The CO2-neutral self-supply of heat and electrical energy is an important objective for new and existing buildings in the future [1,2]. By 2021 in the European Union the nearly zero-energy building-standard will be obligatory for all new buildings [3]. Therefore a combination with reduction of the primary energy consumption by min. 20 % and an increased integration of renewables is required. Further an improvement of the energy performance of buildings and their evolution to new integrated building concepts is necessary. Actually the final energy consumption of all households in Germany shows in general that the main consumption is in the heating sector (hot water, space heating) by more than 84 %, see Fig. 1 [4] on the right.

One new concept for single-family buildings in central Europe is the Energy Autonomus House (EAH) of HELMA as a combination and an advancement of the concepts of solar houses and efficiency houses. It is based on a fully self-sufficiency in thermal (partly provided by a fireplace) and electrical energy (100 %), see [1]. Two occupied EAH are built in Freiberg / Germany and they are now under an extensive scientific monitoring with real user behavior. Here the results of one single family EAH are presented only.

### Details of the Energy Autonomous House Concept

**Building properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living area / effective area / heated house-</td>
<td>162 m² / 206 m² / 544 m²</td>
</tr>
<tr>
<td>air volume</td>
<td></td>
</tr>
<tr>
<td>Windows (triple glazed): area / U-Value</td>
<td>~ 49 m² / ~ 0.6 - 0.8 Wm²/K</td>
</tr>
<tr>
<td>Walls (monolithic bricks with plaster): area /</td>
<td>~ 169 m² / ~ 0.18 Wm²/K</td>
</tr>
<tr>
<td>U-Value</td>
<td></td>
</tr>
<tr>
<td>Area of solar thermal-/ PV-collector / slope</td>
<td>46 m² / 58 m² / 45° (south)</td>
</tr>
<tr>
<td>of the roof</td>
<td></td>
</tr>
<tr>
<td>Volume of heat storage tank / capacity of</td>
<td>9.12 m³ / 58 kWh</td>
</tr>
<tr>
<td>storage battery</td>
<td></td>
</tr>
</tbody>
</table>

**Planned consumption and yield**

- House operation without fossil fuels and without planned purchase of electricity from the grid
- House is connected with electrical grid (for feed in / purchase)
- Solar electrical coverage ratio ≥ 100 %
  - low annual electrical energy consumption with ~ 2000 kWh/a is needed (whole EAH)
  - additional house technique: BUS-System, water well pump
- Solar thermal coverage ratio ≥ 65 % (in winter proportional use of fireplace)
- Annual demand in thermal heat was calculated for 185 days of heating (~ 2915 kJ)
- Planned primary energy consumption is ~ 80 % lower than the standard of passive houses

### Results of the first year (2014)

**Local Weather**

**Annual demand in thermal energy (heating; hot water)**: ~ 45.2 kWh/a (3000 kWh/a)

**Annual electrical energy yield**: ~ 8000 kWh/a

**Annual wood consumption (beech, stacked)**: 2 - 3 m³

**Solar thermal collector**

**Photovoltaic collector**

**Thermal energy**

- Total yield ~ 2117 kWh (~ 1021 kWh from solar thermal and 1052 kWh from PV-yield)
- Solar thermal collector ~ 1052 kWh
- Photovoltaic ~ 1021 kWh
- Solar electrical coverage ratio
- ~ 80 % lower than the standard of passive houses
- Solar electrical coverage ratio (2014): thermal ≥ 71.7 %, electrical ≥ 92.1 %

**Electrical energy**

- Total yield ~ 2117 kWh (~ 1021 kWh from solar thermal and 1052 kWh from PV-yield)
- Solar electrical coverage ratio
- ~ 80 % lower than the standard of passive houses
- Solar electrical coverage ratio (2014): thermal ≥ 71.7 %, electrical ≥ 92.1 %

**Summary of Measurements**

- Solar energy yield ~ 8000 kWh/a
- Solar energy yield ~ 717 kWh (~ 1021 kWh from solar thermal and 1052 kWh from PV-yield)
- Solar energy yield ~ 8000 kWh/a
- Solar energy yield ~ 8000 kWh/a
- Solar energy yield ~ 8000 kWh/a

**Outlook**

- Continue the scientific monitoring of two EAH with different user behavior for reliable results
- Investigation of different charging strategies of the e-mobil / houses concerning the house autarky
- Cooperation with energy provider to investigate the integration of the storages in the national grid