Bosch Complete - Net Zero Energy Home

Innovation Through Experience

The Bosch Group is a leading global supplier of technology and services and operates in the areas of automotive, industrial technology, consumer goods and building technology.

- Global turnover of roughly 63.4 billion USD (47.3 billion Euros) in 2010
- Around 300,000 associates
- Innovation and highest quality standards since 1886
- Each year Bosch spends more than 4.7 billion USD (3.5 billion euros) for R&D and applies for around 3,800 patents worldwide

14 patents per working day and 8% investment of revenue in R&D!
Bosch Complete - Net Zero Energy Home

Saving Energy – a Bosch Focus and Strength

- Powertrains
- Solar heating systems
- Self-sufficient house
- Gear units for wind turbines
- Innovative power tools With lithium-ion technology
- Energy efficient Household appliances
Converting Energy More Efficiently

- Integrated Systems
  - 30% efficiency increase
  - Simplest hydraulic layout
  - Integration of multiple heat sources
  - Reducing installation costs

Bosch Tankless Water Heaters
For Restaurants, hotels, schools and other commercial applications you receive an endless supply of DHW.

Bosch Solar Thermal Systems
Low flow collectors require smaller pumps and diameter piping reducing system hardware and operating costs.

Bosch Heat Pump Water Heater
Air to Water heat pump transferring hot water to a insulated storage tank.

Bosch /Buderus Boilers
Compact condensing boiler for combining DHW and space heating needs.

Bosch Geothermal Heat Pumps
Ground source heat pumps for cooling and heating applications.
Basics

The Challenge:
- Is it possible for an average family to live their everyday lives in a home, without using fossil fuels for one year?

The Concept:
- Demonstration of alternative energy with monitoring and streaming of all energy data real time.

The Goal:
- Development of a pre-fabricated energy efficient house that will be affordable and available for the average family.
EcoPlus Home - Facts

- Constructed in Bathurst, New Brunswick
- Pre-fabricated home integrating solar, geothermal, energy efficient appliances and user-friendly monitoring system.
- Focus on affordability and self sufficiency while keeping comfort.
- Typical family of five lives in the home – energy consumption was tracked over a one year time span
EcoPlus Home Front

Passive Design

- Compact building Envelope
- R28 Walls
- R22 Insulated Concrete Foundation (ICF)
- R42 Roof
- Daylight usage for heating and lighting
- Low E Triple Pane IG windows
- Shading of S facing windows
EcoPlus Home Back

Active Design

- Ventilation with heat recovery
- Solar thermal for DHW and heating support
- Photovoltaics
- Geothermal Heat pump for heating and cooling
- Energy Monitoring
- Energy efficient household appliances
Bosch Complete - Net Zero Energy Home

Factsheet – Building Loads

Heat Loss

- Wall 31%
- Glass 34%
- Roof 5%
- Floor 5%
- Ventilation 10%
- Infiltration 8%
- Door 6%

37.8 KBtu/hr

Heat Gain

- Glass 64%
- People 15%
- Door 3%
- AED Excursion 3%
- Ventilation 7%
- Infiltration 1%
- Wall 1%
- Roof 5%

1.5 Tons
Solar Thermal Contribution

Energy provided by a solar collector system in relation to the annual energy demand for **Domestic Hot Water**

Energy provided by a solar collector system in relation to the annual energy demand for **Domestic hot water and heating**
Factsheet - Components

- **Solar Thermal:**
  - 4 Flat plate collectors for DHW preparation and heating support
  - Aperture area: 89.96 ft²
  - Delivered energy to system: 18.06 MBtu/yr
  - Installed Gross Output: 22.96 kBtu/hr
  - Tilt angle 36° facing south
  - Solar storage DHW tank 120 gallons

- **Photovoltaic:**
  - 52x monocrystalline solar modules
  - 230/Wp Active
  - PV surface area: 921 ft²
  - Installed PV output: 11.98 kWp
  - Cal. grid feed-in (AC): 13.971 kWh/yr
  - CO2 emissions avoided: 27,661 lbs/yr (12.547 kg/yr)
Factsheet- Components

➔ **Ventilation**
  - Heat recovery HRV31 with earth collector 164 ft (50m) around the house for passive cooling and heating
  - Controlled room air exchange of 5650 ft³

➔ **Geothermal Heatpump**
  - Ground source/air
    - 1st. stage = COP of 4.8
    - 2nd. stage = COP of 4.1
  - 3 Closed Loops/150 ft
Factsheet- Home Appliances

- Energy efficient appliances
- ENERGY STAR rated
- Less water consumption
- Quiet operation
- Eligible for incentives
Important:
Ca. 3 m deep
(min. ca. 10’ deep)

Important:
min 2 m deep
(ca. 7’ deep)

Important:
2% slope

Important:
Ca. 3 m deep
(min. ca. 10’ deep)

Radius of min. 1m
(radius of min 3’)

As long as possible

Important:
Ca.
3 m deep
(min. ca. 10’ deep)
Factsheet - Controls

- TR0603mc U
  - 40 Pre-configured systems
  - Vacation Mode
  - BTU Metering

- Cristal Controls
  - BACnet/Lonworks
  - Zoning
  - Wall/Floor/Duct Sensors

- Fronius DATCOM
  - PV System Monitoring
  - Remote access
### Factsheet – Energy Consumption/Generation

<table>
<thead>
<tr>
<th>Category</th>
<th>Consumption (kWh/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling</td>
<td>1400</td>
</tr>
<tr>
<td>Heating</td>
<td>5230</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>2980</td>
</tr>
<tr>
<td>Home appliances</td>
<td>2120</td>
</tr>
<tr>
<td>Lighting</td>
<td>1039</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1200</td>
</tr>
<tr>
<td><strong>Total Consumption</strong></td>
<td><strong>-14069</strong></td>
</tr>
<tr>
<td><strong>Energy generated by PV</strong></td>
<td><strong>14164</strong></td>
</tr>
<tr>
<td><strong>Net</strong></td>
<td><strong>96</strong></td>
</tr>
<tr>
<td>EPH annual savings ($0.08/kWh)</td>
<td><strong>$1,125.52/yr</strong></td>
</tr>
<tr>
<td>Conventional home cost ($0.08/kWh)</td>
<td><strong>-$2,160.00/yr</strong></td>
</tr>
</tbody>
</table>
## Advantages of Combining Technologies

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
</tr>
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<tbody>
<tr>
<td>Solar Thermal integration into the ground loop</td>
<td>Increase soil temperature of ground loop from 36°F up to 50°F which improves COP from 4.5 to 6.3</td>
</tr>
<tr>
<td>Permanent regeneration of ground loop temperature</td>
<td>Avoid freezing loop</td>
</tr>
<tr>
<td>Reduced compressor running time</td>
<td>Increase life time of heat pump</td>
</tr>
<tr>
<td>Reduced collector temperatures</td>
<td>Increase collector efficiency</td>
</tr>
<tr>
<td>HRV with earth collector</td>
<td>• Capturing up to 91% of exhaust heat from the indoor air to pre-heat and pre-cool fresh incoming air  &lt;br&gt; • Reduced heat/cooling load for heat pump up to 30%  &lt;br&gt; • Downsizing heat pump/ground loop</td>
</tr>
</tbody>
</table>
EcoPlus Home Mechanical Room
Bosch Complete - Net Zero Energy Home

EcoPlus Home - Kitchen
Bosch Net Zero Home

- Bosch’s first Net Zero model home in the US, demonstrating the integrated systems approach by combining the following products under one roof:
  - Geothermal heating and cooling system
  - Heat pump water heater
  - Solar photovoltaic system
  - Energy efficient home appliances
  - Controls

- Location: Serenbe; 30 minutes SW of Atlanta Airport

The one-stop shop for heating, cooling, water heating, electricity generation, home appliances and controls needs.
Bosch Experience Center at Serenbe (BECS)

BECS showcases a range of Bosch products, including functioning demonstration of:

- Geothermal heating and cooling system
- Solar thermal water heating system
- Solar photovoltaic system
- Energy efficient home appliances
- Security and sound systems
- Power tools
- Structural materials
- Automotive clean diesel

Location: Serenbe; 30 minutes SW of Atlanta Airport

Visit the BECS to learn more about Bosch’s integrated systems for sustainable living!
Thank You!