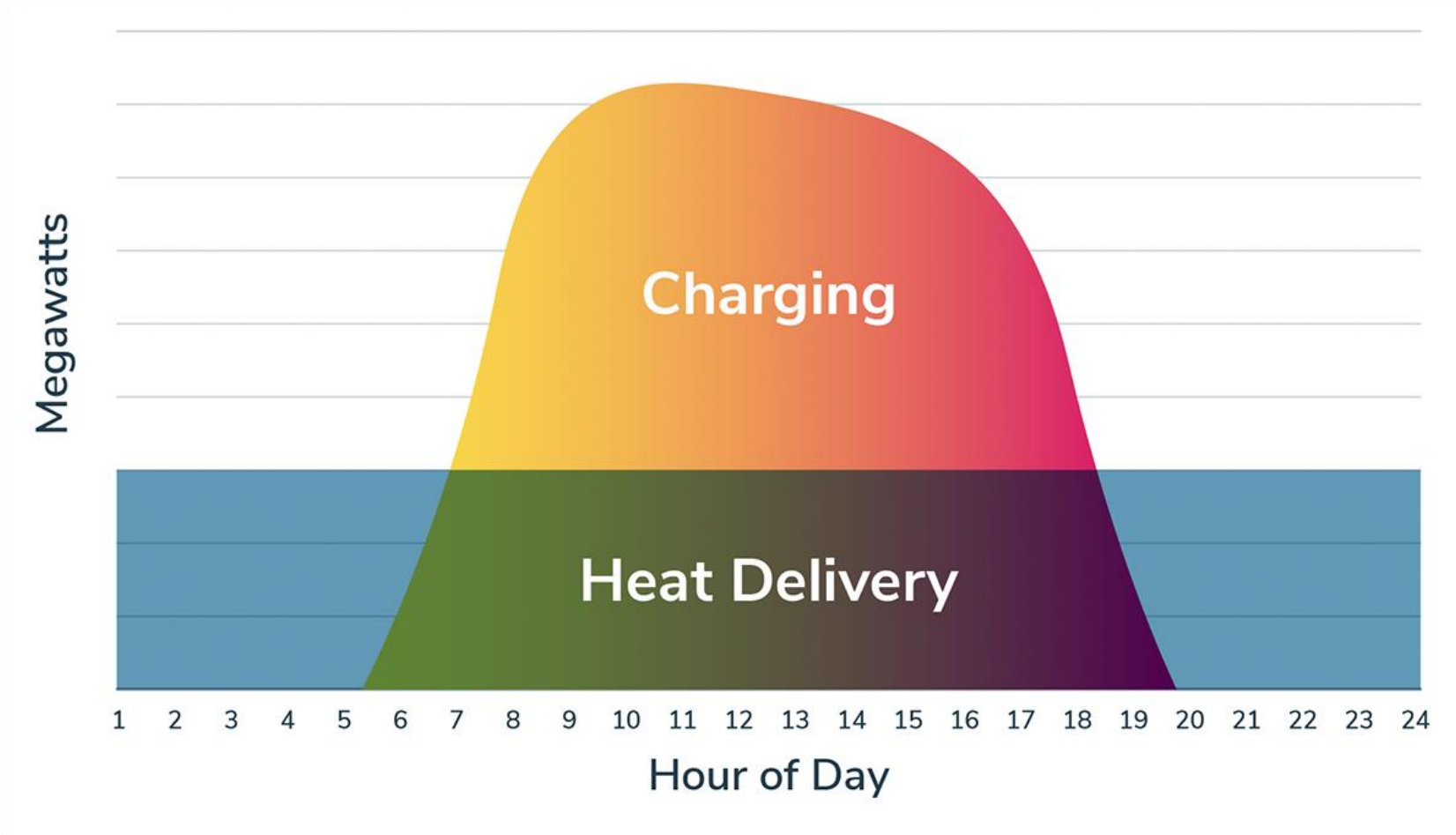
Intermittent power is very low cost now





BloombergNEF

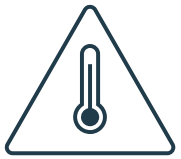
But intermittent power needs to be delivered continuously for industrial use



Any solution must meet three critical requirements

EXTREME SAFETY

Industrial processes have extreme consequences and require total intrinsic safety and/or very high mitigation



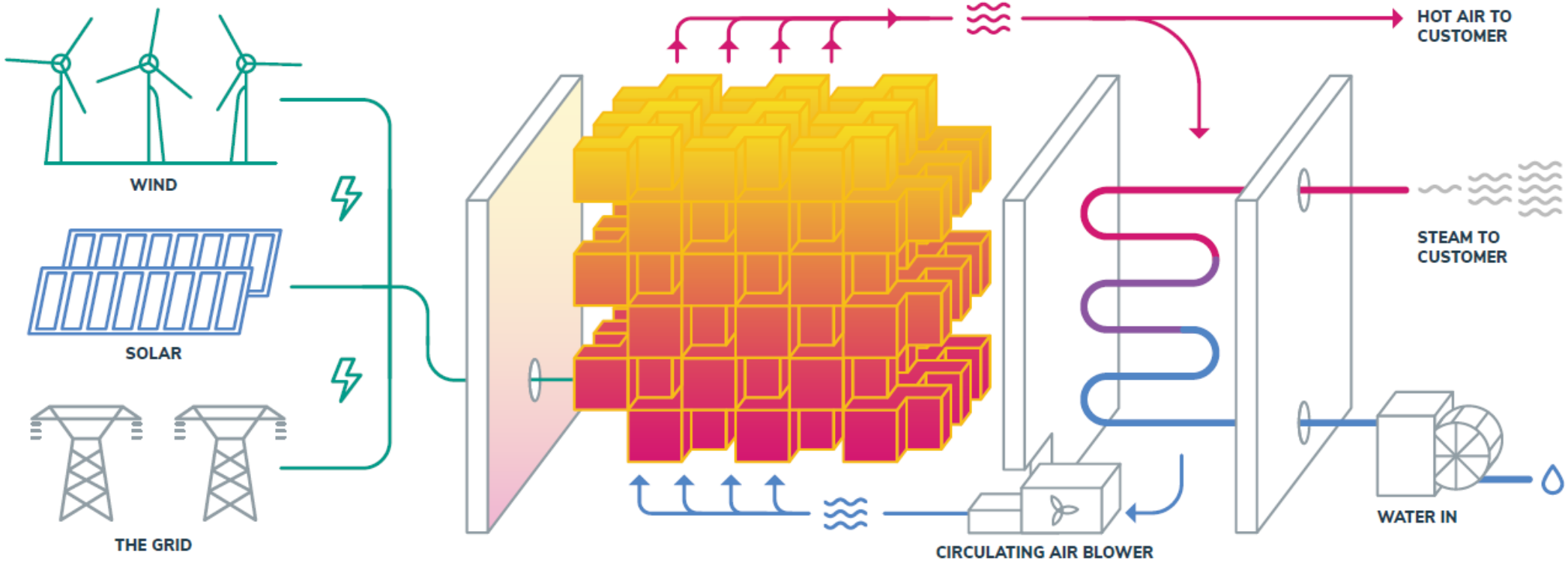
HIGH TEMPERATURE

Energy storage is more efficient at high temperatures. Key processes making steel, plastic, cement, minerals, and H2 require heat at temperatures between 800° - 1500°C

PROVEN RELIABILITY AND DURABILITY

Factories run continuously >8500 hours per year for decades, and any process interruption can take many days to restart

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.

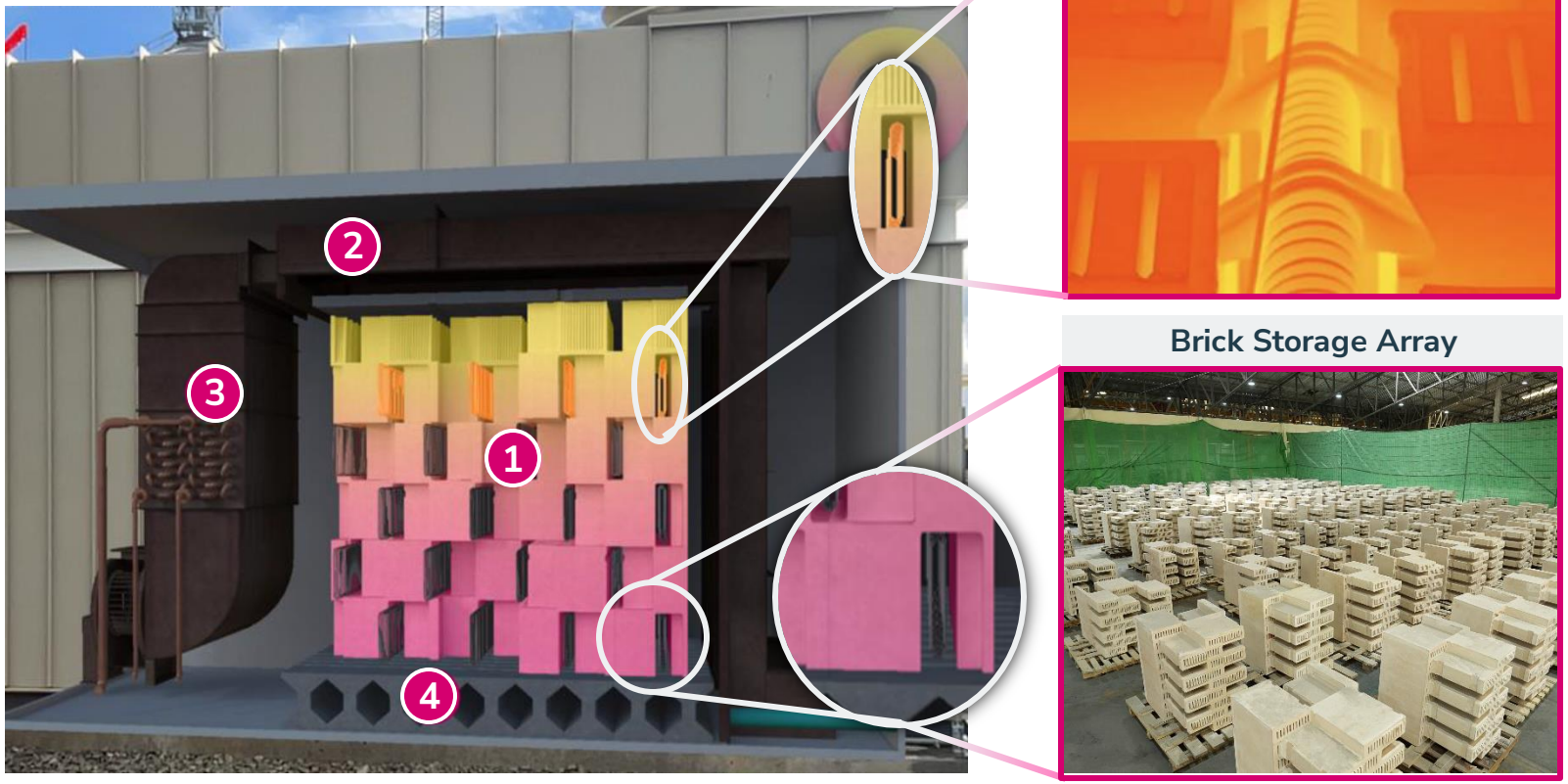
RONDO

A low-risk, mature technology, designed to ensure reliability, safety and scalability

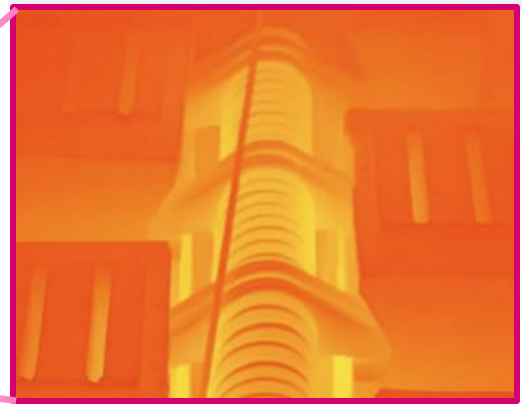
Thermal Core: The Heart of Rondo's Technology

Proven to scale

Superheated air from storage delivers heat through the HRSG



Embedded radiant heating



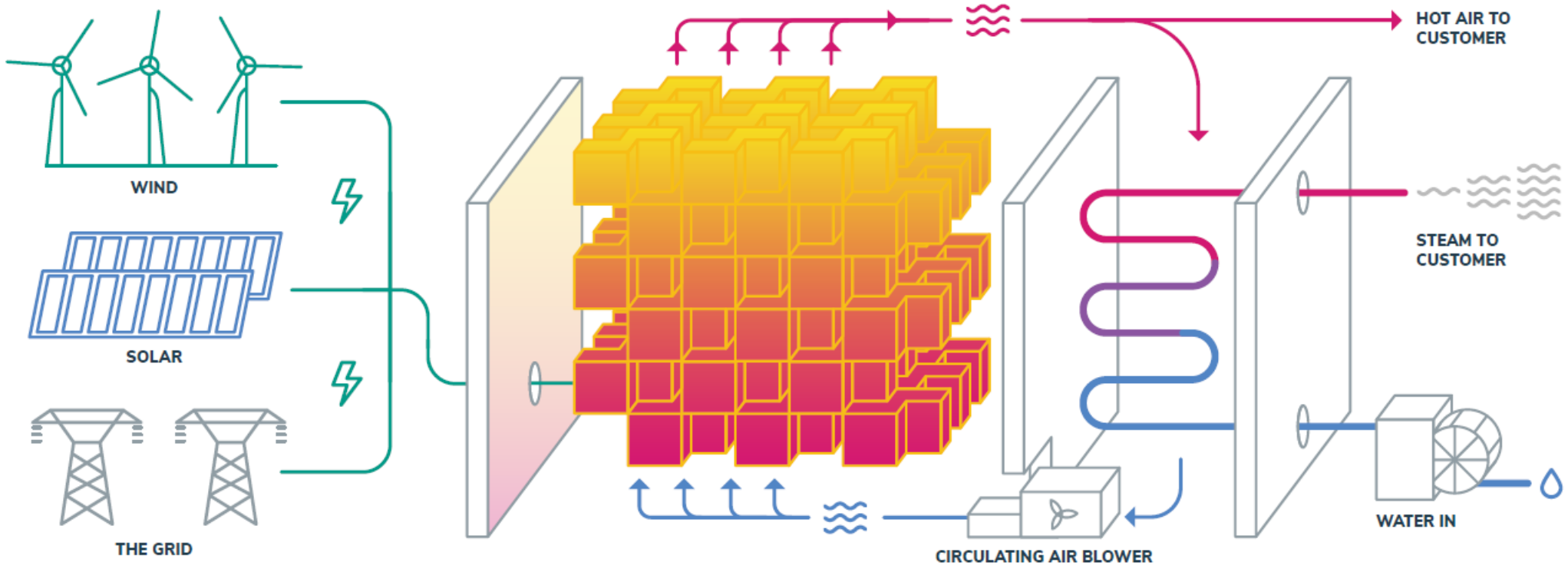
Brick Storage Array

- Standard bricks and heaters proven in the field today are **identical across RHB models** *(RHB100 and RHB300).*
- The RHB steam (HRSG) and electric power subsystems are from leading suppliers using **well-proven components**
- The Calgren RHB success validates that the entire RHB system **performs as designed**
- **This is the safest thermal energy storage technology.** Inert material means no fire risk, no thermal runaway, and safe shutdown. No risk of toxic leaks found in alternative technologies.

RONDO

The RHB300 delivers 24x7 high temperature heat

70 MW_{ac} 300 MWh_{th} 20 MW_{th} (70 MMBtu/hr)



Rondo patents pending.

RONDO

Two Standard Heat Battery Sizes

RHB300: 20MW of steam

- 30m x 13m x 10m tall
- 70 – 80 MWdc solar field
    - 350-400 acres (0.9-1.2 sq km)

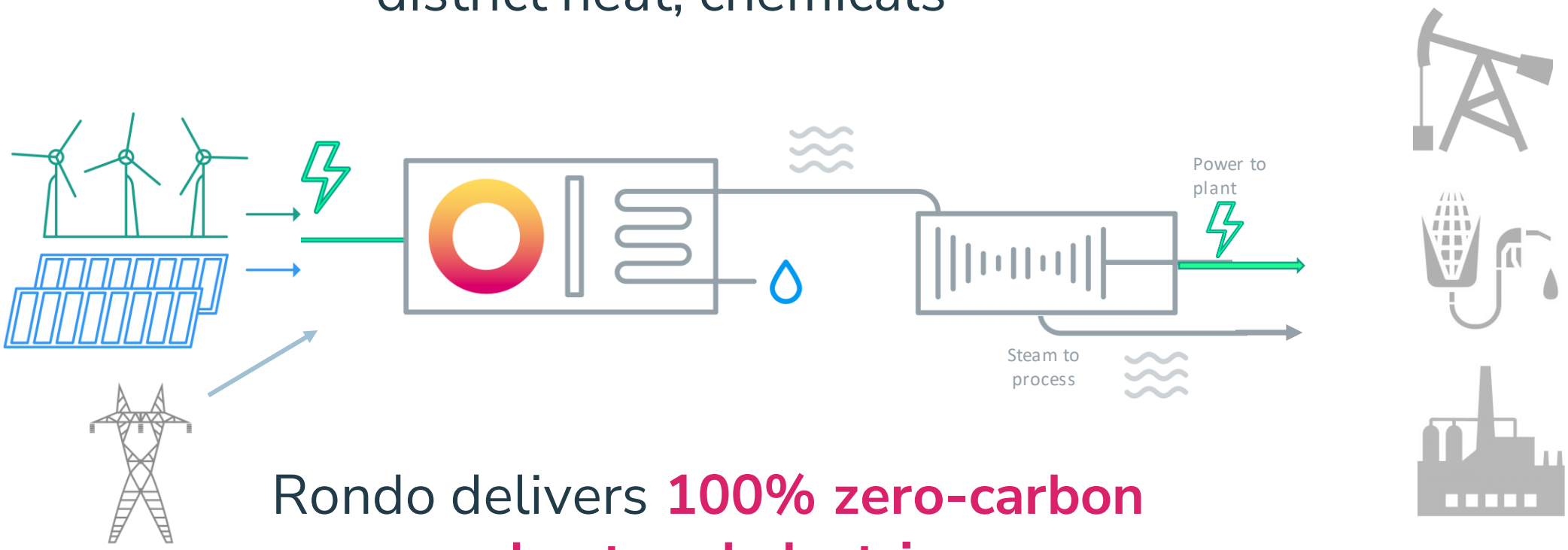
RHB100: 7MW of steam

- 10m x 13m x 10m tall
- 20-25 MWdc solar field
    - 80 – 100 Acres (0.3-0.4 sq km)

RONDO

Rondo's breakthrough applies across industries

Baseload steam and power for fuels, food, paper, district heat, chemicals



Rondo delivers **100% zero-carbon process heat and electric power at over 95% combined efficiency**

Rondo patent pending.

RONDO

Two Standard Heat Battery Sizes

RHB300: 20MW of steam

- 90’ x 40’ x 30’ tall
- 70 – 80 MW typ. charging rate
    - For solar, 350-400 acres (0.9-1.2 sq km)

RHB100: 7MW of steam

- 30’ x 40’ x 30’ tall
- 20-25 MW typ. charging rate
    - For solar, 80 – 100 Acres (0.3-0.4 sq km)

We have two sales models: direct sale and HaaS

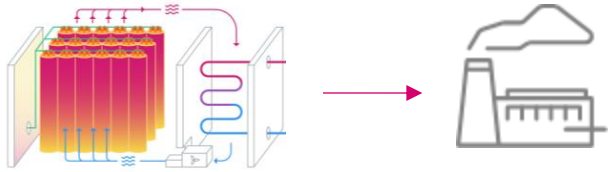
DIRECT SALE - CAPEX

Example #1: Direct Sale with renewables PPA

Developer

Renewables Developer sells electricity to Heat User under a PPA

Heat User

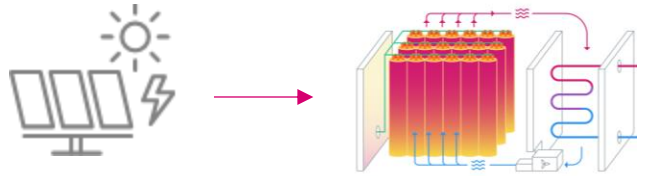


Heat User owns RHB, charges it with renewable electricity, and uses it to generate heat for its industrial processes

HEAT AS A SERVICE (HaaS) – PROJECT FINANCE

Example #4: HaaS with renewables CAPEX

HaaS SPV



HaaS SPV owns off-grid wind/solar infrastructure and RHB and charges RHB with renewable electricity

Heat User

Heat User purchases HaaS from HaaS SPV for its industrial processes

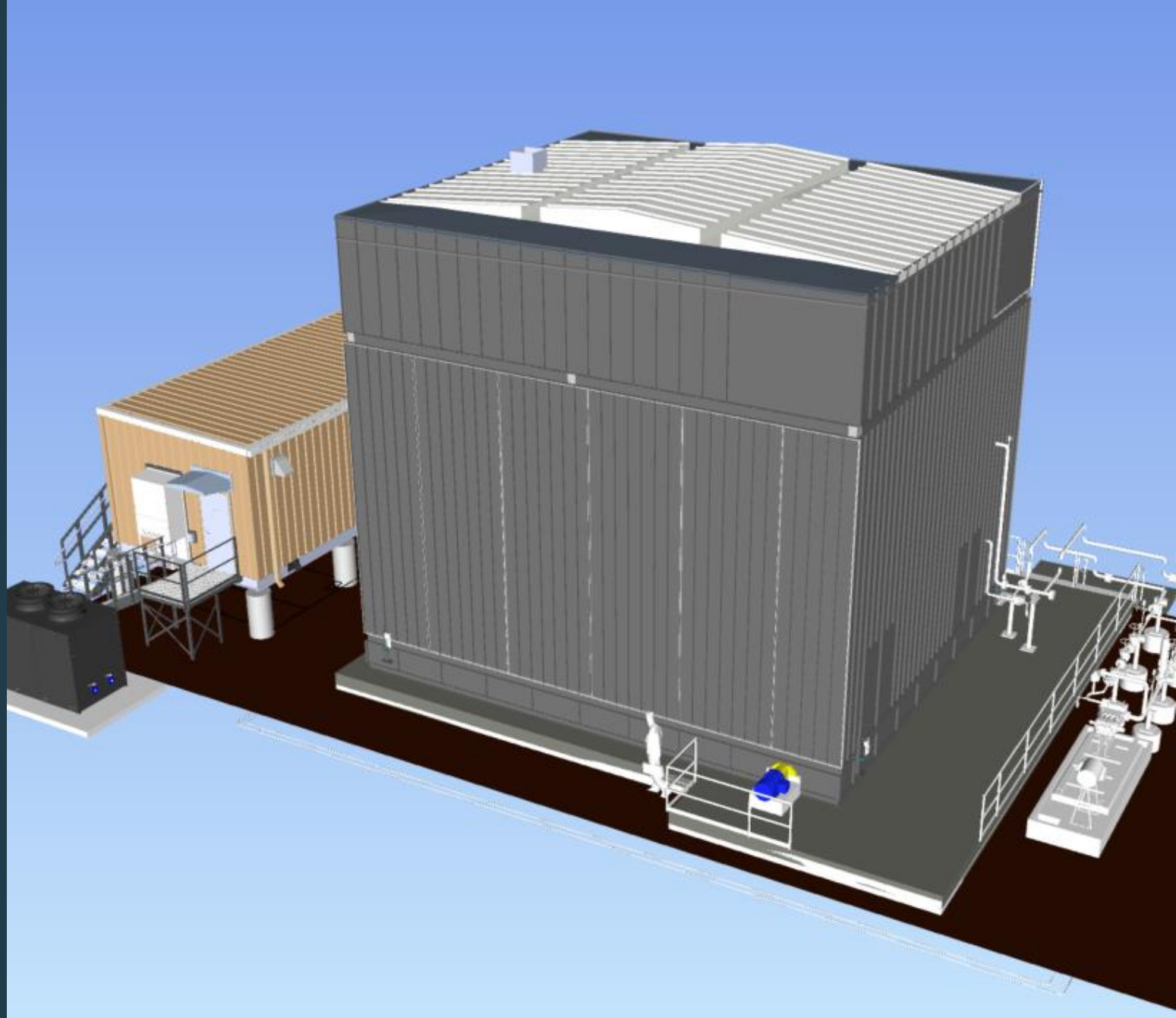
Typical Project Development:

1. First call to verify project fit, general economics
2. Collect facility energy information
3. Feasibility Study
4. Term Sheet
5. Front End Engineering and Design
6. Definitive Agreement
7. Engineer, Procure, Construct, Commission
8. Deliver Steam

RONDO

Our solution:

The Rondo **Heat Battery**



Thank you

Jeremy Keller, P.E.

SVP of Market Development

jeremy@rondo.com

Q&A


Partners in
Project Green
A Program of Toronto and Region Conservation Authority

Thank You!