125 Years Bosch 1886–2011

Residential
Geothermal Technology

Geothermal Heating and Cooling

BOSCH
Invented for life

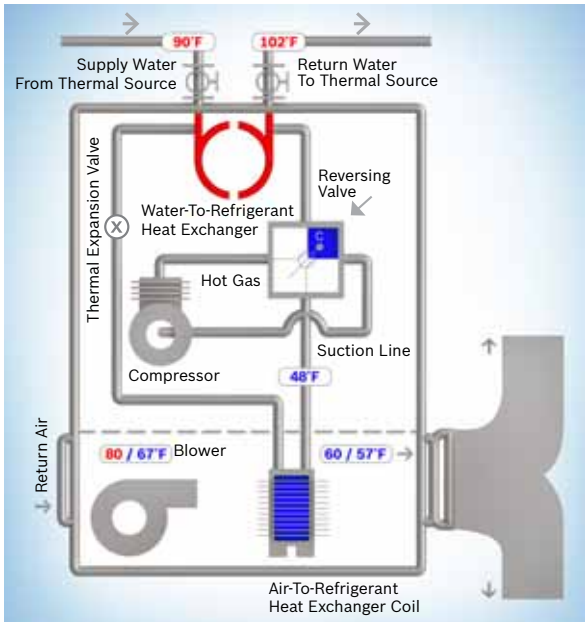
Bosch Geothermal Heat Pumps

Cooling Mode

Heating Mode

Our Geothermal Heat Pump systems are the most energy and cost efficient systems on the market and therefore the greenest technology for heating and cooling. The technology uses the relatively constant temperature of the earth (thermal energy) to provide heating, air conditioning and hot water. Ground and water temperatures, 6 feet below the earth's surface, stay relatively constant throughout the year. This allows the system to provide extremely efficient heating or cooling all year long in virtually any climate. Sometimes the term "environmental comfort system" is used to describe a geothermal heat pump. This happens because a heat pump absorbs or rejects heat from the earth and has absolutely no impact on the environment.

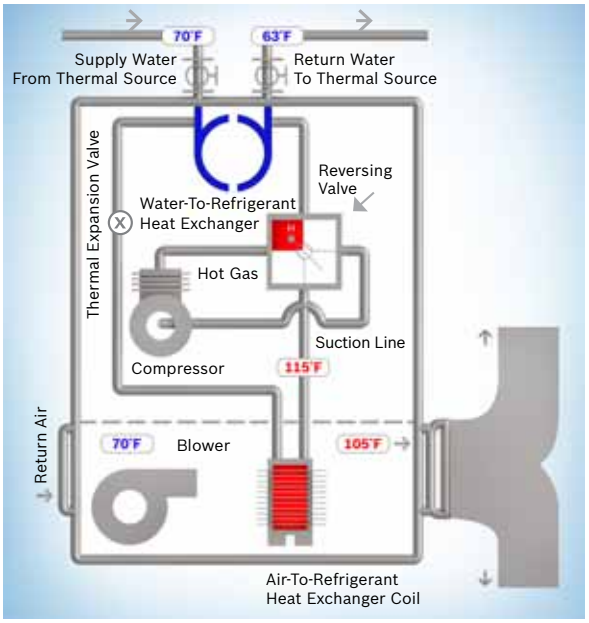
Operation Modes of a Heat Pump



Cooling Mode

In the COOLING mode, the refrigerant, a hot gas, is pumped from the compressor to the water-to-refrigerant heat exchanger via the reversing valve. Water, generally with an antifreeze, flowing through the water-to-refrigerant heat exchanger removes heat and the hot gas condenses into a liquid. This liquid then flows through a metering device to the air-to-refrigerant heat exchanger coil. In evaporating into a gas, the liquid absorbs heat and cools and dehumidifies the air that passes over the coil surface. The cooling cycle is completed when the refrigerant flows as a low pressure gas through the reversing valve and back to the suction side of the compressor. The fluid from the water-to-refrigerant heat exchanger is pumped to the ground loop heat exchanger where it transfers the heat to the earth. The cooled fluid then flows back to the unit.

Operation Modes of a Heat Pump



Heating Mode

During the HEATING mode, the refrigerant, a hot gas, is pumped from the compressor to the air-to-refrigerant heat exchanger coil via the reversing valve. In the air-to-refrigerant heat exchanger coil, the heat is removed by the air that passes over the coil surface, and the hot gas condenses into a liquid. The air is circulated to the space and provides heating for the house. The refrigerant liquid then flows through a metering system to the water-to-refrigerant heat exchanger. When evaporating into a gas, the liquid absorbs heat and cools the water. The heating cycle is completed when the refrigerant flows as a low pressure gas through the reversing valve and back to the suction side of the compressor.
In the winter the fluid in the ground loop extracts heat from the ground, raising the fluid temperature and circulates back to the heat pump into the house.

Earth Coupling Options

Geothermal systems use the earth as a heat source and heat sink. In order to transfer heat to or from the house, heat exchangers (ground loops) are installed in the ground. These consist of high density polyethylene plastic pipes. The loops are then connected to the heat pump and fluid is circulated between them transferring the heat between the heat pump and the earth.

Vertical Ground Loop System

Horizontal Ground Loop System

Pond/Lake Loop System

Well Water System

Vertical Ground Loop System

This type is used mainly in commercial buildings or where space is limited. Vertical holes 100 to 400 feet deep are drilled in the ground, and a single loop of pipe with a U-tube at the bottom is installed. The borehole is then sealed with grout to ensure good contact with the soil. The vertical ground loops are then connected to a horizontal underground header pipe that carries fluid to the unit. The earth's temperature is more stable farther below the surface which is an advantage for the system. Vertical ground loop fields may be located under the house and garden lots. The life expectancy is in excess of 50 years.

Horizontal Ground Loop System

This type of design is cost effective on smaller projects or where there is sufficient space for the loop. Trenches, three to six feet deep, are created and a series of parallel plastic pipes are laid inside them. These loops are manifolded and connected to the heat pump. The fluid is then circulated, absorbing or rejecting heat to the earth depending on the mode of operation. A typical horizontal loop will be 400 to 600 feet long for each ton of heating and cooling but will vary according to the soil type and the layout of the piping.

Pond/Lake Loop System

This type of design is economical when a project is located near a body of water. Fluid circulates through polyethylene piping in a closed system, just as it does through ground loops but in this case underwater. The pipes may be coiled in a slinky to fit more surfaces into a given amount of space. The lake needs to be a minimum size and depth depending on the load. Lake loops have no adverse impact on the aquatic system.

Well Water System

This type of design is only possible if there is sufficient ground water available in a well, a lake or river in the area. The water must be of good quality. Local codes may limit the use of this system in certain areas. The system is open which means that water is pumped directly into the geothermal unit and then discharged either into a return well or a body of water. The water quality remains unaffected.

Advantages of Bosch's Geothermal Systems

Environmental stewardship is a core philosophy for Bosch from design to production to the reduction in our customers' energy bills. At Bosch, we are working on a better future every day.

Environmentally Friendly

Bosch's green technology is the most environmentally friendly way to cool and heat your home. The system has no carbon dioxide emissions or any other negative effects on the environment. Bosch geothermal installations have the effect of reducing greenhouse gas emissions which are responsible for climate change. Saving energy also helps in reducing the US dependence on foreign oil.

Lower Operating Cost

Bosch's technology helps to save up to 70% on your energy bills for heating, cooling and hot water because of the more efficient operation compared to conventional systems. Simple payback could be as short as 5 to 7 years and you can experience costs savings from the beginning. For a new installation with the cost of the system included in mortgage payment you could have a positive cash flow from day one.

Flexibility and Comfort

Depending on the season, our systems allow you to heat or cool your home. Experience a greater level of comfort without the hot spots from a conventional system. Bosch units can be equipped with the ability to recover "waste" heat from the compressor to heat the water virtually for free, saving you extra dollars in your hot water bill.

Reliability

Ground loop systems have a life expectancy in excess of over 50 years. Your Bosch unit is manufactured with rigorous standards ensuring a high efficient operation over the life of the unit. Our residential warranty offer is among the best you will find on the market.

Quiet operation

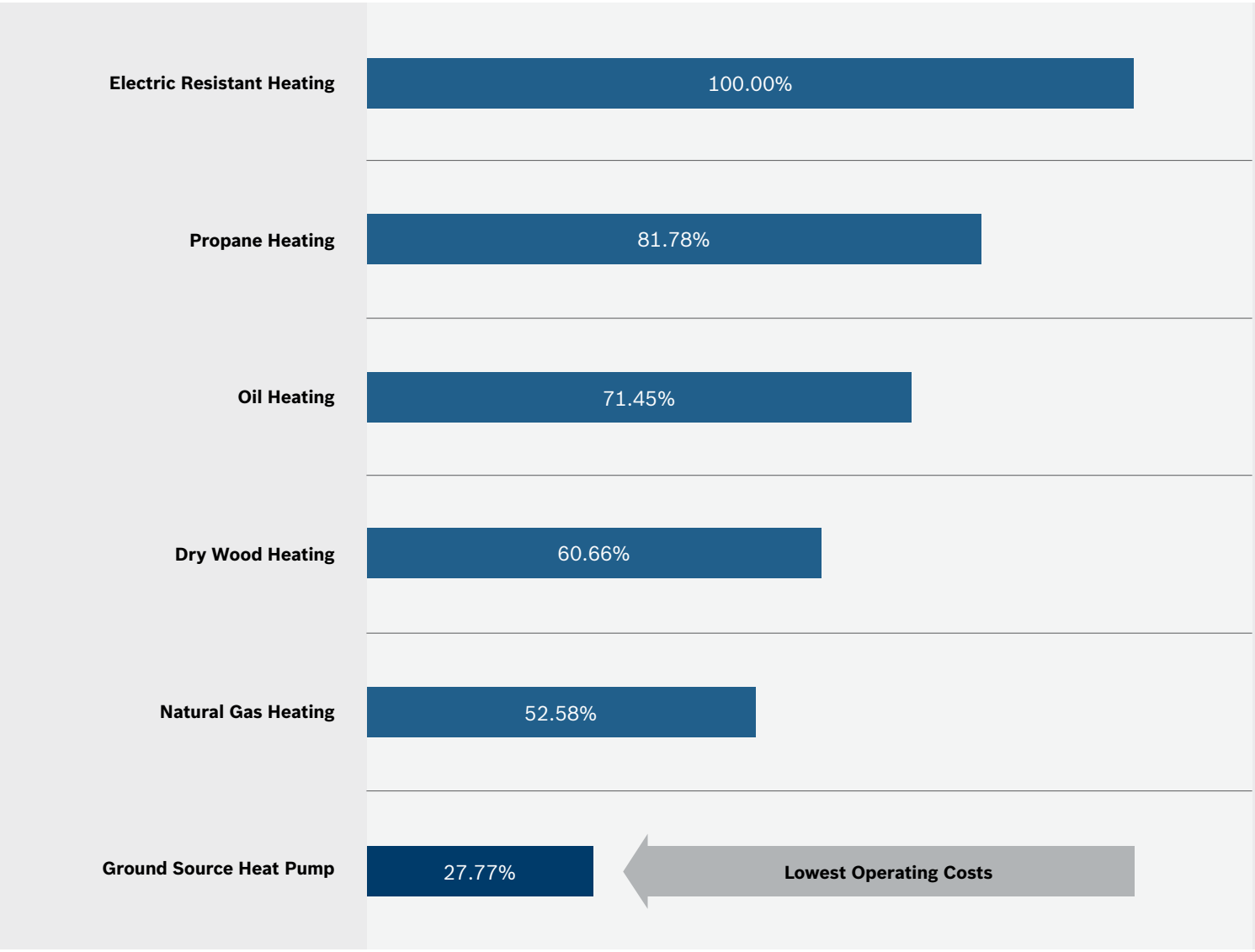
Customer satisfaction is our goal and therefore Bosch units come equipped with a unique floating base pan and an optional compressor blanket that turn our units into the quietest ones available.

Cost and Payback

Geothermal heat pumps not only provide dependable, natural heat, they also provide you with more financial independence through the money the heat pumps can save.

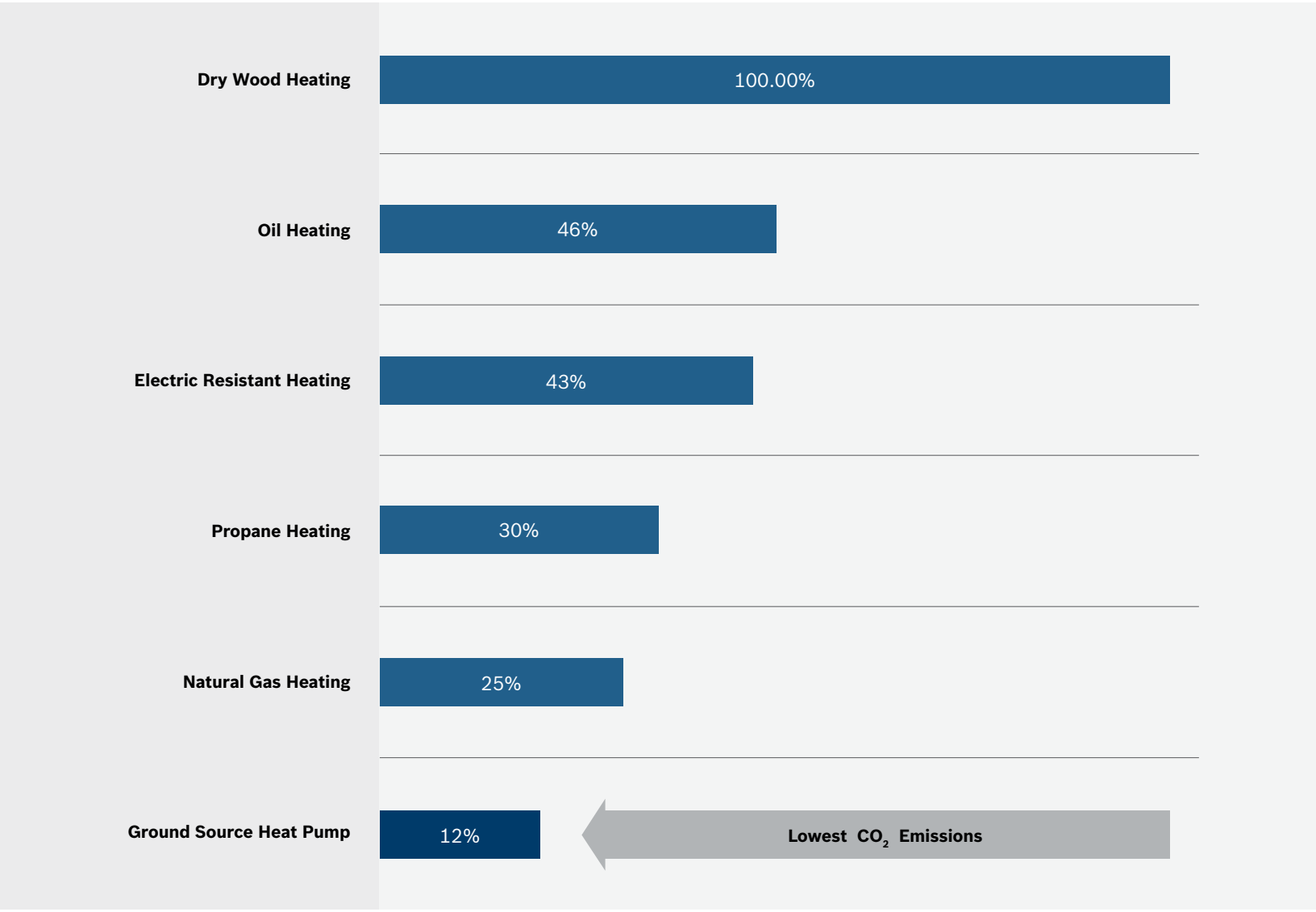
- Geothermal heat pumps have the lowest life cycle cost today — 25% to 50% less than a conventional system
- Savings up to 70% in your energy bill depending on location and which GSHPS you use
- Will normally cost more than a conventional system, but will pay back that cost difference in a short period of time
- Local and Federal tax credits and rebates decrease your installation cost, which decreases payback period
- Extra money to invest on quality family time
- Considered the technology of choice by the Department of Energy and the Environmental Protection Agency

Heating Operating Cost Estimate

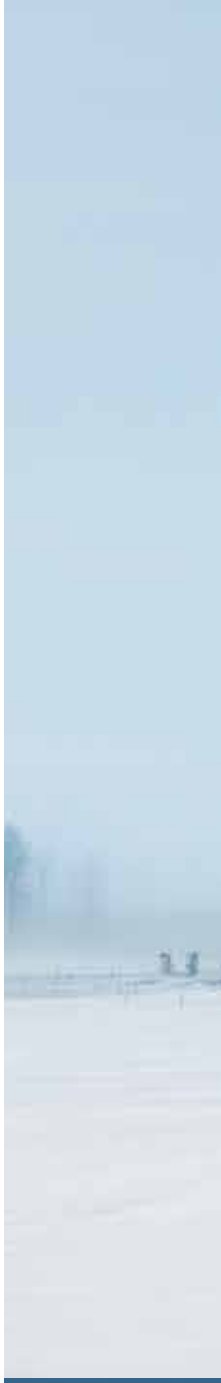


Estimated heating costs of operation for a building with 54,000 Btu/hr Design Heat Loss at -3 F.
Estimates based on the following energy costs:
Electricity - 9.5 cents per kilowatt hour; Natural Gas - $1.20 per therm; Propane - $1.75 per gallon; Oil - $2.25 per gallon;
Dry Wood - $230 per full cord.
Source: 2010 Phoenix Energy Supply; Bosch

CO_2 **Emissions** Estimate



Estimated CO_2 emissions for a building with 54,000 Btu/hr Design Heat Loss at -3 F.
Estimates based on the following CO_2 emission rates:
Electricity - 0.76 CO_2/KWH; Natural Gas - 110 lb CO_2/MBTU; Propane - 126.7 lb CO_2/MBTU;
Oil - 188.6 lb CO_2/MBTU;
Dry Wood - 323.8 lb CO_2/MBTU.
Source: 2010 Phoenix Energy Supply; Bosch



Bosch Thermotechnology Corp.

601NW 65th Court
33309 Fort Lauderdale
Phone: 954-776-5471
Fax: 954-776-5529
www.bosch-climate.us

Printed on Elemental Chlorine Free, FSC-certified,
minimum 10% PCW paper with vegetable-based inks.