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February 7, 2023

MEMORANDUM

TO: Power Committee Members

FROM: Kevin Smit, Senior Energy Analyst

SUBJECT: Emerging Energy Efficiency Technology in the Northwest

BACKGROUND:

Presenter: Mark Rehley, Director, Emerging Technology, Product Management, Codes, Standards & New Construction at the Northwest Energy Efficiency Alliance (NEEA)

Summary: Mark Rehley will present information on some energy efficiency (EE) emerging technologies (ET) that are important to the Northwest energy system. NEEA has a program for developing and progressing ETs through research, testing, evaluation, and demonstrations. In addition, NEEA coordinates and facilitates complementary ET research among NW utilities and other entities through the Regional Emerging Technology Advisory Committee (RETAC). Advances in heat pump technology continue to be at the forefront of ET development, as these impact both space and water heating. Through these efforts, new or improved EE measures become part of NEEA and utility programs and many eventually become mainstream.

Relevance: The Northwest has a long history of acquiring energy efficiency resources. Like any other generating resource, new resources need to continue to be developed to successfully meet future needs at a reasonable cost. This is the view of the Northwest's energy efficiency emerging technology efforts. Existing energy efficiency technologies need to continue to improve, and new measures need to be developed. Prior to each power plan, Council

staff investigate these emerging technologies to determine which ones are ready¹ to be included in the plan's EE supply curves. The 2021 Power Plan includes strong recommendations for the region to continue investing in NEEA and emerging technologies: "Continued investment in NEEA and efficiency-related research and development is critical to achieving the long-term goals...we recommend the region's utilities continue to fund research and development on emerging technologies..."²

Background: NEEA is an alliance of more than 140 utilities and energy efficiency organizations working to increase the adoption of energy-efficient products, services, and practices. To do this, the alliance identifies and removes market barriers to energy efficiency to drive permanent change throughout the supply chain (i.e., Market Transformation). NEEA is a critical component in the development of the NW energy efficiency resource. NEEA and Council staff work closely together in many EE-related areas. The region especially relies on the ET efforts that keep the EE pipeline filled with new technologies and practices.

More Info: <https://neea.org/>
<https://neea.org/our-work/emerging-technologies>
<https://neea.org/committee-documents/retac-charter>

¹ The Northwest Power Act requires that energy efficiency measures be "reliable and available" at the time they are needed.

² Northwest Power and Conservation Council, *The 2021 Northwest Power Plan*, March 2022, Page 34.



Energy Efficiency Emerging Technology

Mark Rehley

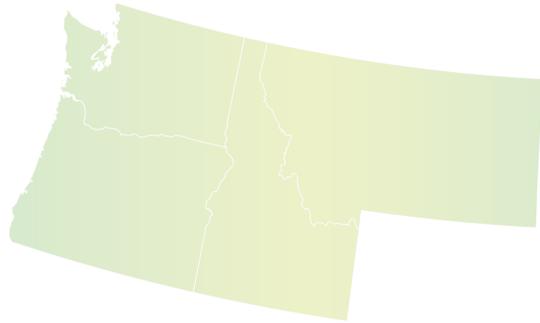
Director, Emerging Technology, Codes, and Standards

February 14, 2023





The Alliance





What Does NEEA Do?



***EMERGING
TECHNOLOGIES***



***PORTFOLIO
EXECUTION***



***CODES
& STANDARDS***



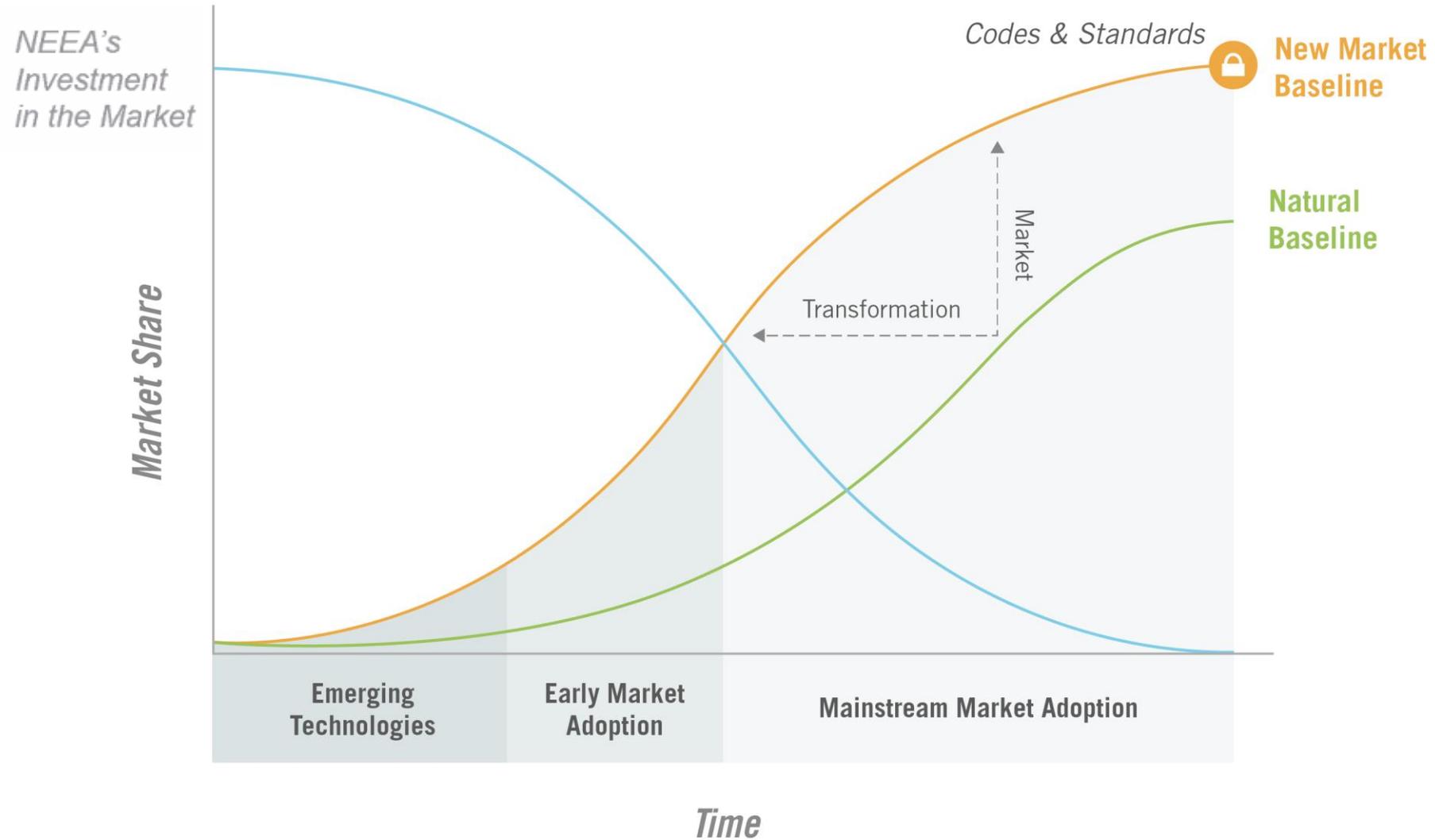
***CONVENE AND
COLLABORATE***



***MARKET
INTELLIGENCE***



Market Transformation



Initiative Life Cycle



A large, faint, light blue geometric logo consisting of several overlapping, nested shapes that resemble a stylized 'E' or a series of interlocking lines, centered in the background.

Emerging Technology Program



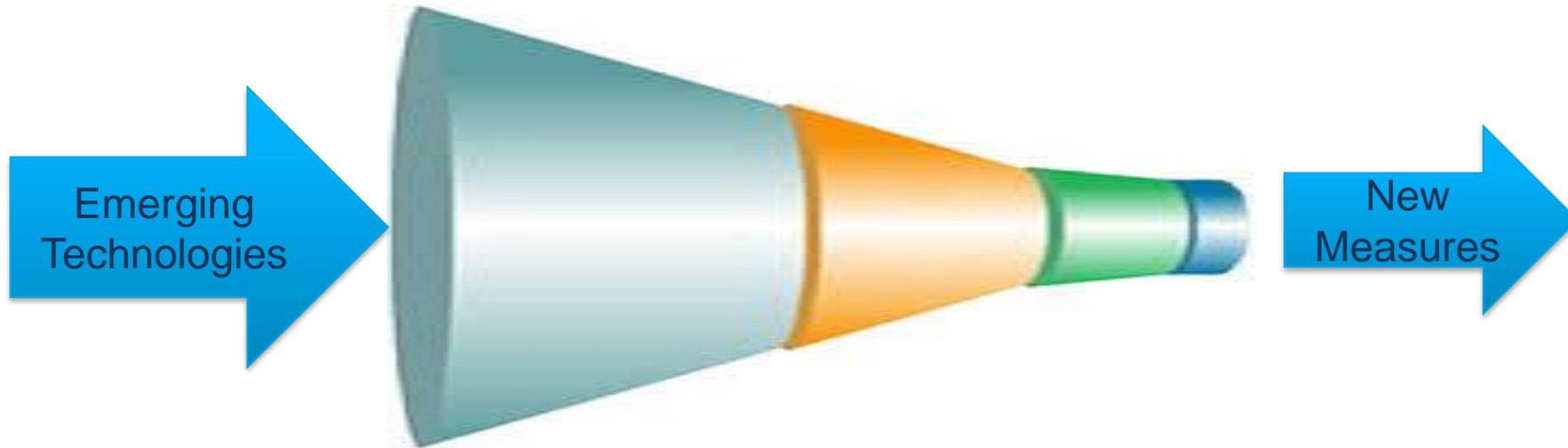
RETAC



Regional Emerging Technology Advisory Committee



➤ *Maintain a full pipeline*



- Readiness
- Product
 - Market
 - Program





Product Summary & Readiness Levels

	PRODUCT	PROGRAM*	FUEL TYPE	SECTOR	ELECTRIC SAVINGS POTENTIAL**	PRODUCT PERFORMANCE*	MARKET/ COMMERCIAL*	PROGRAM READINESS*
Products	Paired Washer-Dryer	RPP	 		TBD	3	5	5
	Ultra-High Definition TVs	RPP	 		57	4	5	5
	Residential Laundry Field Study	RPP	 		N/A	5	5	5
HVAC	Very High Efficiency Dedicated Outdoor Air Systems	VHE DOAS	 		85	4	3	2
	Variable Refrigerant Flow (VRF) System	N/A	 		TBD	4	4	2
	Efficient Rooftop Units	N/A			TBD	4	3	4
	Heat Pump Rating Representativeness	VSHP	 		TBD	3	5	4
	Heat Pump Advanced Features and Capabilities - Tier 2	VSHP	 		TBD	3	5	4
	Micro VSHP Field Study	VSHP	 		TBD	1	3	1
	Heat Pump Ready ENERGY STAR Manufactured Homes	VSHP	 		TBD	4	5	3
Building Envelope	Window Attachments	Window Attachments	 		35	3	5	4
	High-Performance Windows	HPW	 		60	4	3	4
	Secondary Windows	Window Attachments	 		TBD	4	5	4
Lighting	Luminaire Level Lighting Controls	LLLC	 		75	4	4	3
	LLLC with HVAC Control	LLLC	 		358	3	2	3
	Circadian Lighting for Residential Homes/Facilities	LLLC	 		TBD	1	1	1
Water Heating	Combination Hot Water and Space Heat	N/A	 	 	130	1-4	1-3	2
	Central Commercial Heat Pump Water Heater	HPWH	 		50	3	3	3
	Split System Heat Pump Water Heater	HPWH	 		50	3	3	3
	Integrated Commercial Heat Pump Water Heater	HPWH	 		50	3	3	4
Motors	Power Drive Systems	XMP	 	 	TBD	4	3	4
	Commercial & Industrial Fans	N/A	 	 	TBD	5	4	2
Other	Machine Learning (ML) Building Controls	N/A	 		TBD	1	2	2

* **Program Acronyms Defined:** Retail Product Portfolio (RPP); Ductless Heat Pumps (DHP); Variable Speed Heat Pumps (VSHP); Very High Efficiency Dedicated Outdoor Air Systems (VHE DOAS); Residential New Construction (RNC); Luminaire Level Lighting Controls (LLLC); Heat Pump Water Heater (HPWH); Efficient Gas Water Heaters (EGWH); Extended Motor Products (XMP); High-Performance Windows (HPW)

** Technical **electric savings potential** for the region in aMW
 * **Readiness Level Definitions** provided on page 24; **Rating Scale** 1=low 5=high

Fuel Type Symbols: Electric  Gas 

Sector Symbols: Residential  Commercial  Industrial 



Residential Emerging Technologies

Space Conditioning



- Heat Pumps (cold climate, gas & electric)
- Thermostats
- Heat recovery ventilation

Water Heating



- Heat Pump Water Heater (gas, electric)
- Energy Storage
- Recirculation Pumps



Envelop



- Windows (thin triple)
- Window coverings
- Walls / Ceiling
- Air Sealing

Appliances



- Laundry
- UHD TV
- Refrigerator / Freezer
- Air Purifiers

Lighting

- LED 200 lpw



Commercial Emerging Technologies

Lighting



- LED 200 lpw
- Occupancy based controls

Water Heating



- Heat Pump Water Heater
- Energy Storage
- Recirculation Pumps



Envelope



- Window coverings
- Air Sealing

Space Conditioning



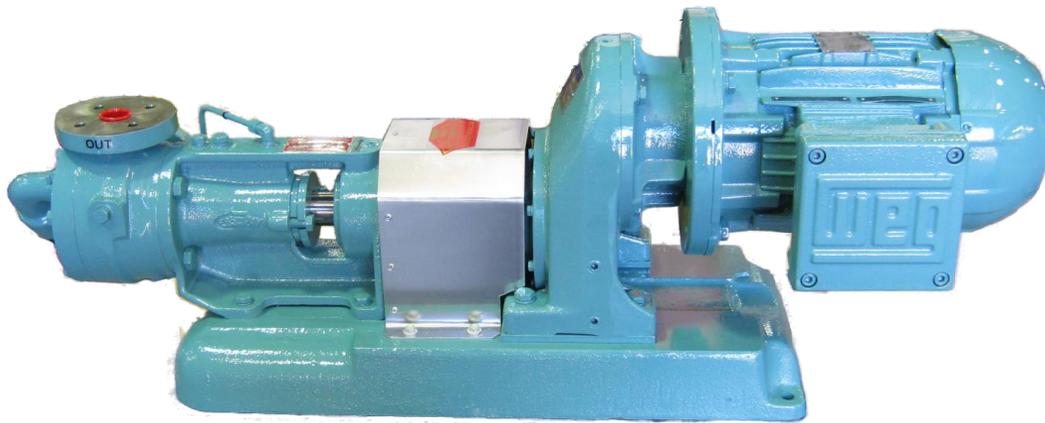
- Heat Pumps
- Condensing gas roof top units
- Occupancy based controls
- Heat recovery ventilation



Commercial / Industrial Technologies

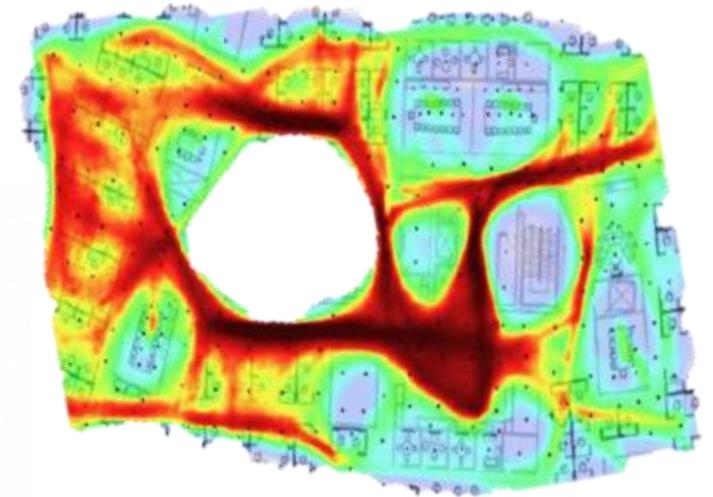
Extended Motor Products

- Motor
- Control system
- Pump, Fan, Compressor



Controls

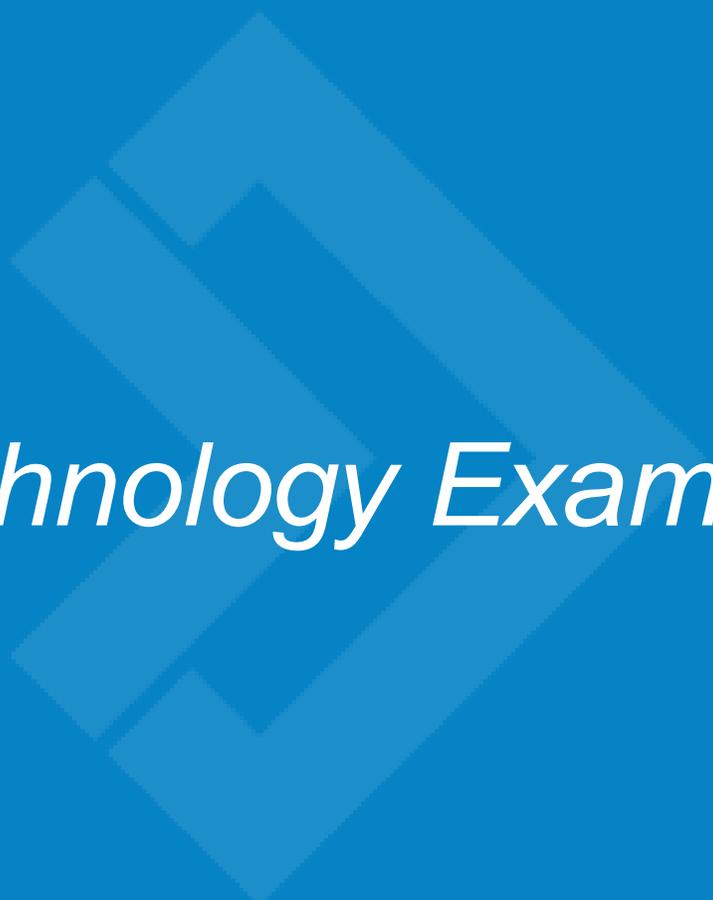
- Machine learning
- Zonal controls





Emerging Technology Trends

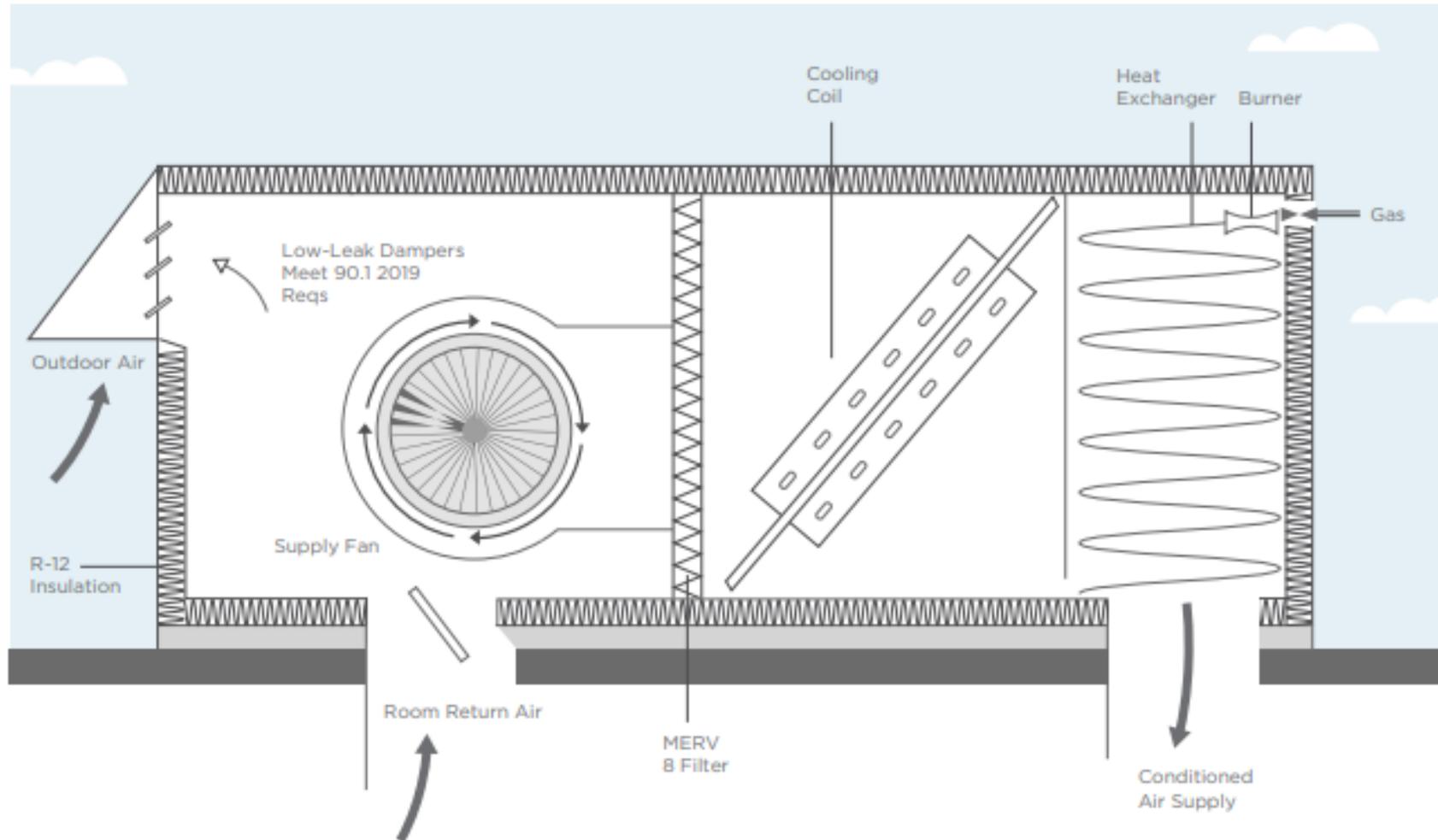
Trends	Benefits	Challenges
Cheap sensors and computing power	Better data and improved control	Constant changes make product validation difficult
Machine Learning and Artificial Intelligence	Optimize benefits and efficiency over time	Increases potential for unintended consequences
Opportunities are shifting to systems	Offers significant savings and other benefits	Challenging to implement and verify persistent performance



Technology Examples

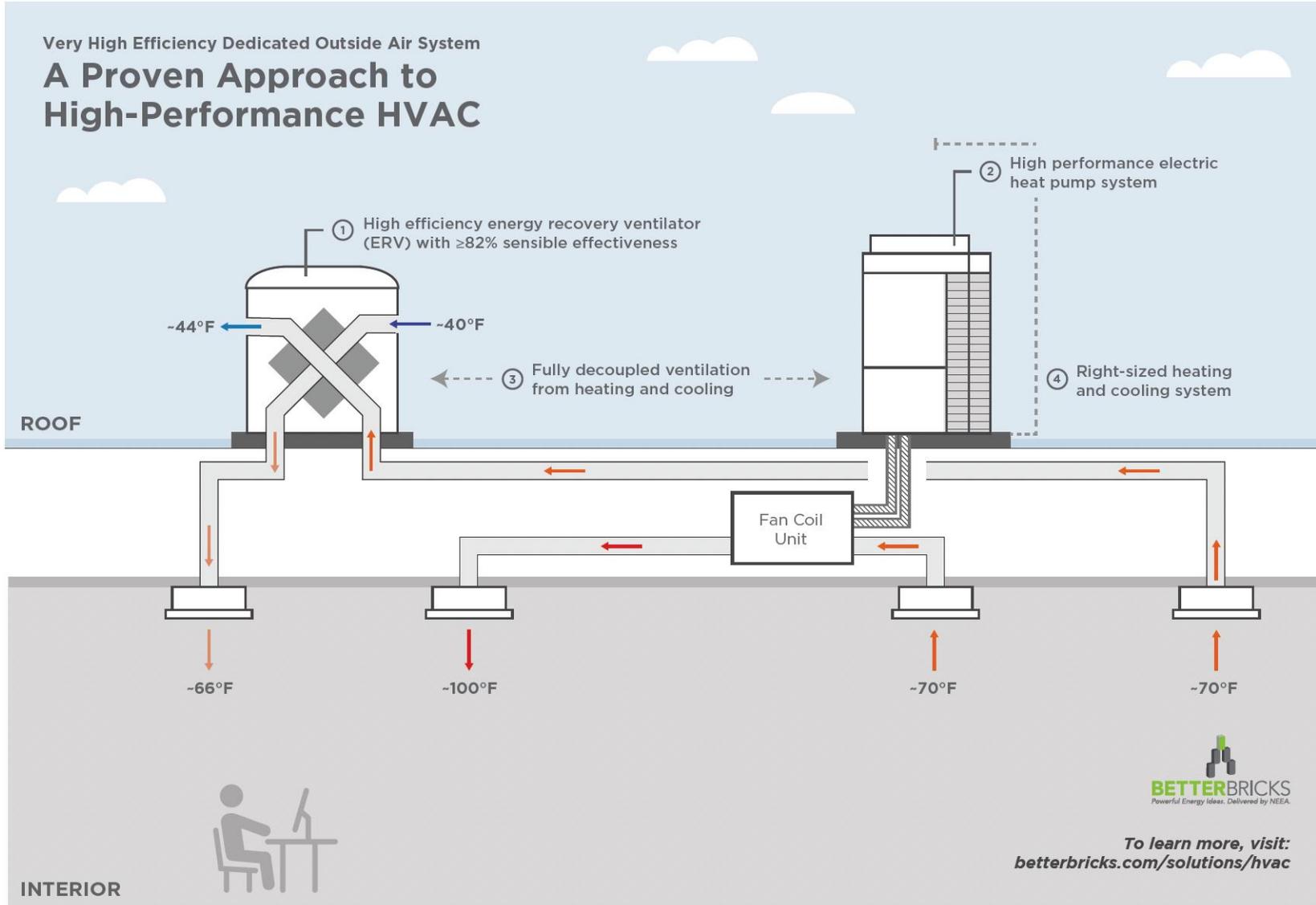


Typical Commercial Heating, Cooling and Ventilation(HVAC) System



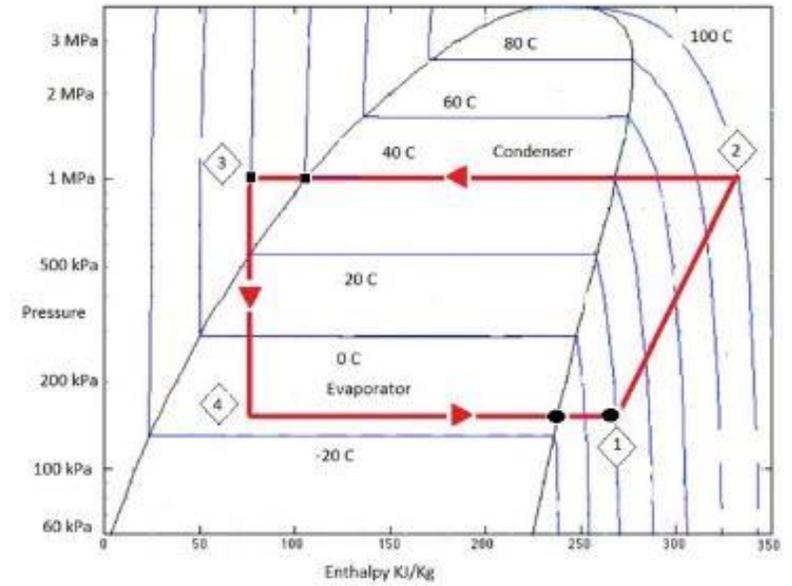
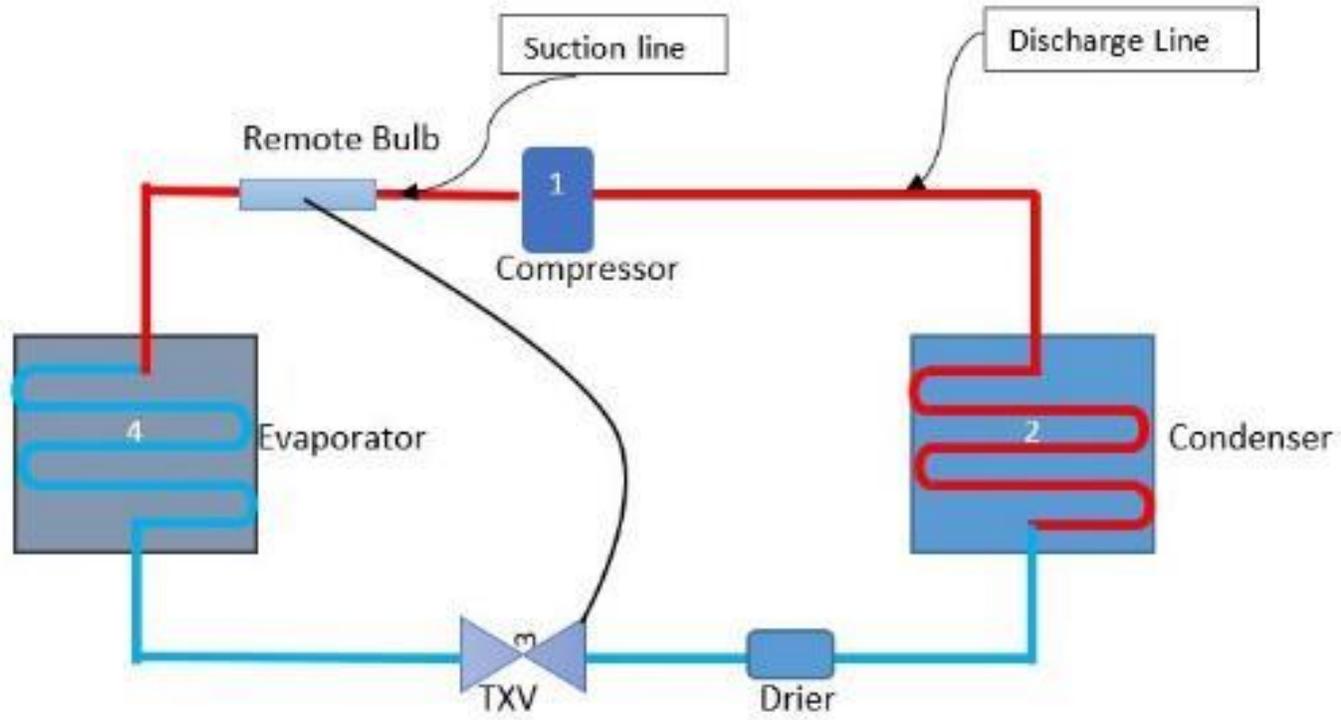


High Performance HVAC System





Heat Pumps



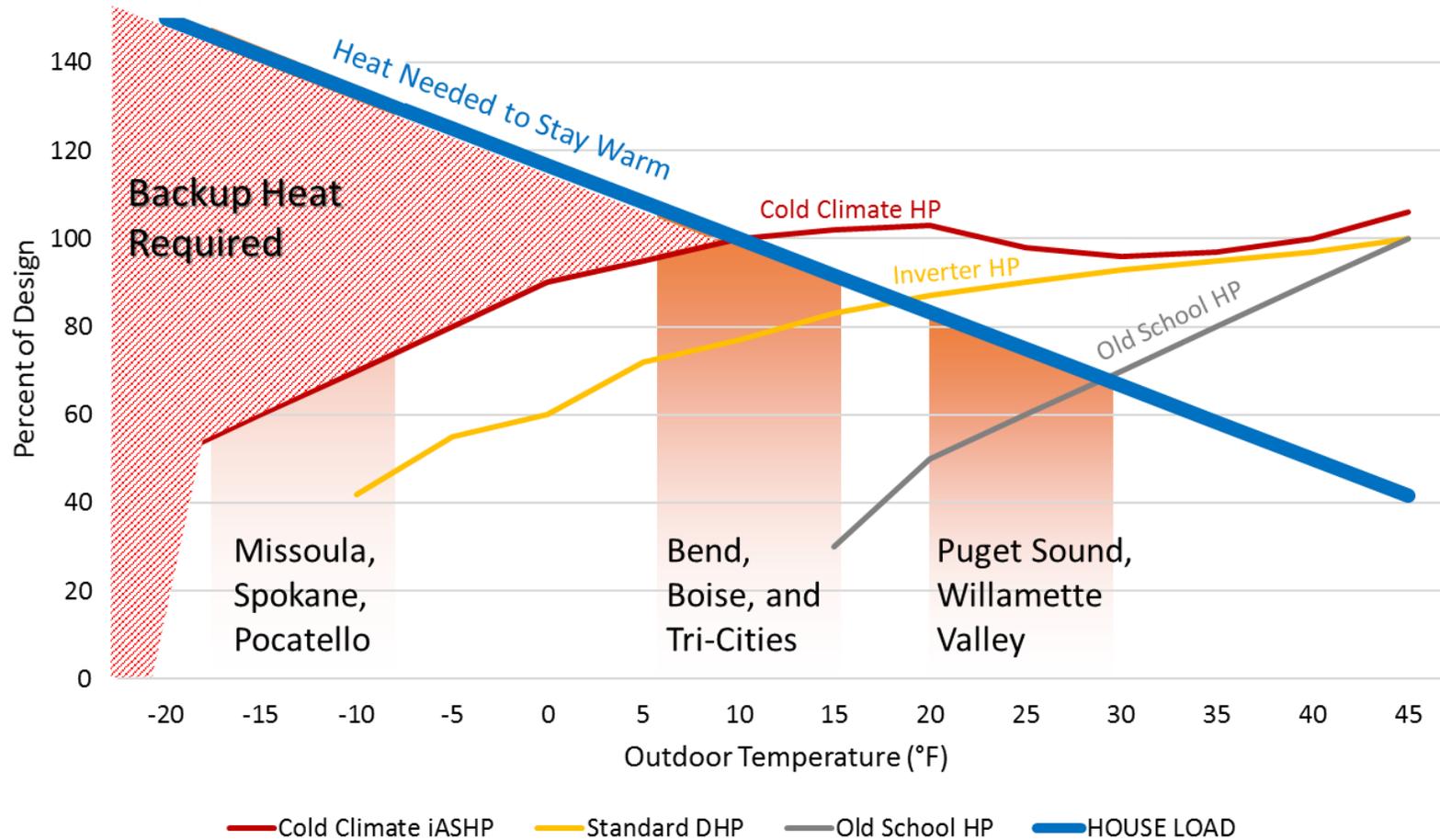


Heat Pump Applications





Heat Pumps work in cold climates (and are getting better)

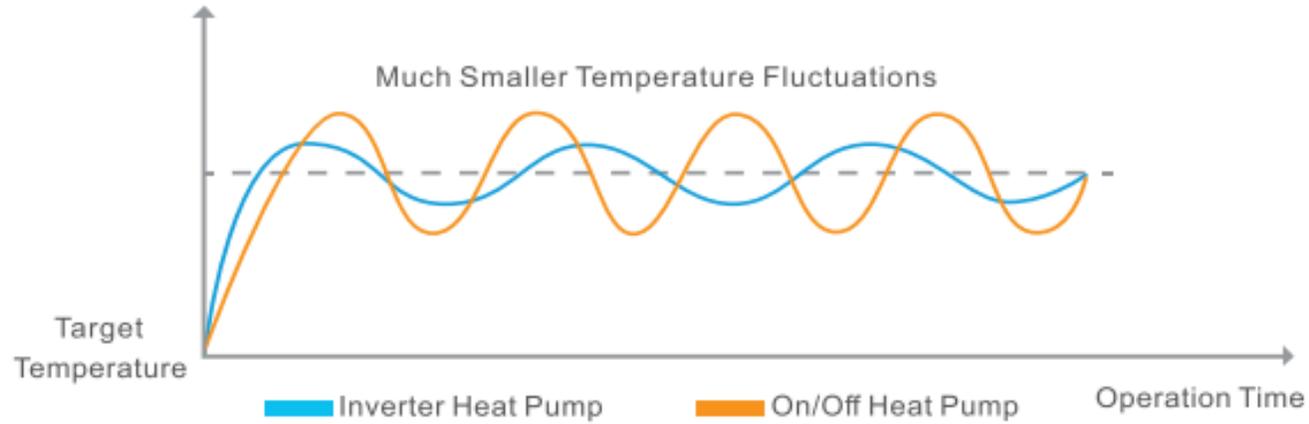


Note: these are representative curves, not a specific product

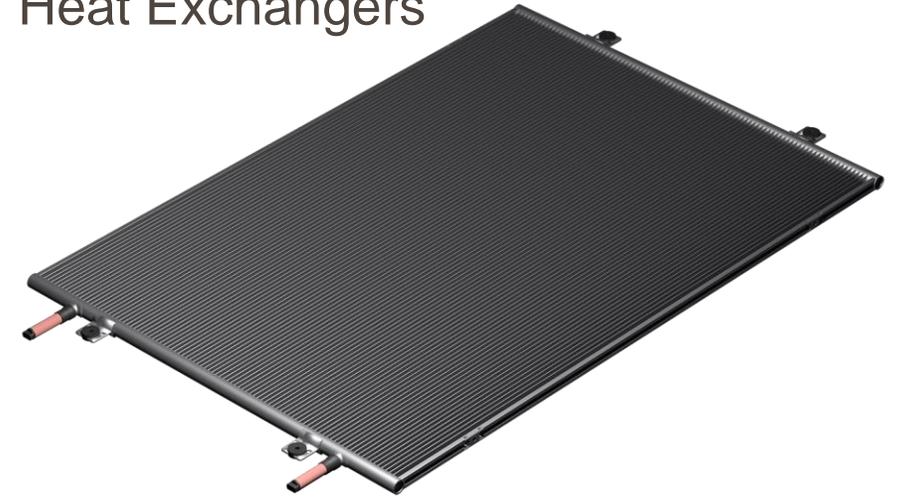


Heat Pump Technologies

Variable Capacity



Heat Exchangers



Natural Refrigerants



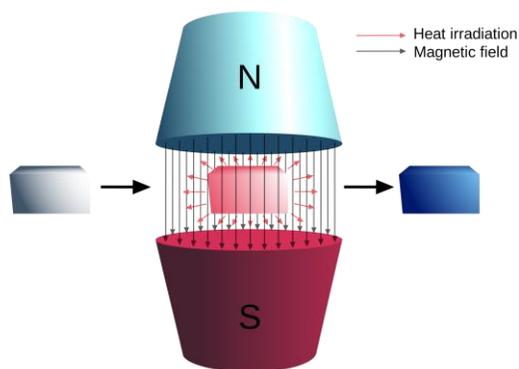
Smart Controls



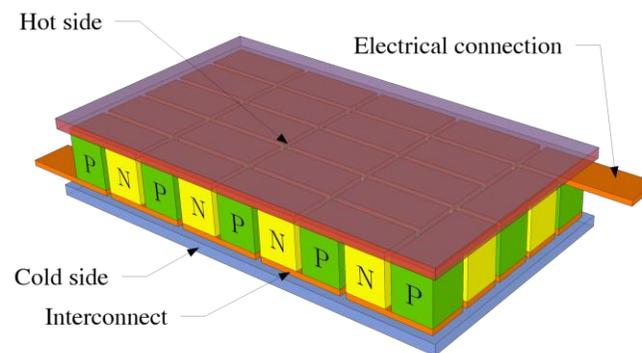


Alternatives to Vapor Compression

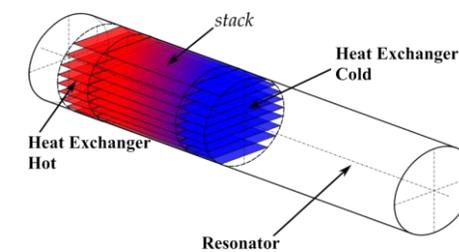
Thermomagnetic



Thermoelectric



Thermoacoustic





Personal Heat Pumps





Gas Driven Heat Pumps





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