



Decarbonizing industry with steam-generating heat pumps

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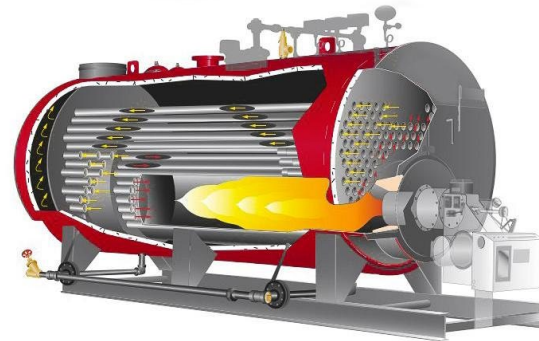
FACT

20% of global carbon emissions are caused by industrial heat



Manufacturers are committed to decreasing factory emissions, but

99% of industrial steam comes from fuel-fired boilers



Fuel-fired boilers: technology from 1867
Historically the only cost-effective option

WHY?



ELECTRIC BOILERS AND RNG

cost 3-5x more than natural gas



EXISTING HEAT PUMPS

cannot produce steam at high enough temps and pressures

Source: <https://www.nrel.gov/docs/fy22osti/81721.pdf>

Source: www.siemens-energy.com/global/en/offerings/power-generation/heat-pumps.html

Source: www.edf.org/sites/default/files/documents/MACC_2.0%20report_Evolved_EDF.pdf



WHAT WE DO

Skyven is an Energy-as-a-Service company pioneering steam generating heat pump technology that delivers clean process steam to industrial facilities at prices lower than natural gas.



Decarbonizing Industrial Steam

The Skyven Arcturus Steam-Generating Heat Pump

The world's first and only economically attractive solution to decarbonizing industrial steam



Emissions-free steam production using electricity instead of natural gas



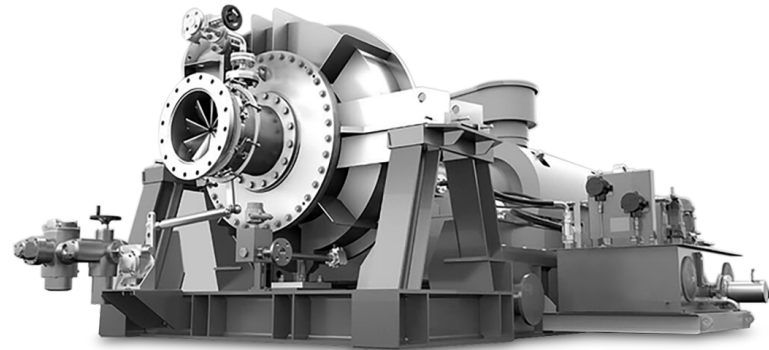
Costs less than natural gas due to high COPs that counteract electricity-to-gas price differentials



Meets industry needs for steam temperatures and pressures (up to 420F and 300 psig)



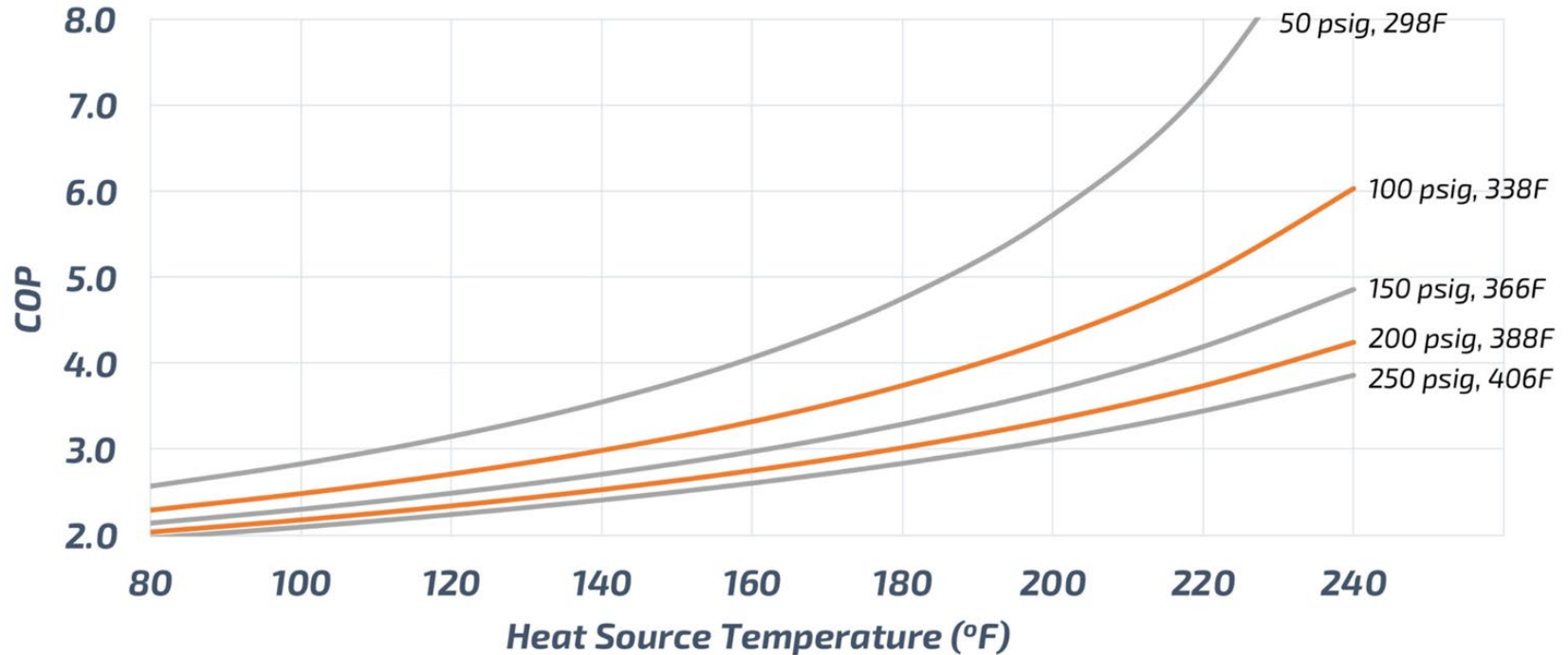
Deep decarbonization – average 57% reduction in facility-level emissions





High Coefficient of Performance (COP)

COP depends on heat source temperature and steam pressure/temperature.

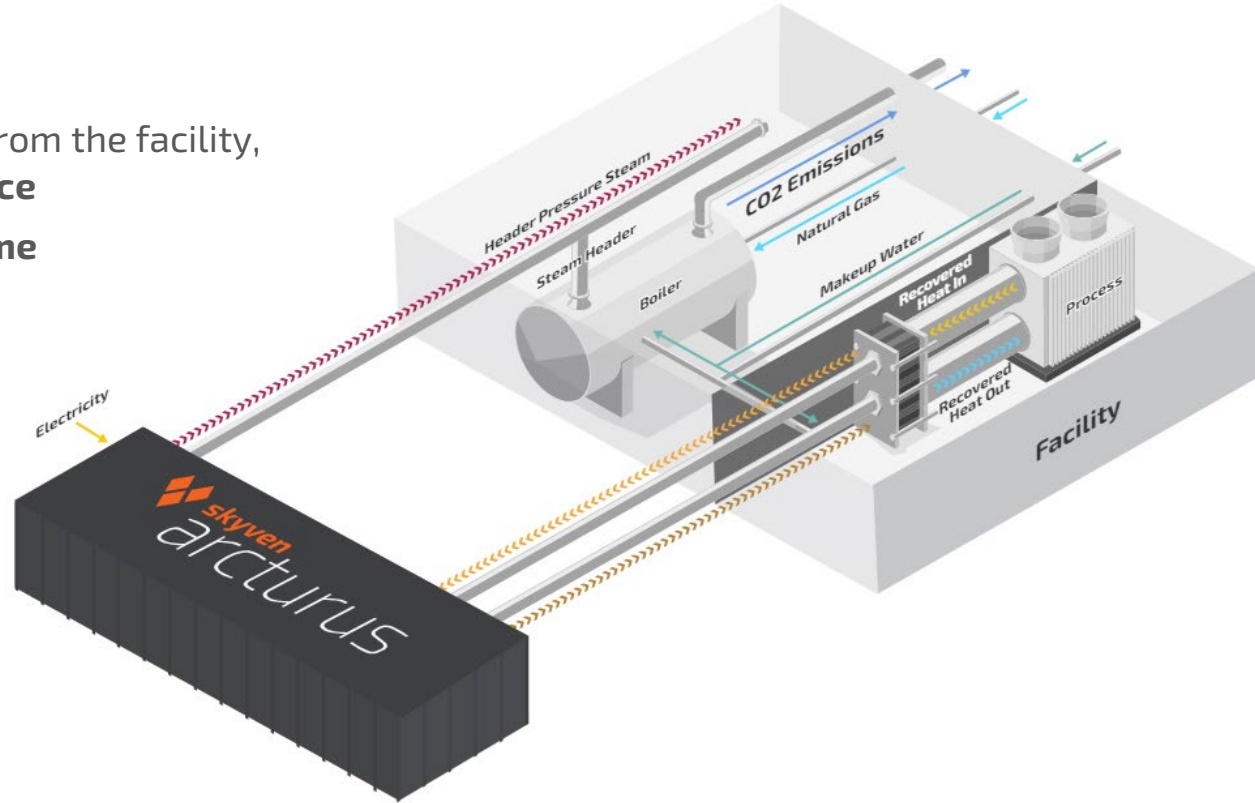




Skyven Arcturus

Skyven Arcturus

- Placed on the ground away from the facility, where there is **plenty of space**
- Easy integration, **no downtime**
- Packaged and modular
- Optimized design
- Supply chain leverage
- Economies of scale
- Fuel Switching Option





Arcturus | Industries



PULP & PAPER

Annual Natural Gas Usage:
4,301,236 MMBtu

Steam Temperature*: 377°F
Steam Pressure*: 175psig
Steam Demand*: 80,000lb/hr

With Skyven Arcturus:

Annual Fuel Usage Reduction:
1,829,988 MMBtu

Annual Scope 1 & 2 CO2e Emissions Reduction:
96,653 MT

Total CapEx Required:
\$0

Average Annual Facility Savings
\$830,000



FOOD & BEVERAGE
Annual Natural Gas Usage:
880,254 MMBtu

Steam Temperature*: 366°F
Steam Pressure*: 200psig
Steam Demand*: 35,000lb/hr

With Skyven Arcturus:

Annual Fuel Usage Reduction:
648,041 MMBtu

Annual Scope 1 & 2 CO2e Emissions Reduction:
34,203 MT

Total CapEx Required:
\$0

Average Annual Facility Savings
\$174,000



ETHANOL

Annual Natural Gas Usage:
1,998,938 MMBtu

Steam Temperature*: 3354°F
Steam Pressure*: 120psig
Steam Demand*: 38,000lb/hr

With Skyven Arcturus:

Annual Fuel Usage Reduction:
513,316 MMBtu

Annual Scope 1 & 2 CO2e Emissions Reduction:
27,106 MT

Total CapEx Required:
\$0

Average Annual Facility Savings
\$348,000



CHEMICALS
Annual Natural Gas Usage:
8,875,764 MMBtu

Steam Temperature*: 414°F
Steam Pressure*: 275psig
Steam Demand*: 50,000lb/hr

With Skyven Arcturus:

Annual Fuel Usage Reduction:
750,203 MMBtu

Annual Scope 1 & 2 CO2e Emissions Reduction:
39,658 MT

Total CapEx Required:
\$0

Average Annual Facility Savings
\$807,000

*Example. Every facility is different.

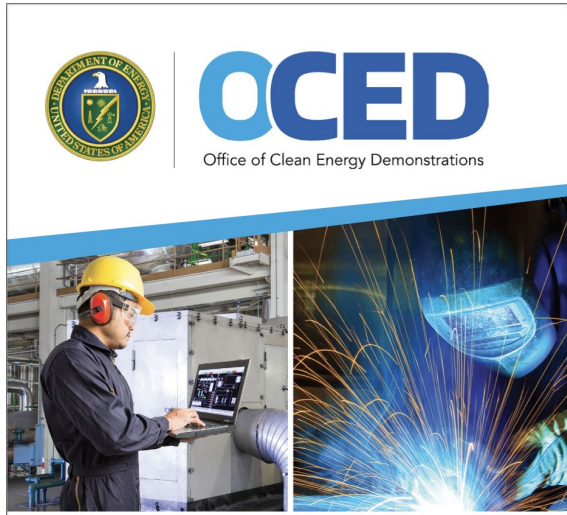


Business model & Economics



Department of Energy OCED Grant (IRA)

Skyven Selected to receive \$145M to deploy a portfolio of Arcturus SGHP projects across multiple manufacturing facilities and industries



Project Goals

- Make heat pumps the **new industry standard** for emissions-free steam
- Reduce **facility-level emissions by 57%**
- **Benefit communities** by improving air quality and creating jobs

Key Metrics

- Reduces annual CO2 emissions by over **400,000 MT**
- Creates **good-paying jobs local to project sites**
- Benefits over **330,000 people** in neighboring communities
- **90% of sites** located in disadvantaged areas



Three Implementation Models

Skyven Ownership

1. Energy-as-a-Service (EaaS) Model

- ◇ Skyven secures capital, installs the system and operates Arcturus.
- ◇ Skyven secures electricity contract and/or upgrades
- ◇ Skyven shares the savings generated (aka benefits) vs existing steam production system with Customer.

2. Tolling Model

- ◇ Skyven secures capital, installs the system and operates Arcturus.
- ◇ Customer pays Skyven a Fixed Fee + Operating Costs.

Customer Ownership

3. CAPEX Approach

- ◇ Customer secures funds to cover the cost of the project.
- ◇ Skyven installs the system and "turns over the keys" following product commissioning.
- ◇ Skyven is available for O&M.

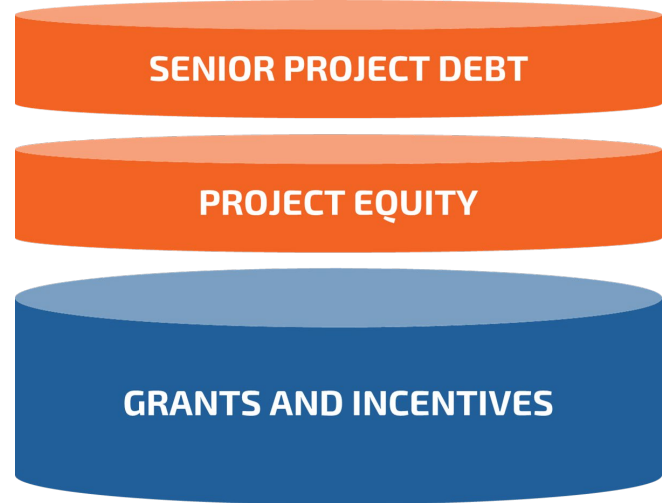
Project Capital (EaaS)

50% Skyven-formed Special Purpose Vehicle (SPV) funds

- ◇ 25% from senior project debt (secured by the heat pump asset) or customer
- ◇ 25% from project equity (provided by Skyven)

50% Funds available from Grants & Incentives*

Capital Stack



SENIOR PROJECT DEBT

PROJECT EQUITY

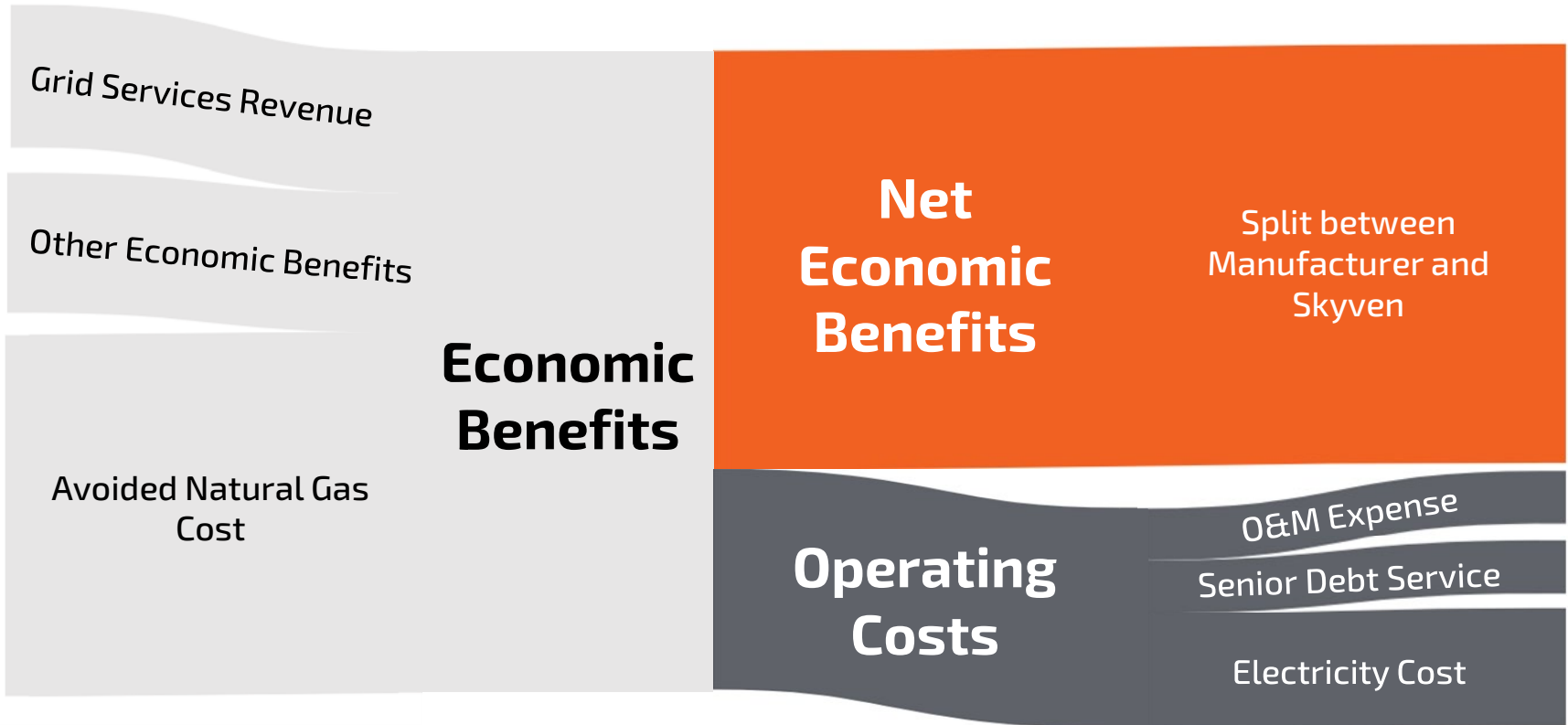
GRANTS AND INCENTIVES

*Skyven has successfully secured \$145m from the US DOE OCED and several millions from other US state agencies.



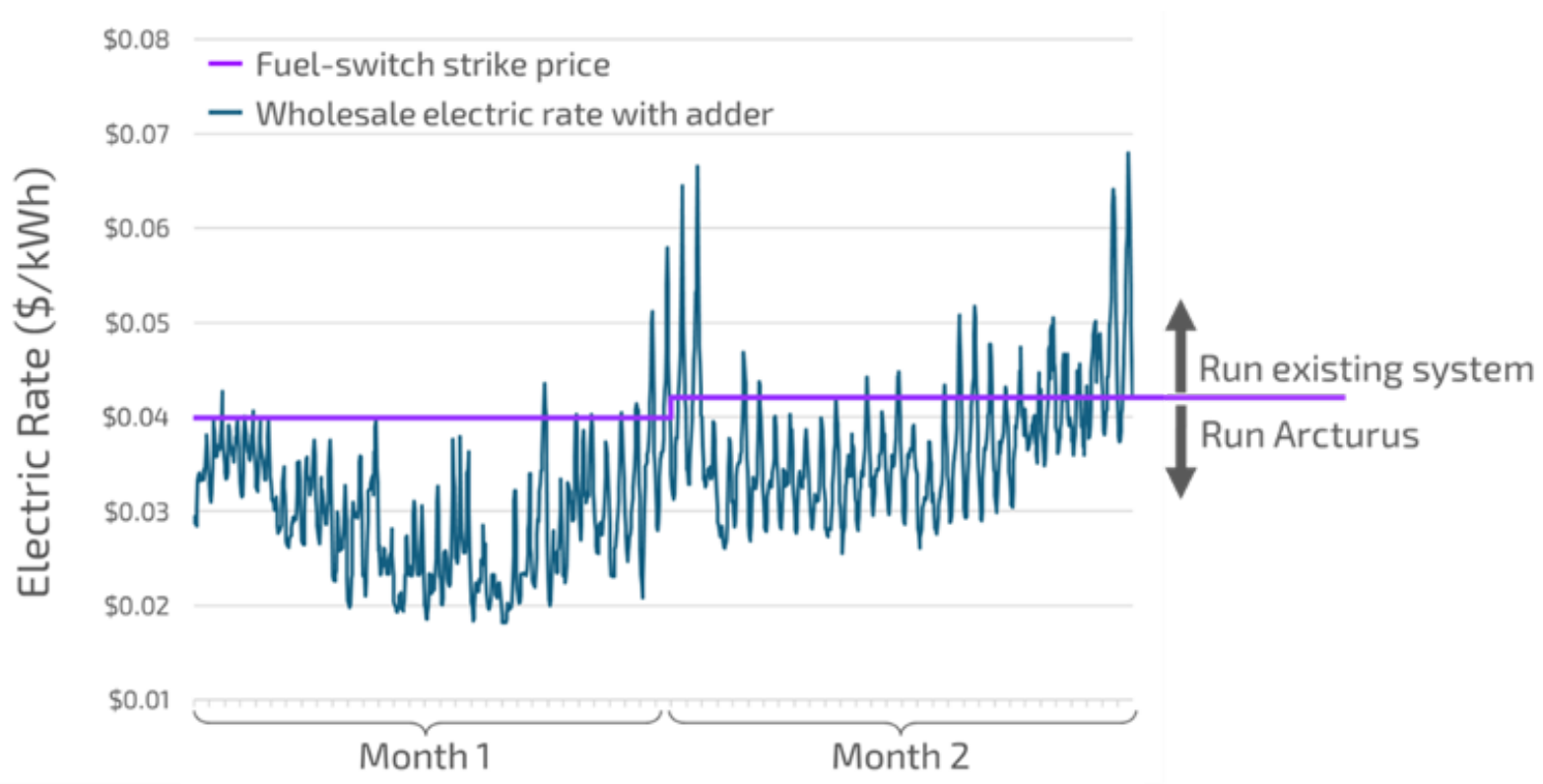
Skyven's Energy-as-a-Service Business Model

Skyven covers all CapEx; Skyven and Customer share economic benefits

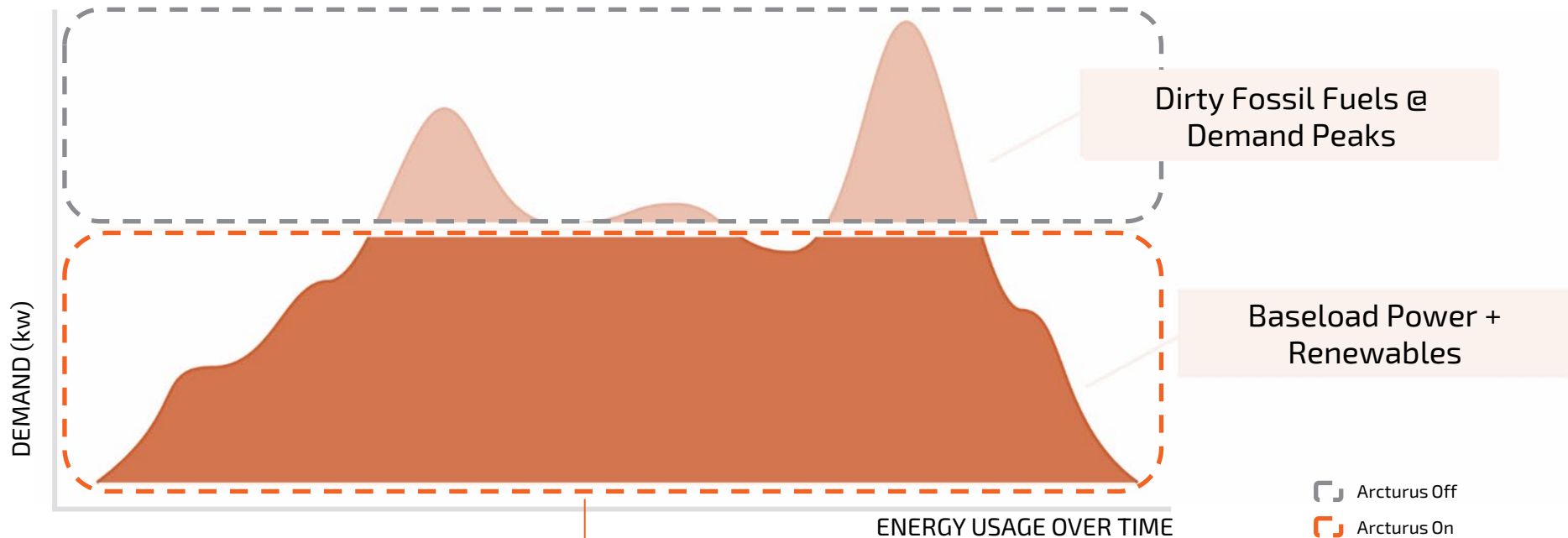




Skyven leverages fuel-switching to maximize economic benefits



Arcturus - Playing With The Grid



Skyven Arcturus can be turned off at highest demand peaks

**Alleviates
grid congestion**

**Better utilizes
existing grid**

**Allows for deeper
penetration of renewables**



Why our model proves value

Profitable, low-risk decarbonization



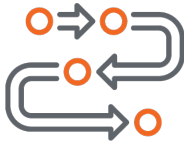
Highly Reliable Cutting-Edge Technology

- ◇ **Mechanical Vapor Recompression (MVR)** technology
- ◇ **In-situ Guarantee:** Skyven's capital investment serves as a multi-million-dollar guarantee that the system will perform



Financially Attractive

- ◇ **Zero CapEx:** Skyven covers 100% of capital costs
- ◇ **High COP** to counteract electrification expense
- ◇ **Aligned Incentives:** Skyven only makes money if the customer cuts carbon and saves money



No Impact to Operations

- ◇ **Very Low Risk:** Fully redundant system with existing natural boilers, drastically reducing risk
- ◇ **No downtime, easy integration:** Arcturus can be installed up to half-mile from the plant and ties in only at three standard and straightforward points.
- ◇ **Fuel Switching:** Alleviates grid congestion during peak times, with no impact to operations



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