



About the Industrial Heat Pump Alliance

The Industrial Heat Pump (IHP) Alliance offers resources and guidance to support the deployment of this vital technology in the United States. The IHP Alliance is an initiative of the American Council for an Energy-Efficient Economy ([ACEEE](#)), the National Electrical Manufacturers Association ([NEMA](#)), and the Renewable Thermal Collaborative ([RTC](#)). We have four primary objectives:

- Accelerate IHP demonstration and deployment projects
- Increase domestic IHP manufacturing and market implementation capacity
- Raise awareness and knowledge of IHPs
- Identify and advocate for supportive policies and funding

The IHP Alliance also offers training through our Buyers Bootcamp, a full-day workshop for end users to learn more about topics such as technical considerations and available tools, utility planning, financing, and system integration. Contact us to learn more.



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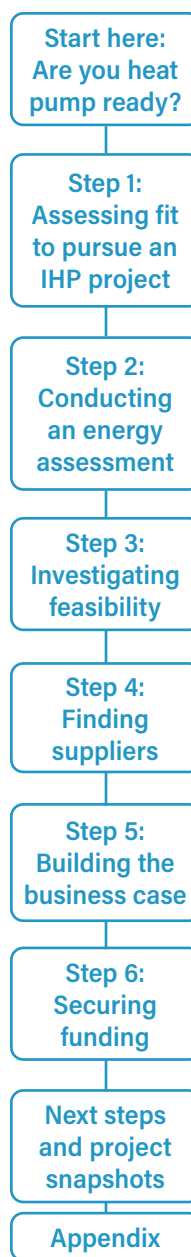
Acknowledgements

ACEEE's Hellen Chen and Andrew Hoffmeister wrote this guide on behalf of the IHP Alliance. The guide was made possible through the generous support of Climate Imperative. The authors gratefully acknowledge external reviewers, internal reviewers, and colleagues who supported this brief. External expert reviewers included Tara Schuelke at Hilmar Cheese, Chris Edmonds at Oatly, Dave McDougall at McDougall Advisors, and a few anonymous reviewers. Internal reviewers included Mary Robert Carter, Mariel Wolfson, Steve Nadel, and Richard Hart, as well as Steve Griffith, Cihang Yuan, and Ruth Checknoff from the IHP Alliance team. External review and support, and any mentions of companies or organizations throughout the guide, do not imply affiliation or endorsement. Lastly, we would like to thank Kate Doughty for her graphic design support, Keri Lee for copyediting, Marci Bloch for proofreading, and Ethan Taylor and Rob Kerns for their help in launching this guide.

How to use this guide

This guide was created to help industrial managers and sustainability officers navigate the many resources available to determine the energy savings and economics of industrial heat pumps (IHPs). As figure 1 shows, we organized this guide according to the six main steps entailed in obtaining an IHP for a facility.

Figure 1. The step-by-step resource guide's contents



Please see [Project Snapshots for real-world examples](#) of two companies that are moving along these steps. The [Appendix](#) offers an example scenario on how to leverage the different resources to pursue an IHP project. The steps your project follows may not exactly match the steps in this guide. For example, your company may have conducted a specific technology feasibility study before a facility-wide energy audit. You may have secured project funding before choosing a supplier, or you may be pursuing both in parallel. Our guide is illustrative and aims to provide as many resources as possible. We welcome you to contact the IHP Alliance for additional recommendations and resources.

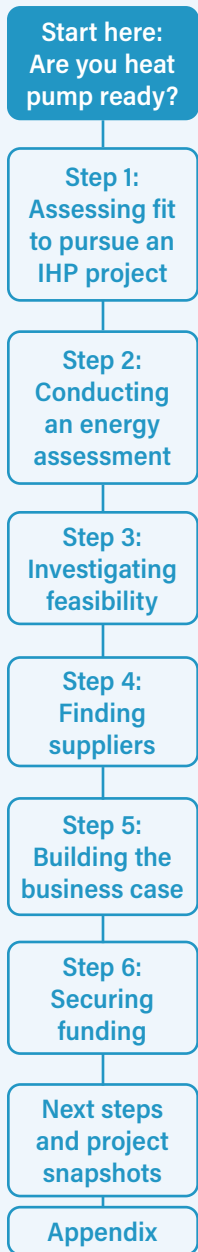
The table of contents is on each page to help you navigate between topics. Within each step, we discuss the importance of the topic and link to relevant resources, with case studies and interactive tools indicated by the following icons:



Case study



Calculator



Start here: Are you heat pump ready?

IHPs are available today to save energy, modernize facilities, and make processes more efficient. IHPs can provide heat for many manufacturing processes, especially those with low to medium temperature needs, and they are three to four times more efficient than conventional fossil fuel equipment. They also offer other benefits, including reduced emissions, reduced maintenance costs, and improved product quality. An IHP may be the right fit for you if at least several of the following apply:

- ✓ Your company has emissions or pollution reduction goals.
- ✓ Your facility has simultaneous heating and cooling streams that are co-located and/or has opportunities for waste heat recovery.
- ✓ Your project includes complementary measures such as onsite renewables, storage, or other technologies, or your facility already generates a significant amount of electricity through onsite renewables.
- ✓ Your facility is in a state with a favorable spark gap (electricity-to-natural-gas price ratio) or has access to low electricity costs.
- ✓ Your industrial processes use propane or another fuel other than natural gas, or you purchase steam rather than generating it on site.
- ✓ Your existing equipment is nearing the end of its life or you anticipate new construction of a process or facility that could benefit from a more-efficient IHP system.
- ✓ Your company has an existing relationship with a potential supplier and/or engineering firm to help with equipment integration.

A [map from ACEEE](#) shows facilities where IHPs and other electric heat technologies are planned or deployed across the United States.

Start here:
Are you heat
pump ready?

Step 1:
Assessing fit
to pursue an
IHP project

Step 2:
Conducting
an energy
assessment

Step 3:
Investigating
feasibility

Step 4:
Finding
suppliers

Step 5:
Building the
business case

Step 6:
Securing
funding

Next steps
and project
snapshots

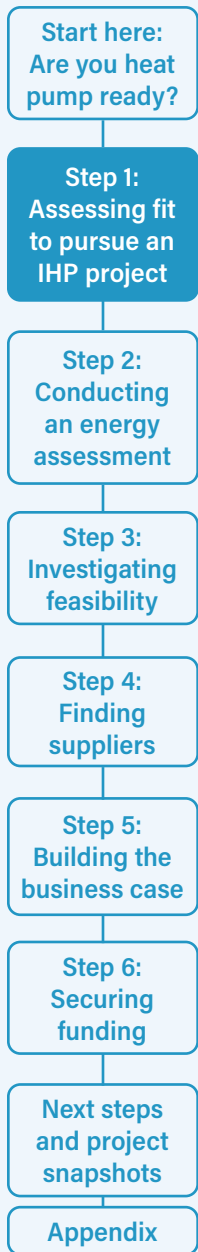
Appendix

Staying engaged with your utility provider throughout the process

It is important to have a good working relationship with your utility as you plan to adopt IHPs at your facility. Determining the contact points at both your company and your utility is critical. If your facility does not already have a utility account manager or active relationship, a technical assistance organization such as a U.S. Department of Energy (DOE) Industrial Training and Assessment Center or your state energy office may be able to help identify the appropriate contact for industrial energy projects.

You should be able to inquire about the potential to add load and associated infrastructure both behind and in front of the meter. Utilities may have funding or incentive programs for energy efficiency, demand response, or even electrification projects. These awards are usually allocated on a rolling basis and can have different eligibility requirements. These programs may include energy audit opportunities as well. Close collaboration with your utility as you move closer to technology procurement ensures that the utility can provide you with feedback on incentive opportunities, various technology options, energy cost changes, and potential electrical infrastructure upgrade timelines and costs.

More guidance can be found in RTC's [Utility Engagement Playbook for Industrial Customers](#).



Step 1: Assessing fit to pursue an IHP project

Companies pursue energy efficiency and/or thermal decarbonization projects for reasons that may be stated in corporate goals such as to reduce costs, reduce emissions, and provide quality jobs in their communities. Some early opportunity sectors include food and beverage (e.g., dairies, breweries); chemicals (e.g., pharmaceuticals); refining (e.g., ethanol processing); and pulp and paper (e.g., drying), all of which have low process heat needs and simultaneous heating and cooling requirements. For subsector-specific resources, see the [feasibility study step](#).

More information is available from the following resources:

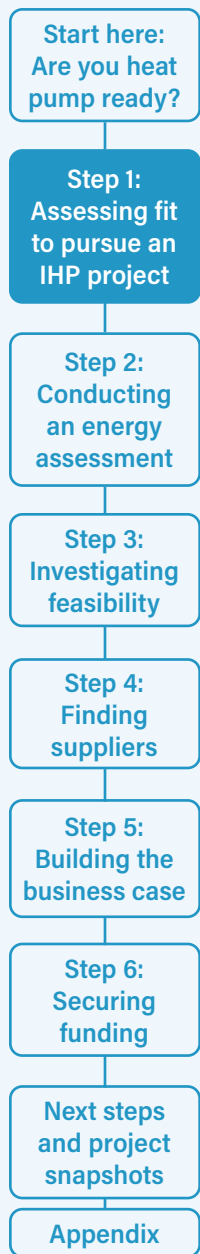
1. Industrial heat pump basics (shorter reads)

- The IHP Alliance website provides basic information about IHP technology and its benefits.
- A two-page [factsheet on IHPs](#) summarizes the technology, its advantages, available technical assistance, and funding resources, along with recommendations for states to drive adoption (Industrial Innovation Initiative).
- Tip sheets about industrial decarbonization include [one on IHPs](#) and guidance on calculating performance and costs (Lawrence Berkeley National Laboratory).

- A New Zealand [website](#) provides basic background for IHPs and their uses, along with other resources (New Zealand's Energy Efficiency and Conservation Authority).


2. Technical and economic potential (briefs and reports)

- [ACEEE's Industrial Heat Pumps](#) page covers various topics, including
 - An [overview](#) of IHP applications and the support needed to advance adoption
 - The [technical potential](#) for IHPs to replace industrial boilers in the United States
 - The [many benefits](#) of IHPs, including benefits to facilities, neighboring communities, and the economy; air pollution reduction; and [electrification of smaller industrial boilers, which presents a near-term opportunity](#) for facilities to improve health and safety for their workers and the community



- A [report](#) on how IHPs can electrify manufacturing across different sectors, including models of energy demand and emissions reductions from IHP applications (Berkeley Lab)
 - A [report](#) about the potential for IHPs to decarbonize low-temperature process heat (Energy Innovation)
 - A [report](#) on electric technologies, including IHPs, and how they can replace industrial boilers (Evergreen Action, Sierra Club)

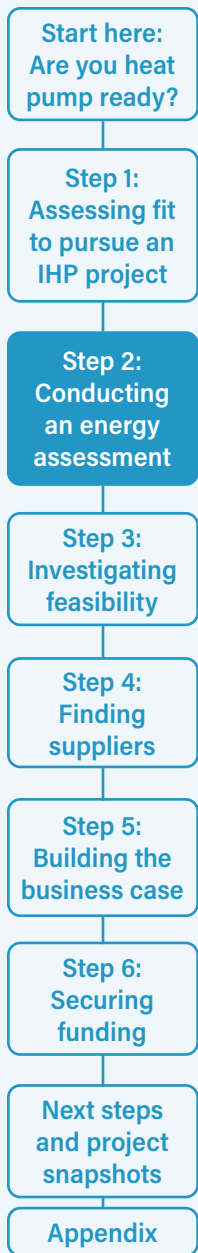
3. Real-world examples

- The International Energy Agency’s Technology Collaboration Programme on Heat Pumping Technologies provides information on heat pump technologies, applications, and markets to help accelerate implementation. Its [annexes](#)—35, 48, 58, and 68—collect data and case studies on IHPs from 20 member countries. A webinar describes [the current capabilities of high-temperature heat pumps and their applications and potential to help decarbonize various industries](#).
-  RTC’s case studies on thermal technology applications, including [one on IHP technology used in a distillery](#).

How might your industrial heat pump project affect your local community?

We highly recommend that every industrial project be scoped for community impacts. While there are great benefits from IHP technology, there can also be indirect consequences that facilities need to consider. These consequences might include workforce displacement and a need for reskilling maintenance workers who are less familiar with heat pump operations. Another consequence might be resource adequacy concerns, which could result in increased electricity bills for area residents. Facilities should work with community leaders to help mitigate negative impacts and prioritize health and safety, especially in underserved communities. To learn more, see the following:

- [Aligning Community Benefits with Decarbonization Goals: Lessons Learned from Development of Community Benefit Plans](#) by ACEEE
- [Navigating Industrial Decarbonization Funding: Principles for Companies Engaging with Local Communities](#) (webinar) by ACEEE
- [Community Benefits Handbook](#) by RTC
- [Delivering Equitable and Meaningful Community Benefits](#) by RMI



Step 2: Conducting an energy assessment

An energy assessment helps facilities find opportunities to reduce energy use and improve energy efficiency. Many of these assessments cover thermal opportunities (especially energy-intensive ones) and are technology agnostic, but they can include specific technologies, strategies, or practices upon request. Berkeley Lab has published



[several tools and factsheets about industrial assessments.](#)

There are many ways to obtain an energy assessment for your facility, including some no-cost options. Many of these providers can also provide technical assistance for feasibility studies or engineering design if you choose to further scope an energy project after the assessment.

Talk to your utility: Many utility programs have a pre-approved list of contractors or vendors that can conduct energy assessments on behalf of the utility. You can find out if your utility has a preferred contractor network by visiting its commercial and industrial (C&I) program website or by reaching out to your utility contacts directly to ask about available options.

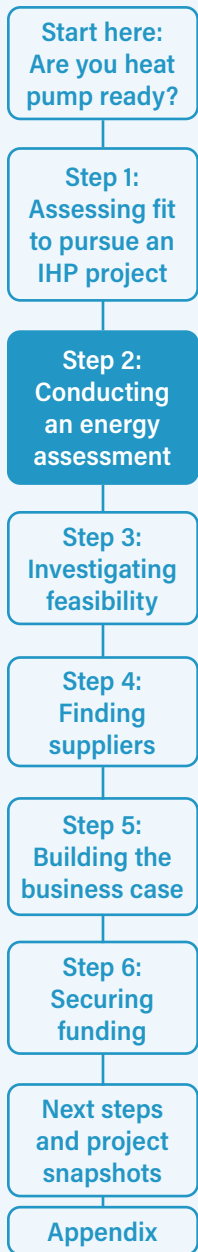
Check your state: Some states, particularly those with climate targets, have set aside state funding for industrial projects. Some programs include low-cost energy assessments, which are often done through a preferred vendor. For example, the Massachusetts [Mass Save](#) program provides

energy audits for industrial facilities that use more than 1.5 million kWh or 40,000 therms of natural gas per year.

- Staying up to date with the National Association of State Energy Officials (NASEO) can be helpful because it posts resources such as [“An Overview of Industrial Technical Assistance for State and Territory Energy Offices.”](#)

Use federal resources: DOE has several programs that offer energy audit or assessment resources. It also provides funding for projects, which is covered in [federal funding resources](#).

- DOE’s [Onsite Energy Technical Assistance Partnership](#) (TAP) Program offers technical assistance to help facilities understand and evaluate technology options including IHPs, thermal storage, and combined heat and power. TAP provides estimates of potential savings, implementation pathways, and cost-effectiveness models to large energy users of all kinds, including industrials. The program prioritizes sites with high feasibility for electrification and strong sustainability goals.
- The [Better Plants](#) Program is composed of organizations that have voluntarily committed to reducing energy intensity



by at least 25% over a 10-year period. The program offers technical assistance through an account manager, who helps to develop energy management plans and savings opportunities, as well as tools, resources, and training options that analyze energy performance and determine further savings pathways.

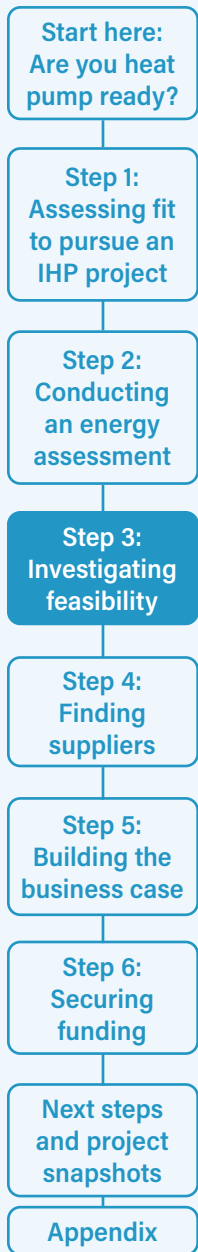
- **Small- to medium-sized business?** DOE's [Industrial Training and Assessment Centers](#) (ITACs) operate out of engineering universities around the country. Teams of students and professors provide free energy assessments to small- to medium-sized businesses.
 - **Functionally equivalent groups:** A total of 34 additional energy assessment provider companies have been selected by DOE as providing ITAC-equivalent audits. Find a full [list](#) of the providers here.
- **Larger facility?** The [Energy Intensive Industries Initiative](#) is trialing a range of technical assistance resources, including energy assessments, through Oak Ridge National Lab (ORNL). The initiative covers large facilities with utility bills of more than \$3.5 million (that do not qualify for ITAC assessments) in seven subsectors: food and beverage, iron and steel, aluminum, cement, glass, pulp and paper, and chemicals.

Look for private options: Engineering consultants are typically able to provide assessments without facility requirements if you do not meet those of public options. Some of these consultants offer financing options for audits and studies. You can also find original equipment manufacturers (OEMs) who offer energy assessments, but these might be tailored more to their own product solutions.

Need a more rigorous audit?

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard 211 defined three energy audit levels for commercial buildings that can also be applied to industrial facilities. Levels 1 and 2 are most like a typical energy assessment; level 3, also known as Investment Grade Audits, functions like a feasibility study. ASHRAE assessments are typically conducted by qualified engineers and energy professionals from engineering and energy consulting firms, certified energy managers, certified energy auditors, energy service companies, or utility implementers. For more information, see the following:

- [Understanding ASHRAE Level 1, 2 & 3 Energy Audits](#)
- [Understanding the Importance of Investment Grade Energy Audits](#)
- Some state funding programs cover some or all of the cost of an ASHRAE audit. One example is Colorado's Industrial Tax Credit Offering ([CITCO](#)), which includes ASHRAE level 2 and 3 audits.



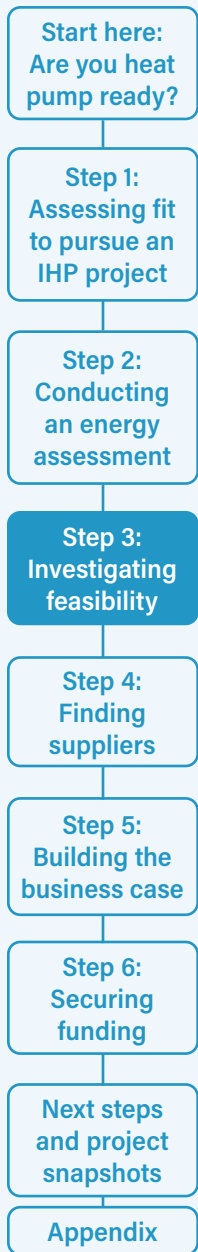
Step 3: Investigating feasibility

A feasibility study is an in-depth analysis of the viability of the different energy efficiency and thermal energy improvement opportunities. It typically includes technical elements such as process mapping and heat integration analysis (e.g., pinch); equipment performance modeling (e.g., optimized efficiency, part-load behavior, redundancy needs); and infrastructure compatibility (e.g., electrical, floorspace) to come up with a basis of design for the project. A feasibility study also looks at budget, cost estimates (both capital and operational), and return on investment or payback analysis.



To learn more and find help with assessing IHP feasibility, see the following interactive tools and calculators:

- The [RTC Heat Pump Decision Support Tools](#) enable industrial end users to perform initial technical and commercial viability assessments for IHPs by calculating key performance factors and economic inputs (e.g., coefficient of performance (COP) and payback).
- [A2EP Heat Pump Estimator](#) for Australia
- [Heat Pump Check](#) for the Netherlands
- Danfoss [Heat Recovery Tool](#) for European countries
- GEA [Heat Pump eCalculator](#) for the European Union and United Kingdom, where savings are presented in euros
- An [Industrial Assessment Guidance](#) website that includes four tools—Sankey, levelized cost, pinch analysis, and electric load planning—with associated tip sheets (Berkeley Lab, University of California, Davis)

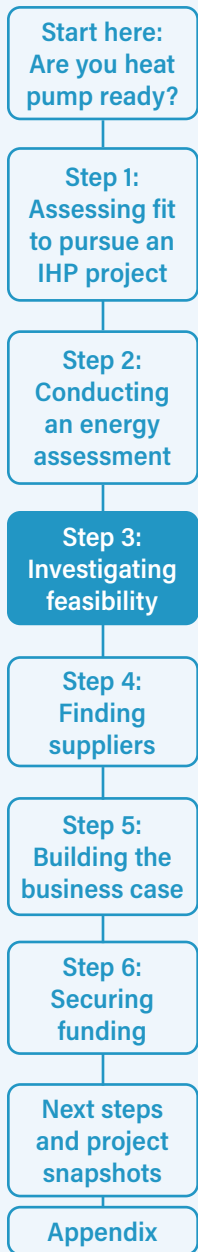


Vendors and programs for feasibility studies:


- Many energy assessment providers also perform feasibility studies, including those within Onsite Energy TAPs, DOE ITACs, utility and state programs, and other third-party engineering firms. The New York State Energy Research and Development Authority (NYSERDA) [Heat Recovery Program](#) Category 2 funding provides up to \$80,000 for a Heat Recovery Project Design. Facilities have the option to choose from [NYSERDA's FlexTech Consultants](#) or use their own contractor to perform the assessment. For more information about these organizations and resources, see the [energy assessment section](#).
- The National Association of Energy Service Companies (NAESCO) has a range of resources, including a [preferred partners network](#) for help with feasibility studies (e.g., Investment Grade Audits), energy consulting, and other services such as financing and finding incentives.

Additional resources for technical considerations:

- A [brief](#) that reviews IHP system integration and how to redesign for right-sized, optimized performance and efficiency, which may also factor into [business case considerations](#) (ACEEE).
- A [brief](#) that presents basic information about the different refrigerant types used in IHPs, which may affect which type of IHP your facility prefers (ACEEE).



Resources for assessing feasibility in specific subsectors

-  The [Initial Screening Tool in the RTC Heat Pump Decision Support Tools package](#) can show case studies by subsector and provides some U.S. examples.

Food and beverage


- An [analysis](#) of how IHPs could save energy and reduce carbon emissions in five food and beverage prototype applications for the United States and in California (EPRI).
- [RTC's food and beverage playbook](#) looks at two technology options for decarbonizing food and beverage process heat, including IHPs.
- An [article about IHPs for food processing](#) includes insights from several heat pump manufacturers (*Food Engineering* magazine).


Case studies of IHPs in

- Meat processing: [Cutting coal and carbon emissions at Silver Fern Farms](#) and [Red meat, green energy](#) (EECA).
- Dairy processing: [Heat is on to find alternative energy sources](#) (EECA).


Textiles

- [A report on low-carbon thermal technology options](#), including heat pumps, for the textile industry in five Asian counties (Global Efficiency Intelligence).


-  A case study for a [hot-water heat pump used in wool washing](#) (EECA).

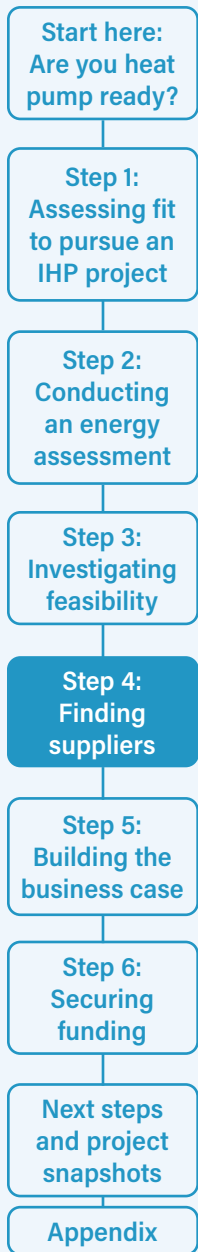
-  An [ethanol plant in California](#) uses mechanical vapor recompression, a type of heat pump technology, for more cost-effective and energy-efficient operations.

Lumber drying

-  [Heat pump technology is being used to dry wood](#) at a family-owned New Hampshire lumber company.
 - A [review](#) of heat pump wood-drying technologies (ORNL).

Industrial-scale heat pumps can also be used for other applications, including district energy. Example case studies include the following:

- [Kendall Station](#) in Cambridge, Massachusetts, uses heat from the Charles River to produce steam for buildings in downtown Boston as part of its district heating network.
-  Industrial laundry services can use a variety of heat sources for a steam generating heat pump, including solar thermal energy generated onsite; an example is the upcoming Advanced Linen project funded by the California Energy Commission.



Step 4: Finding suppliers

There are more than 20 active IHP suppliers in the United States, offering a range of heat pump solutions for different industrial subsectors. Results from a feasibility study can help a company find the best technical and financial heat pump solution from a supplier to fit the project parameters. Some technology providers also offer services such as thermal assessments, financing options, and integration of other complementary technologies. Note that you may also need to find an installation contractor; IHP suppliers might suggest third-party engineering firms that they recommend, or you might be able to choose your own (see more in [feasibility studies](#) and [energy assessments](#)). Supplier selection depends on your process needs, temperature requirements, system design constraints, and procurement approach.

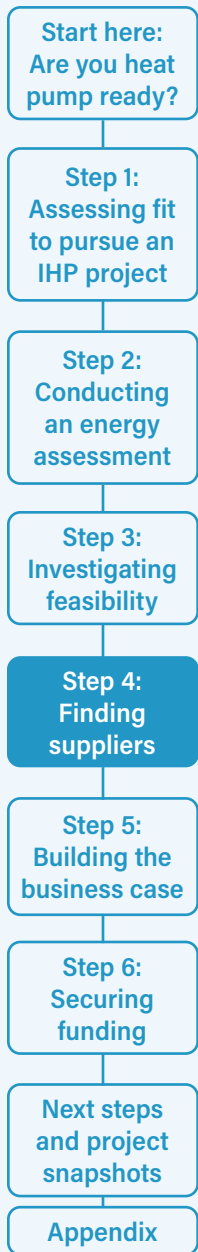
Consider the following:

- Technology fit for your heat source/sink and temperature range
- Integration support and service model (e.g., full package vs. equipment only)
- Vendor experience in your industry or process type
- Willingness to engage early for feasibility support
- Availability of financing or performance guarantees



Interactive tools to help you find a supplier

- **If you know your site's process requirements:** The IHP Alliance [IHP Procurement Toolkit](#) (published in 2024 and updated on a rolling basis) helps reduce the iterative costs of supplier and end user back and forth on technical, site, and budgetary considerations needed to scope a heat pump project. A facility can submit the completed Toolkit to suppliers directly; this enables competitive bids while reducing the need for extensive conversations with and potential site visits from numerous vendors. The list of active U.S. heat pump suppliers includes contact information and a brief description of their heat pump technology.
- **For a map view of projects and suppliers:** ACEEE's [map](#) of industrial electrification across the U.S. dataset has a non-exhaustive list of heat pump suppliers for various application types such as breweries, dairy, ethanol production, and general food processing.

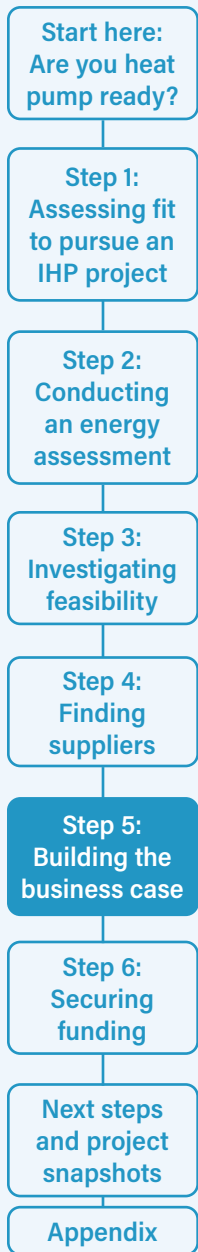


- **To see suppliers by country:** The [Supplier Database](#) in the [RTC Heat Pump Decision Support Tools package](#) has a list of suppliers that you can filter by country. RTC’s [partner locator](#), with the “thermal efficiency” and “U.S.” filters on, could provide options for heat pump suppliers and related vendors (e.g., third-party engineering companies that can help with installation).

Additional venues and resources

- **Trade shows and expos** are another way to start building a relationship with heat pump suppliers for future projects. **Trade associations and professional organizations** such as the [Association of Energy Engineers](#) often host [webinars](#) where solution providers talk about their technology offerings.
- **State programs** may also provide lists of qualified solutions providers (e.g., [NYSERDA Qualified Solutions Providers](#)).

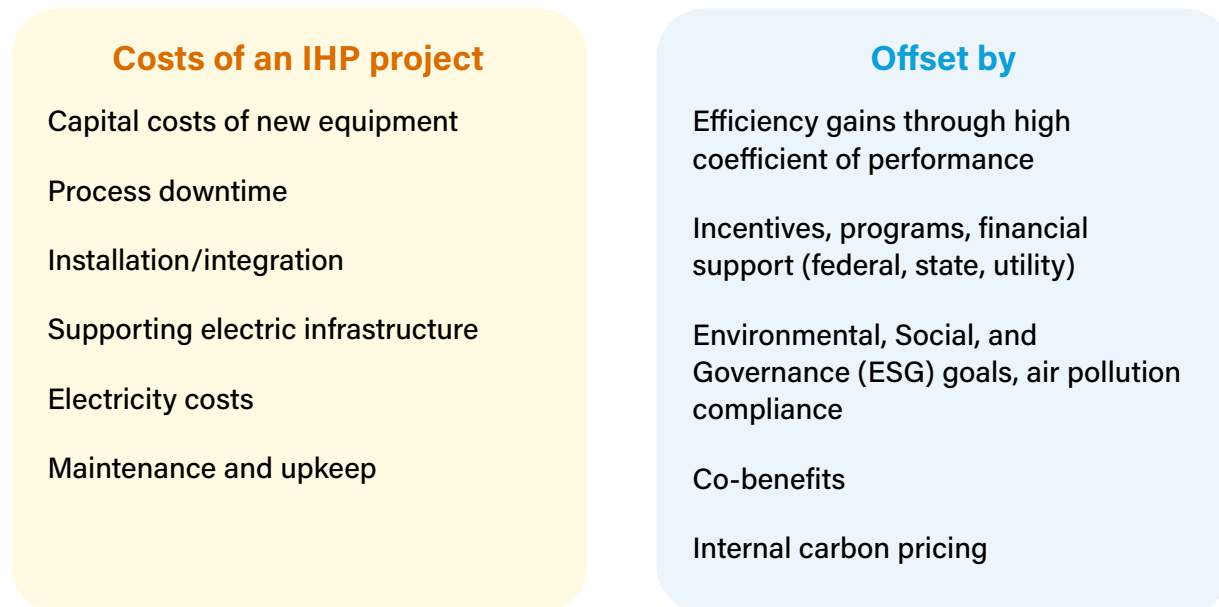


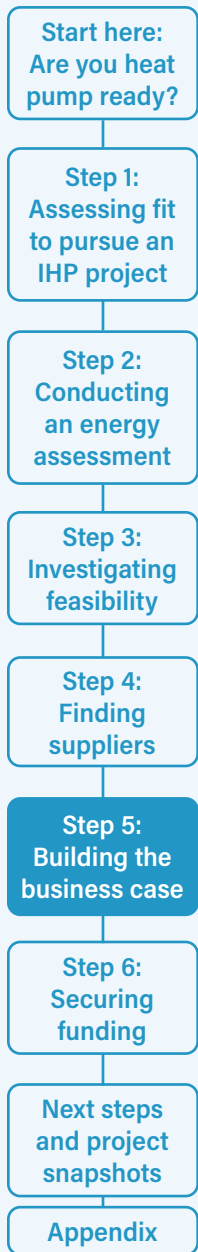


Step 5: Building the business case

Have you considered every way in which an IHP will both impact costs and create savings? Capital and operational expenditures, performance, energy savings, and co-benefits all affect a project's payback and return on investment. Figure 2 summarizes the typical costs and complexities of electrifying with a heat pump, as well as the savings and considerations that can help offset those costs. See [Oatly's Project Snapshot](#) to read more about building the business case.

Figure 2. Costs and savings of electrifying with an IHP



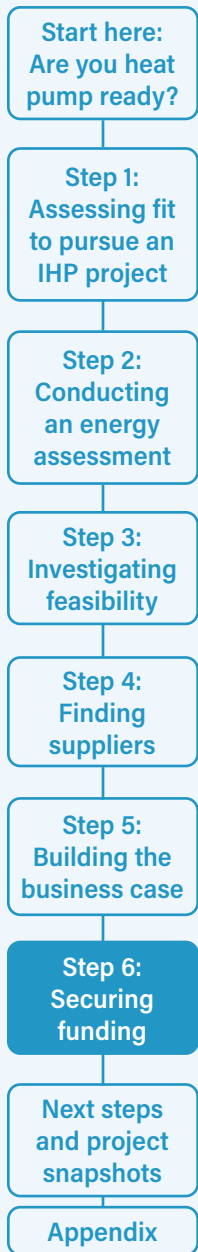


 As part of New Zealand’s Government Investment in Decarbonising Industry funding application, the EECA provides a [business case checklist](#) to help applicants ensure that they have all the materials needed to apply for funding. The checklist includes a comprehensive list of considerations for an industrial decarbonization project that could be helpful to interested IHP buyers.

Additional reading on IHP state of the market and economic considerations:

- A [market report](#) on high-temperature and steam-generating heat pumps in the United States and in California, focused on food and beverage applications, textile, and automotive industries (CaINEXT). The report also lists heat pump types and manufacturers.
- A [market report](#) explores which sectors in Bonneville Power Administration’s service territory would have the most near-term IHP applications (Cascade Energy).
- A [webinar](#) on IHP economics hosted by the IHP Alliance features insights from speakers from the Electric Power Research Institute, the Center of Applied Environmental Law and Protection, and Cascade Energy.





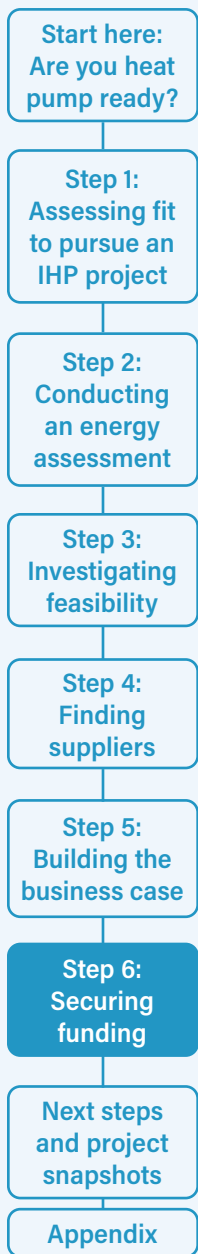
Step 6: Securing funding

After building your business case, you will need both internal and external funding. Each of these funding sources may have different requirements, decision points, performance measurements, and timelines. As you pursue internal and external funding, keep in mind the requirements from each source. You should also ensure that each funding route is stackable with other programs, (e.g., federal funding) with state or utility funding, so that you can minimize your payback period and avoid any compliance issues when you implement your heat pump project.

This section will cover external funding; table 1 indicates which types are the best fit for specific scenarios.

Table 1. External funding options

Funding Type	Best For
<u>Federal grants</u>	Emerging tech, pilot/demo projects
<u>State programs</u>	Capital-intensive retrofits, sector priorities
<u>Utility incentives</u>	Projects with measurable energy savings
<u>Local/municipal</u>	Smaller or community-aligned projects
<u>Financing tools</u>	Filling funding gaps or off-balance sheet models

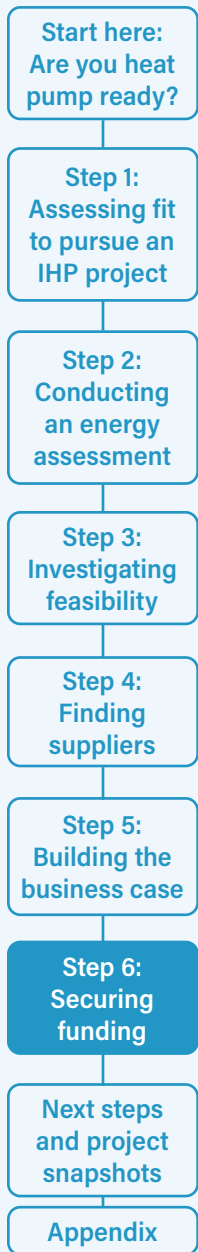


Federal grants

Federal programs can provide technical and financial assistance for IHP projects. Some are offered on a rolling basis, while others are competitive grants.

- [ITAC Implementation Grants](#) provide up to \$300,000 funding per small- to medium-sized facility to implement the recommendations made during the audit process. Facilities that received an assessment from an Onsite Energy TAP or are [ISO50001/50001 Ready-certified](#) can also apply for the grant. To be eligible, facilities must
 - Be within Standard Industrial Codes (SIC) 20–39 and located within 150 miles of a participating university in the ITAC program
 - Have annual energy bills between \$100,000 and \$3.5 million, and gross annual sales of less than \$100 million
 - Have fewer than 500 employees at the plant site and no professional in-house staff to perform assessments
- The Industrial Technologies Validation ([ITV](#)) program provides up to \$400,000 for installation of emerging technologies with 50% cost-share. Participants receive support from the Better Buildings Initiative and share data with DOE to inform technology performance metrics.

- The National Institute of Standards and Technology has a [clearinghouse](#) of funding opportunities and [resources](#) relevant for manufacturing facilities.
- Other funding opportunities (e.g., through DOE or the Environmental Protection Agency (EPA)) can be found on websites such as
 - [Grants.gov](#)
 - [ENERGYWERX Grants & Collaboration](#)
 - [EERE Funding Opportunities](#)

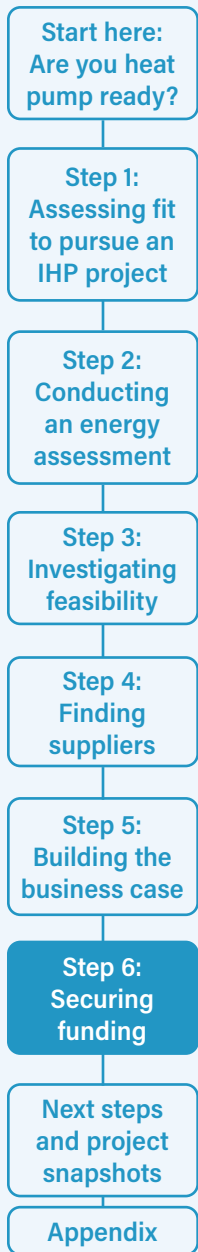


State programs


Table 2 shows examples of state programs offered by different agencies and offices. Most are competitive grants, but some also offer tax credits.

Table 2. State funding program examples

State office/agency type	Example program
Energy office	California Energy Commission provides many different competitive grants through programs such as Food Production Investment Program (FPIP) and the Industrial Decarbonization and Improvement of Grid Operations (INDIGO) Program.
Environmental department or environmental protection agency	The Pennsylvania Department of Environmental Protection’s Reducing Industrial Sector Emissions in Pennsylvania (RISE PA) is a competitive grant funded through the federal EPA.
Office or chamber of commerce	The Illinois Department of Commerce offers Grant Opportunities .
Economic development (sometimes combined with a state’s Department of Commerce)	Louisiana’s Economic Development Office offers property tax abatement for a manufacturer looking at a new investment.



- The Manufacturing Extension Partnership ([MEP](#)) is a nationwide network of technical resources provided through public-private collaboration, which includes support for facilities to find funding for projects.
- Another option is state commercial property assessed clean energy programs ([C-PACE](#)) for industrial properties that the company owns. C-PACE programs typically cover most costs associated with building improvements, but some programs also provide funds for industrial facilities. The C-PACE Alliance has a map of states that have such programs.

 For example, the Texas PACE Authority provides [financing options for industrial projects](#) because high capital projects—such as equipment replacements—typically need additional funding, especially if they have long paybacks. An industrial project is mostly defined by manufacturing or size of facility, and the behind-the-meter program is highly customized based on the local utility provider. Read [this guide](#) for more information.

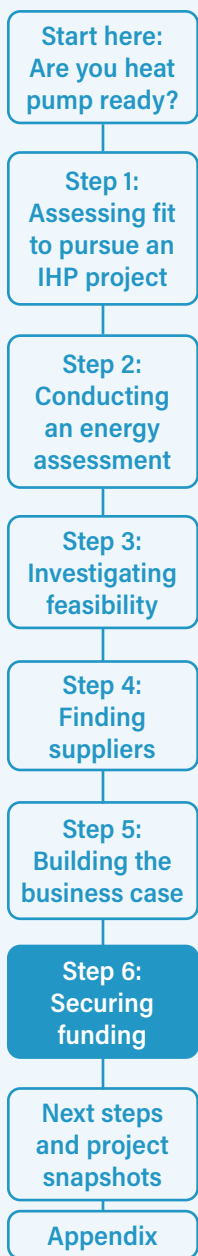
- Green banks are another source of financing that can be found in almost every state. The Green Bank 50 ([GB50](#)) is a national coalition that can be used to find relevant entities in your state. The [Coalition for Green Capital](#) may also be a good resource.



The Database of State Incentives for Renewables & Efficiency ([DSIRE](#)) is mainly geared toward residential and commercial incentives for energy efficiency, but some listed programs could apply for industrial projects.



RTC has a state (and federal) [Policy Finder database](#). For potential funding programs that could support IHP projects, filter the table by “Grant,” “Tax credit,” and “Sustainable finance.” Reach out to the IHP Alliance team to help you find and connect to relevant state programs.



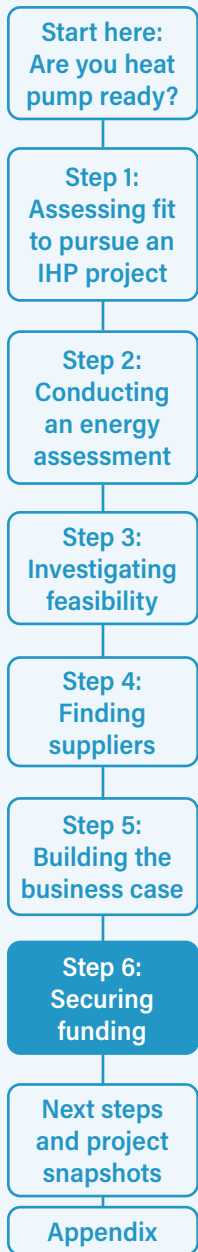
Utility incentives

Your utility will likely have a C&I offering that could help fund efficiency upgrades in your facility. Because IHPs are a nascent technology in the United States, it is likely that a heat pump project will fall under the “custom” category. Your utility may also offer on-bill financing for an industrial project.

The industry section in [ACEEE’s State Scorecard](#) showcases a few state and utility programs that could be applied to IHP projects. Examples include the Michigan [industrial retooling program](#) and Efficiency Maine’s [Manufacturer Thermal Efficiency Projects](#) under its custom C&I program. Note that some states may have policies that prohibit utility programs from funding fuel-switching projects. Despite restrictions, some utilities can still offer electrification incentives around energy efficiency improvements such as IHPs compared to less-efficient electric baselines.

Local/municipal resources

Cities and municipalities may also have resources available for industrial projects. For example, as part of its [Climate Action Plan](#), the City of Cleveland is planning to increase funding for research, development, and demonstration projects for small- and medium-sized enterprises. Also, some cities—including the [City of Milwaukee](#)—have their own C-PACE programs. We encourage facilities to reach out to the city’s sustainability office or chamber of commerce and other offices to work together with community leaders toward projects that can benefit surrounding neighborhoods.

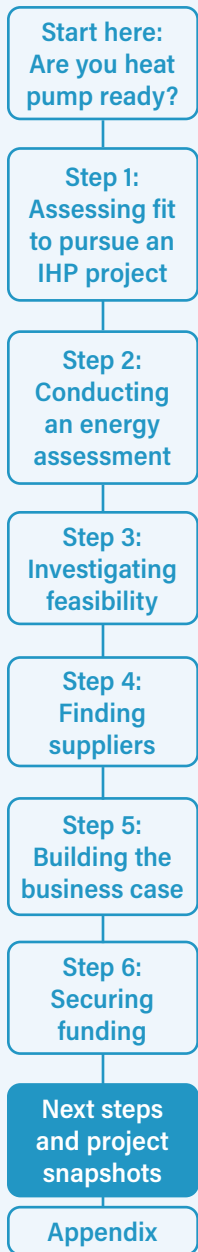


Other finance models

Additional models might include [transition](#) or [green](#) financing options such as the following:

- Energy as a Service (EaaS) models outsource energy management and equipment ownership to a third party and help to mitigate concerns over large upfront costs by providing energy as a subscription instead. Entities such as [Metrus Energy](#), which is also a Better Plants partner, and some vendors offer EaaS as part of their product package/business strategy.
- Companies such as [Generate Capital](#) and [Redaptive Capital](#) offer more tailored financing solutions for energy efficiency projects.
- An Energy Service Performance Contract (ESPC) might be applicable for a heat pump project. For more information, please read the dropdowns on [NAESCO's](#) website.
- Green bonds could be a great option for your facility if you have the financial and transactional structure to publicize your project and get buy-in from bondholders, who will then receive the principal amount invested at the bond's maturity.
- Other types of loans through a federal credit union or a bank (e.g., Bank of America's [Global Equipment Financing and Equipment Leasing Solutions](#)), could be explored as well.





Next steps

You're on your way to installing a heat pump! Capital costs aside, there are operational and maintenance considerations to keep in mind. Operational costs may now include both electricity and natural gas as commodities for the facility. Monitoring, measuring, and evaluating performance of the heat pump may be required for both internal and external (e.g., if part of a program) tracking purposes. Effective management of resources, new infrastructure, integration of tools and strategies, and the upkeep of heat pump technologies are imperative to maximizing savings and performance and ensuring their duration of use.



- **Peer exchange** is critical to learning about best practices, common barriers, and emerging solutions. Voluntary programs, such as DOE's Better Plants, allow access to a ready-made network of like-minded peers. The IHP Alliance's regular working group meetings (available to RTC members, NEMA members, and ACEEE Allies) are another great way of interacting with others who are investigating IHP implementation potential.

- **Close collaboration with your utility** on interval-level electricity data can help you make informed business decisions on optimal IHP use, load-shifting, and new investments. To access granular data, you could:
 - Request interval data access or real-time data (if available) from your utility's account manager.
 - Some utilities participate in voluntary programs like the [Green Button](#) initiative, which aims to standardize how electricity customers access and share electricity usage data.
 - In three states—California, Illinois, and New York—manufacturers have a right to access interval data under public utility or service commission rules.
 - Utilize data sharing agreements, which some utilities require prior to delivering interval data.
 - Install submeter(s) on the circuit feeding your IHP.

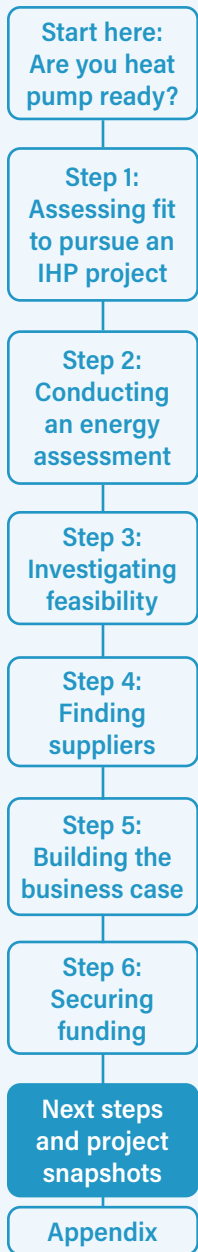


- **Staying closely engaged with your IHP supplier** can help ensure continuity of service and opportunities for repairs, upgrades, and other product specific technical assistance.
- **Training** on optimal IHP use and emerging complementary technologies is routinely offered by several of the DOE programs outlined in earlier sections as well as by non-governmental working groups (such as the IHP Alliance) and IHP vendors.

For those who would like to learn more about other industrial electrification options, please refer to these resources:

-  [Better Plants Industrial Electrification Assessment Framework](#)
 - [Better Plants Industrial Electrification Booklet](#)
-  [MEASUR's 70-plus calculators](#) cover various aspects of industrial efficiency measures, including process heating and cooling, and steam generation (ORNL)
- [ACEEE Industrial Electrification Policy Brief](#)
- [RTC Electrification Road Map](#)





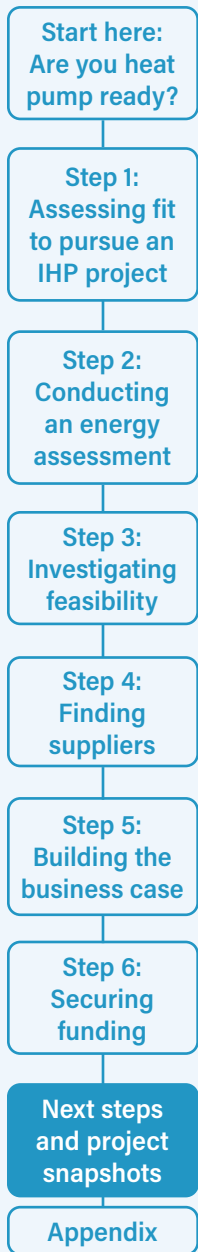
Conclusions

Many tools and resources are available to support IHP adoption. The steps that we have laid out in this guide, while not exhaustive, outline one pathway that manufacturers can take to navigate the process, from starting to learn about IHPs to completing installation. See [Hilmar's Project Snapshot](#) to learn how the company leveraged different resources for its IHP project.

Project feasibility can become reality through

- 1) close engagement with your utility.
- 2) technology agnostic energy assessments.
- 3) the leveraging of technology feasibility tools.
- 4) outreach to identify best-fit IHP supplier.
- 5) the opportunity to obtain and potentially stack funding from multiple sources.





Project Snapshot: Hilmar Cheese

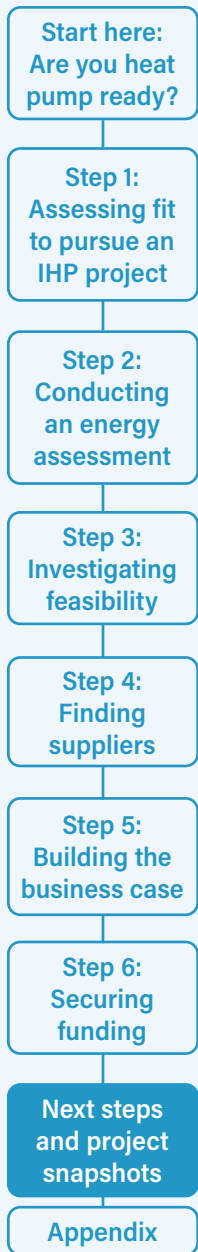
Hilmar Cheese was awarded an \$8 million grant from the California Energy Commission’s (CEC) Industrial Decarbonization and Improvement of Grid Operations Program. The project will reduce gas combustion and associated greenhouse gas emissions by electrifying process heat using industrial heat pumps (IHPs) and reverse osmosis filtration technologies. We interviewed Tara Schuelke, Director of Engineering & Project Management at Hilmar Cheese, who works with teams to identify and evaluate potential projects designed to help the company strategically reach its sustainability goals. Hilmar leveraged expertise from the University of California, Davis and the Denmark Trade Agency for technology ideas to drive sustainability goals. Both collaborated with Hilmar on a decarbonization assessment. Hilmar is also part of the strategic energy management program (SEM) sponsored by Pacific Gas & Electric (PG&E). The SEM program is facilitated by experts from CLEAResult and provides energy audits and objective engineering analysis on efficiency and energy savings. It also supports companies in submitting electric and gas rebates when they complete energy savings initiatives.

During the feasibility study phase of the IHP project, Hilmar considered installation requirements (including personnel safety and support, operational reliability, and performance); infrastructure compatibility; and ease of

maintenance when choosing technologies and vendors. IHPs were found to be a logical solution to reduce Hilmar’s energy demand, costs, and emissions given an IHP’s high efficiencies, lifecycle costs, and reliability. Recommendations from Hilmar’s experience include the following:

- Build longstanding relationships with vendors. Schuelke suggests going to trade shows, conferences, and trade association webinars to learn about technology options (e.g., in Hilmar’s case, expos such as Pack Expo).
- Keep up to date on state programs by checking for potential funding opportunities each month. For example, CEC has an email listserv for grant topics you can [subscribe](#) to (“Solicitations, Awards…” checkbox). For competitive funds, look for partners to help in writing high-quality grants (e.g., Yorke Engineering).
- Ask your utility if it has rebates or loans for energy-saving projects. For example, PG&E’s [On-Bill Financing Program](#) offers interest-free loans of \$250,000 with a maximum of up to \$4 million per customer.

Stay up to date on this project by visiting CEC’s Hilmar project website and learn more about Hilmar’s approach [here](#).



Project Snapshot: Oatly

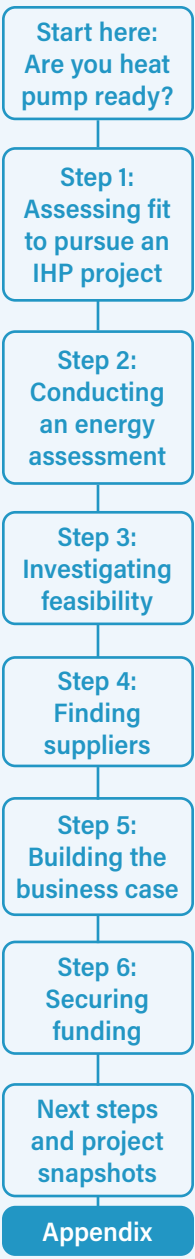
Oatly produces plant-based milk and dairy alternatives. Sustainability is at the core of its company mission and operations. With a goal to achieve 89% emissions reductions per liter of product by 2050, Oatly is currently scoping industrial heat pump (IHP) projects and looking across all available funding and technical assistance resources to help with the process. We interviewed Chris Edmonds, Oatly’s sustainability director for North America; part of his role is to evaluate technologies to help the company reach its sustainability goals. Oatly is working with the University of Delaware and the University of Utah—both part of DOE’s ITAC program—on energy audits for the company’s two North American production sites. Edmonds suggests that project funding should be explored early on, especially as capital plans/corporate funding requests may be set years ahead. Oatly can leverage federal, state, and utility incentives; financing such as Commercial Property Assessed Clean Energy (C-PACE); and other potential funding resources based on the facility location. Oatly’s facilities in the Netherlands and Sweden have successfully installed IHPs, so it is also considering implementing this highly efficient technology in the United States. Oatly’s experience highlights some important considerations:

- Finding a facility’s heat sources and sinks, temperature and pressure requirements, and potential for de-steaming is a critical early step before deciding on a decarbonization technology. Sankey diagrams visualizing

thermal energy flows and pinch analysis can also be instrumental tools early on. More accurate data, and more advanced analysis, leads to a more thorough understanding of all the options available for a site.

- Electrification potential is determined largely by current electricity capacity (both in front of and behind the meter), additional infrastructure needs, spark gap, and technology costs. The costs of electric technology projects rise significantly with new load demand, especially in grids that are already constrained.
- The business case can also depend on equipment age, timing of upcoming retirements, internal corporate carbon pricing, external regulatory requirements, and willingness to complete projects in multiple phases. For example, Oatly is investigating using an underutilized hot-water boiler to expand and serve lower-temperature needs with hot water instead of steam, building out a low-temperature water loop to reduce steam use. The company may also add an insulated storage tank to capture and store hot water, allowing it to access sources of waste heat for heat sinks that wouldn’t be viable via the steam system. These steps could also pave the way to more favorable conditions for a future IHP.

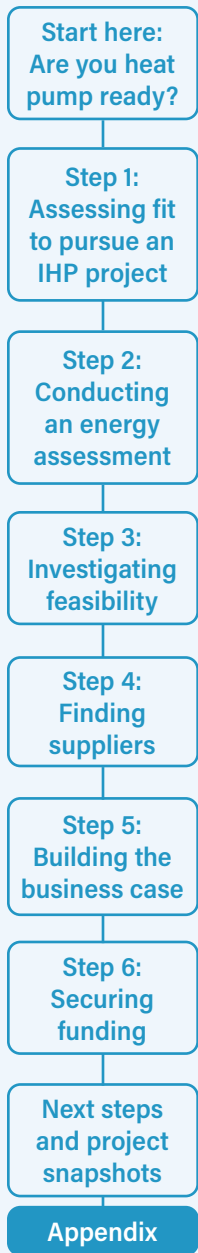
[Read more](#) about Oatly’s commitment to sustainability.



Appendix: Example scenario of how to use the resources in this guide

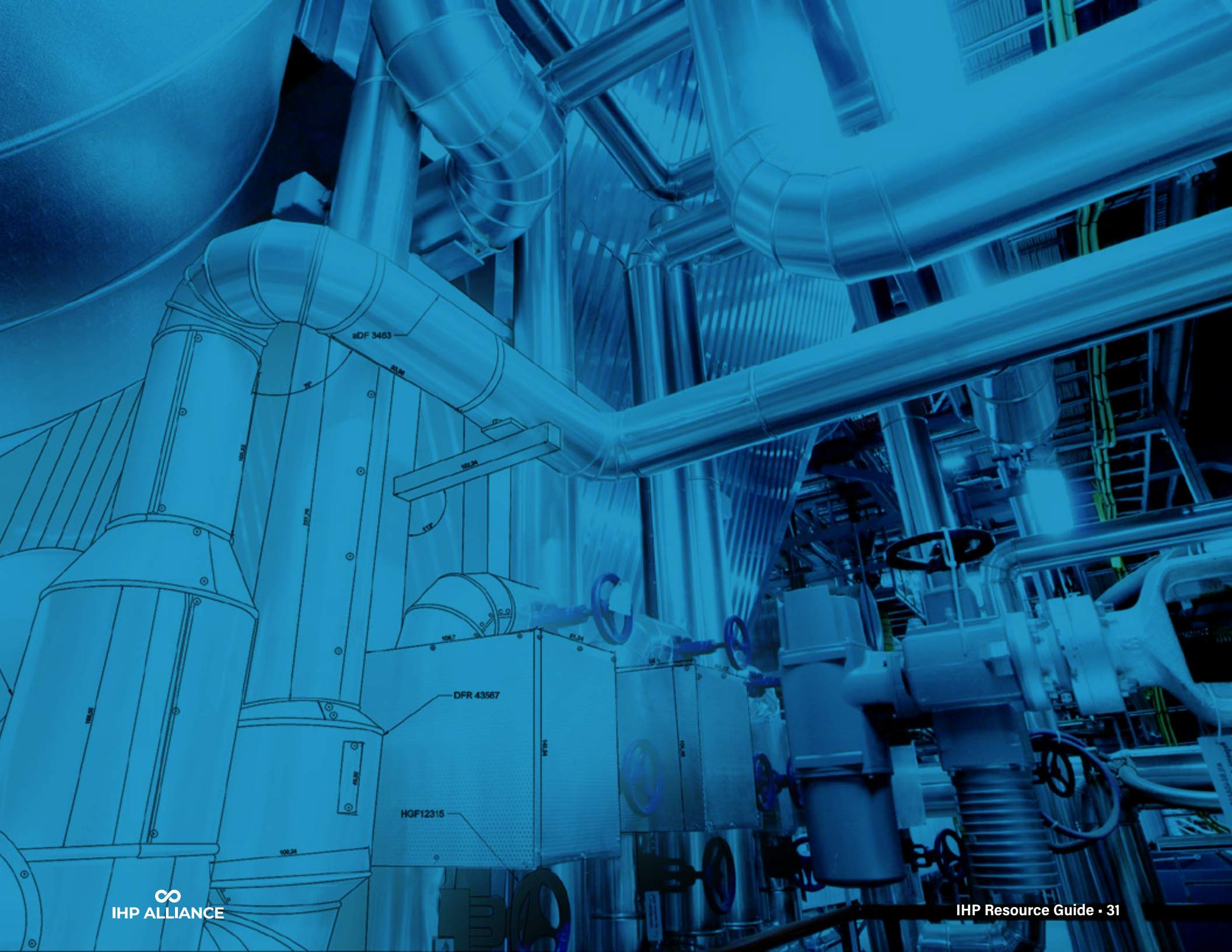
Company A owns a small brewery and is interested in an IHP. The owners have publicly stated scope 1 emissions reduction targets and want to demonstrate progress in reducing on-site natural gas consumption. They anticipate that regulations on air pollutants will continue to be rolled out and want to prepare their facility for the future. They have attended several webinars on best-fit applications and the market status of IHPs.





Company A proceeds by

1. Reaching out to the director of the nearest ITAC and scheduling an energy assessment. The assessment reveals several opportunities for low-cost efficiency improvements as well as an IHP to recover waste heat from the wort cooling process and use it to provide heat for hot-water processes at 85–90°C, significantly reducing the brewery’s use of steam from its natural gas boiler.
2. Engaging a state program that provides cost share for feasibility studies. Program administrators conduct an onsite process heat/pinch analysis and estimate that an IHP application could reduce the brewery’s overall thermal energy consumption by approximately 60–75%.
3. Consulting resources to understand the business case and estimated payback of the potential application—including the RTC Heat Pump Decision Support Tools.
4. Informing the company’s utility account manager about their interest in IHPs, discussing data needs and the potential load that could be added without significant infrastructure upgrades. The owners estimate the added electricity load of the anticipated project to be approximately 750–1000 kW, which will require a new transformer in their facility.
5. Filling out the IHP Alliance Procurement Toolkit using data from the assessment, study, and utility engagement. Sending the toolkit to a few suppliers that Company A’s owners were familiar with to ask for product specifications and equipment/installation quotes. The heat pump they settled on is a closed loop model that delivers a COP of approximately 3–5. The estimated payback without external funding is 4–6 years.
6. Applying to a competitive state funding program with assistance from the IHP Alliance. They also apply for custom utility incentives. The state program awards over \$1 million for the application, roughly 60–65% of the project’s total cost, including integration and installation. Their local utility has an incentive program for efficiency savings per kWh, capped at \$300,000 per project. The total amount offset is approximately 75–80% of total project costs.
7. Purchasing the product, planning carefully with a small team of consulting engineers, the IHP vendor, and the utility staff to ensure timely installation and minimized downtime.
8. Collecting data, sharing learnings with peers, continuing engagement with their utility and IHP supplier, and looking for other opportunities for IHPs and other electric technologies.



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