



Cascade **Energy**®

Cascade Energy & Industrial Heat Pumps (IHPs)

- **Scoping case studies**
- **Customer motivations, barriers**
- **Contractor & design firm survey**
- **What next?**

Dairy Scoping - 1



Sink: pasteurization 200°F

Source: refrigeration condensing 70°F

70K lift, 2.5 COP

Spark gap (elect/ng) 4.0

Gas savings: \$170k

Electric increase: \$200k

Grid intensity: 635 lb/MWh

CO2e Savings: 1,000 tonne/y

Dairy Scoping - 2



New construction

Utility allowed electric boiler baseline

Central IHP system not considered

Two add-on IHP projects identified (~5% NG reduction)

Good economics vs. electric boiler

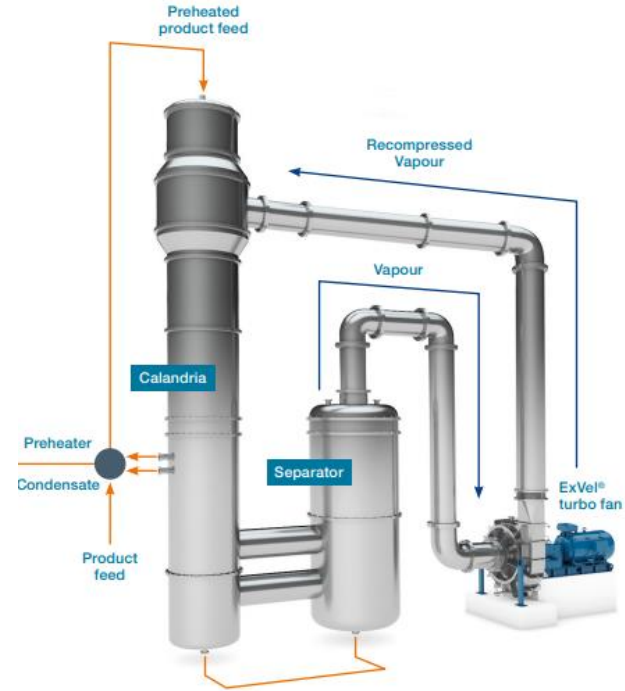
Vegetable processor - 1

Vegetable concentration

Mechanical Vapor Recompression (MVR) on evaporators

Demonstration plants online

Significant incentives offered



Source: Howden.com
MVRHowdenbyChart_MVR_ProductProfileSheet_Digital.pdf

Vegetable processor - 2



Medical manufacturing

Goals: Phase out R22, Save: CO₂, H₂O, kWh, Therms

Roof mounted ASHPs and WSHPs for clean rooms

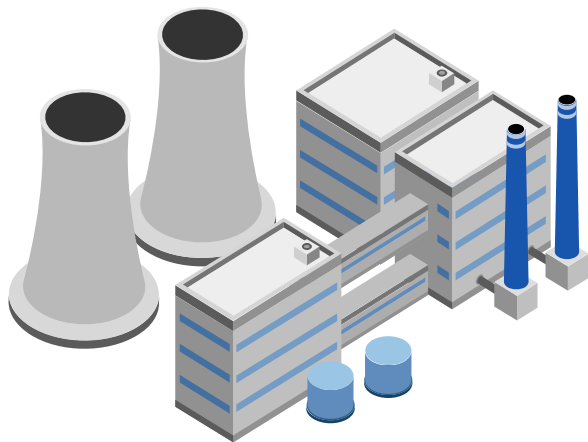
WSHPs use cooling tower water, with air compressor & process loads

Natural gas backup on ASHPs for very cold weather



Customer Motivations & Barriers

Motivations



Reduce costs



Reduce CO₂ emissions



CO₂ regulatory requirements

Barriers



Cost: Equipment & Operating



Design & Integration Barriers

- Source - sink distance
 - Little support from manufacturers, vendors
 - Vendors still learning
 - Construction schedules
-



Temperature Limits



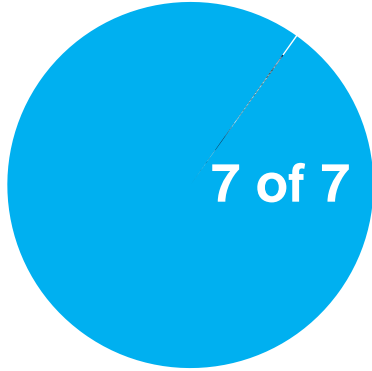
Risks

- Don't see competitors installing IHPs
- Nervous it might not work

Refrigeration Contractors / Food & Bev Design

Informal survey

Survey Results: 7 well known refrigeration contractors



**No Current IHP
Projects**

Installations or quotes



Successful

Heat Recovery
(desuperheaters)

Dedicated Hot Gas
Compressors



Not Interested

Current workload is
sufficient

2 Food & Beverage Plant Design Firms

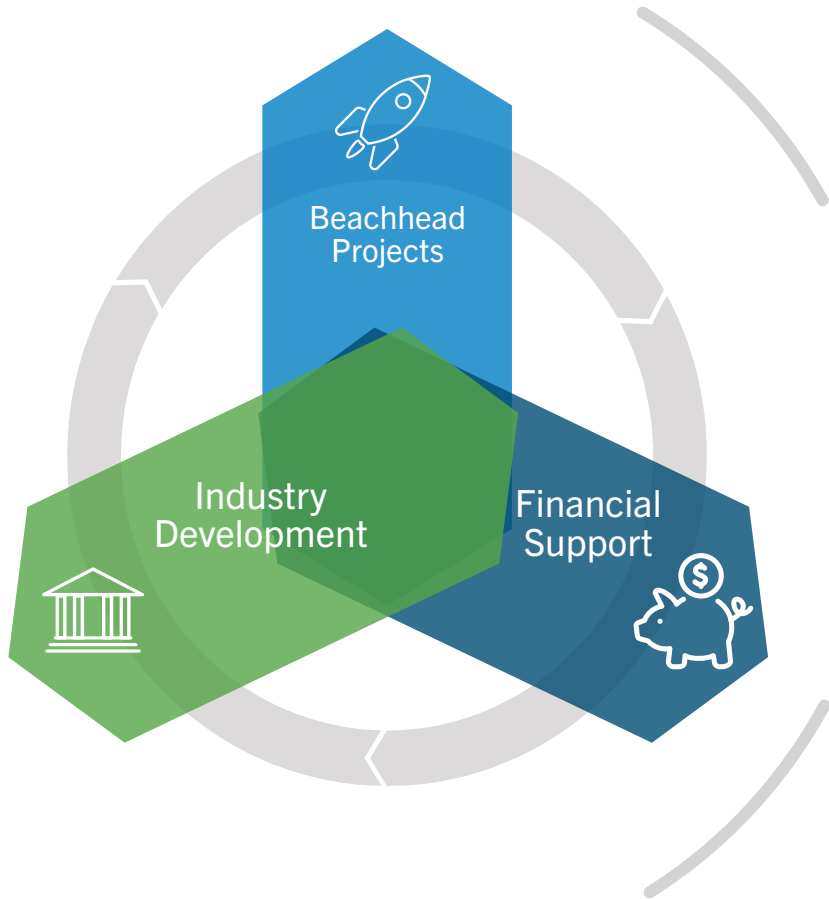


“ No requests for IHPs in plant design ”

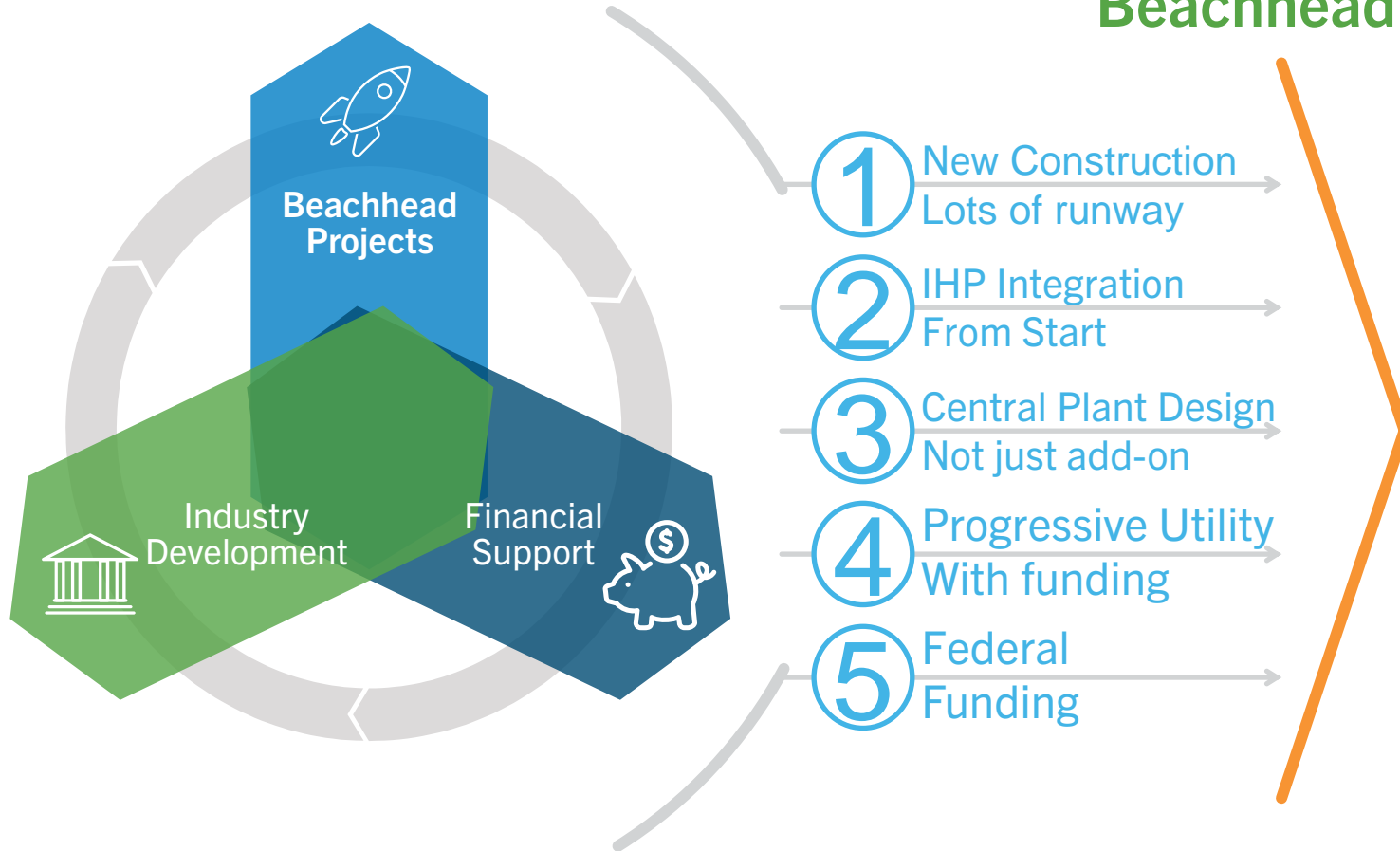


“ Just quoted IHPs on new plant design,
dropped due to cost ”

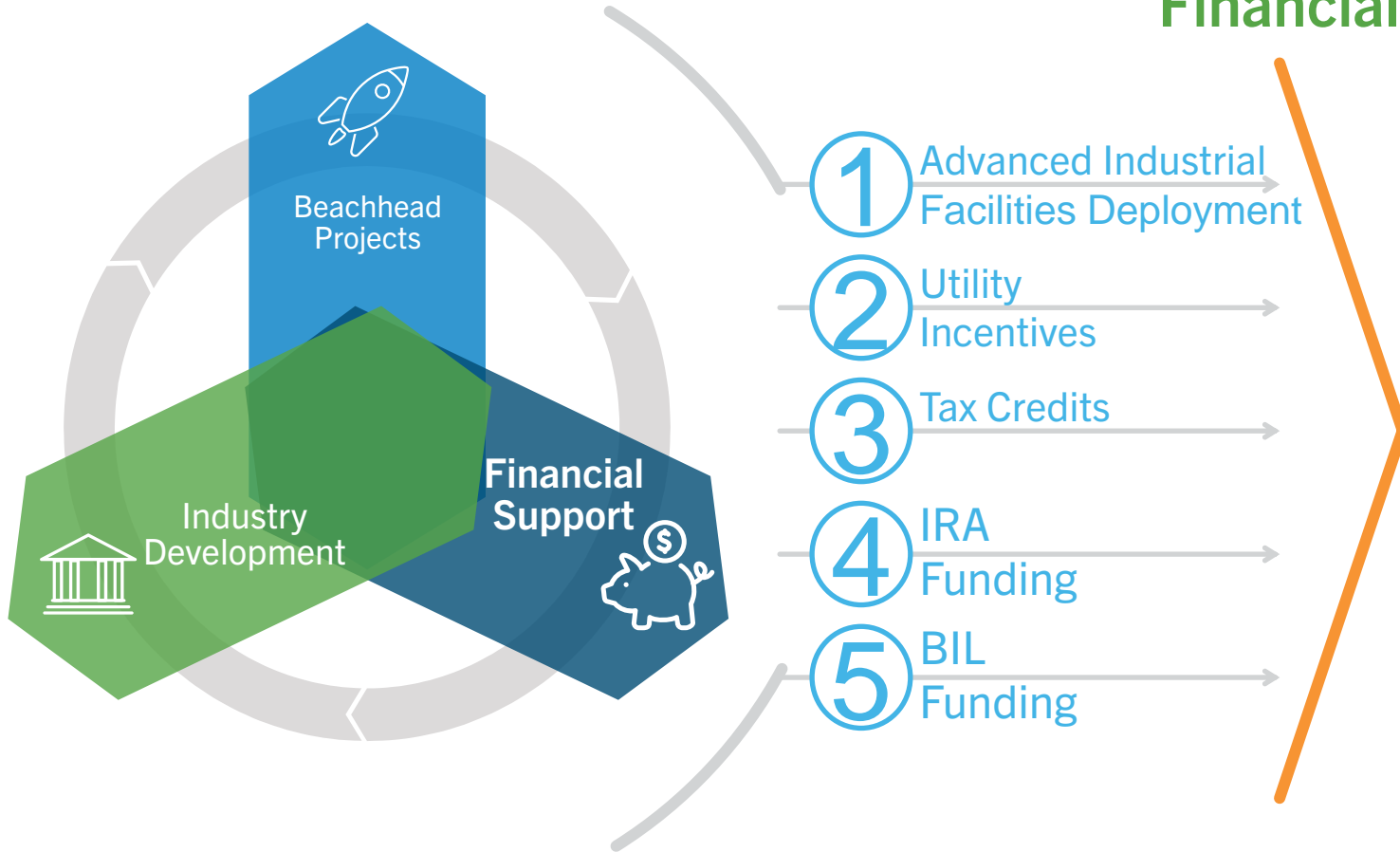
What Next?



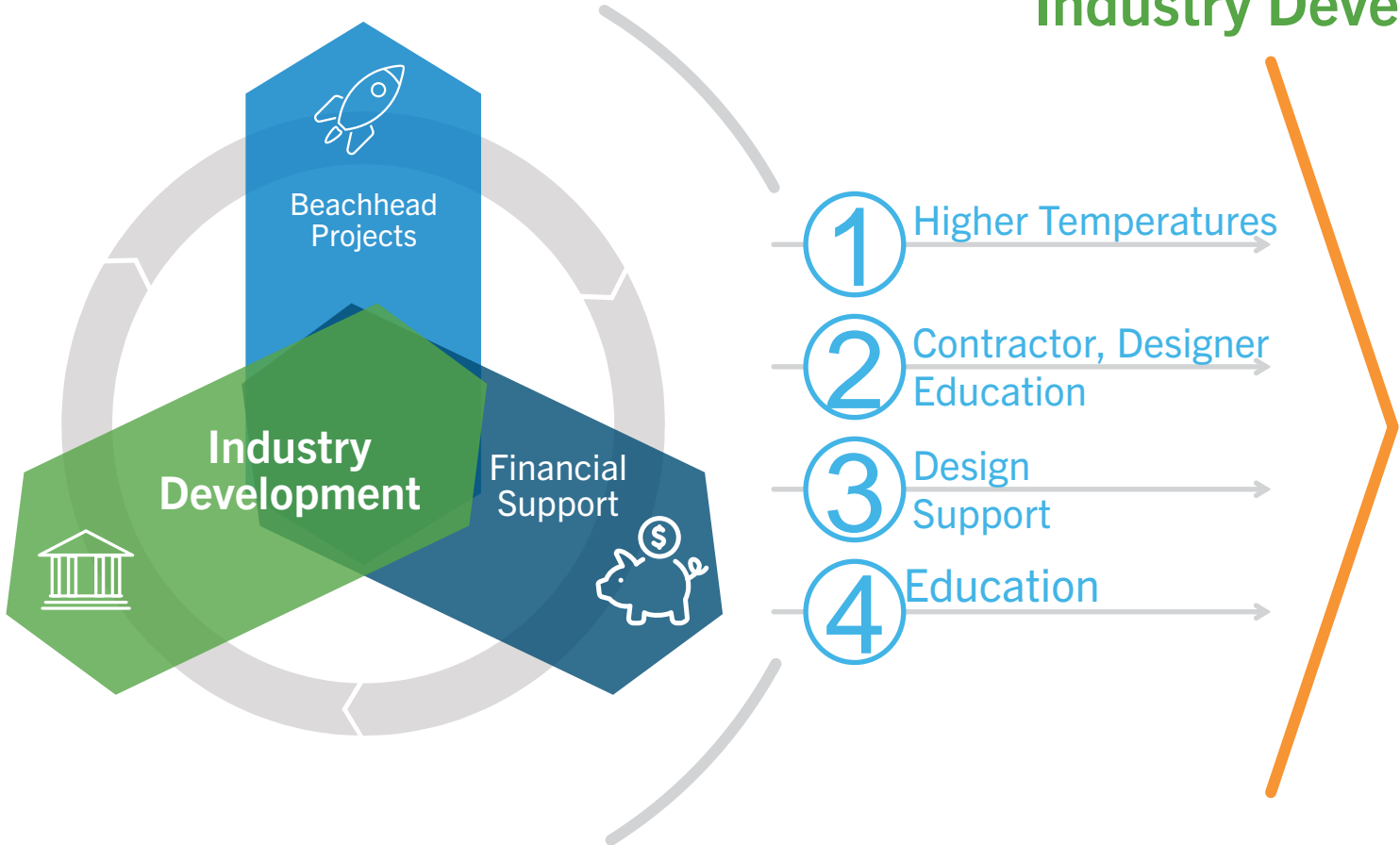
Beachhead Projects



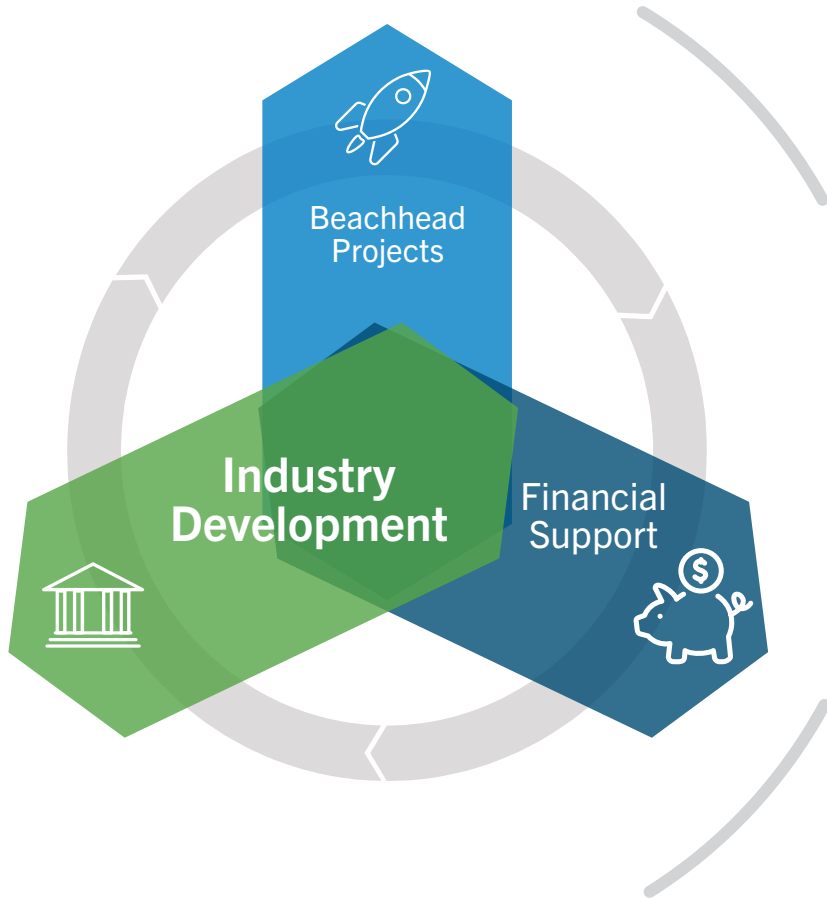
Financial Support



Industry Development



Goals



Goals

- ✓ Track record of success
- ✓ Changed perception of risk
- ✓ Financial support
- ✓ Industry support

Thank you.

Steve Koski, P.E.
Principal Engineer
steve.koski@cascadeenergy.com