Sustainable Energy Action Plan
Fürstenfeldbruck

Short Report, May 2012
Short Report for the Sustainable Energy Action Plan Fürstenfeldbruck

In the context of the covenant of mayors, the city of Fürstenfeldbruck has set itself the goal to reduce its energy-related CO₂ emissions by 35 percent relative to 2005. The “Sustainable Energy Action Plan” describes the way to reach this goal.

Chapter 1 explains the overall strategy behind the action plan: Why reduce CO₂ emissions at all, what can city and Stadtwerke do, which organizational and financial means are provided, how to involve stakeholders and citizens and how to monitor the progress of the action plan.

Starting point is the “baseline emission inventory”, which describes the demand for energy (buildings, facilities and transport) and the energy production in the municipal area for the base year 2005, including the resulting CO₂ emissions. According to it, a total of about 212,000 tons of CO₂ was emitted, a third of it in the electricity sector, about half in the heat sector and 15 percent in the transport sector. Chapter 2 provides an overview, appendix A contains the detailed baseline emission inventory.

Chapter 3 shows the potential for reducing CO₂ emissions in the sectors electricity, heat and transport by (a) reducing the demand for energy, (b) increasing the use of renewable energies and (c) switching to fossil energy sources with lower CO₂ emissions. The corresponding twelve “strategic goals” result in a total CO₂ emission reduction potential of 36 percent.

Chapter 4 describes the measures with which the strategic goals are to be reached. The detailed action plan can be found in appendix B. Note that for many measures, the expected energy saving or production and the resulting reduction of CO₂ emissions is difficult to estimate. Therefore, indicators are specified that will be used to monitor the progress in reaching the strategic goals. A further subchapter takes a closer look at the budget for developing and implementing the action plan.

References and comments ("footnote texts") can be found in appendix C.

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1. Overall Strategy

Why Reduce CO\textsubscript{2} Emissions?
For the city of Fürstenfeldbruck, reducing CO\textsubscript{2} emissions as far as possible and thereby contributing to climate protection is part of its services to the public. The European Community has set itself the long-term goal\textsuperscript{1} to reduce its CO\textsubscript{2} emissions until 2050 by 80, better by 95 percent.

The county of Fürstenfeldbruck has gone ahead in the year 2000 with formulating the vision to switch to 100 % renewable energies until 2030 and simultaneously halve its demand for energy. An important reason besides climate protection was the “regionally added value”: Expenses for renewable energies mainly remain in the county instead of going to other countries. Furthermore, local companies profit. Both applies also for energy saving.

CO\textsubscript{2} Emission Reduction Target
As a member of the Klima-Bündnis e. V.\textsuperscript{2}, Fürstenfeldbruck has committed itself to reduce its CO\textsubscript{2} emissions by 10 % every five years, and to halve them until 2030. As a member of the covenant of mayors\textsuperscript{3}, the city is required to top the EU goal “20-20-20”, i.e., to reduce its CO\textsubscript{2} emissions by at least 20 % until 2020. In its meeting on the 27th march 2012, the city council of Fürstenfeldbruck has therefore decided to reduce the energy-related emissions by 35 % (per capita) in comparison to 2005.

Main Areas of Actions
In the municipal area, the production of renewable energies is very limited. Therefore, it is all the more important to make use of the existing potential. The public utility company (“Stadtwerke”) of Fürstenfeldbruck is traditionally very active in this area. Being the regional distribution network operator, the Stadtwerke are also in charge of extending and modifying the energy infrastructure with regard to renewable energies (keywords: energy storage, intelligent distribution / smart grids).

Because the production of renewable energy is limited, energy efficiency and energy saving are key aspects. The municipal buildings and facilities, however, account for less than 5 % of energy demand and CO\textsubscript{2} emissions. Thus, the city must motivate and support its citizens and companies to save energy and switch to climate-friendly energy sources. Municipal buildings and facilities should lead the way with good examples.

Organisation and Financing
Since the end of 2007, city and Stadtwerke finance the position of a climate protection and energy agent (“Klimaschutzbeauftragte/r”). Regular meetings with the city’s chief officer for building and urban planning, the CEO of the Stadtwerke and the mayor of Fürstenfeldbruck allow to coordinate the various aspects of the switch to sustainable energies. In addition, city and Stadtwerke cooperate with external experts, e.g. for building analyses, urban planning and public relations. In its meeting on the 27th march 2012, the city council of Fürstenfeldbruck decided to check all its future activities regarding their relevance for climate protection.

For climate-protection activities, the city’s budget contains - beside the personnel expenditures - financial means for public relations and support programs. Investments in renovations or infrastructure have been and will be partly financed by using the Stadtwerke as a contractor or with the help of subsidies. Furthermore, it is planned to found an “energy collective”. Chapter 4.2 contains further information regarding the budget.

Involvement of Stakeholders and Citizens
City and Stadtwerke present its activities at the yearly energy fair “Energietage Fürstenfeldbruck“ and at special informative events. In the monthly journal “RathausReport”, one page is dedicated to energy and climate protection. Planned measures include an online energy portal and public “regular’s tables” on energy subjects.

Monitoring and Follow-Up
For the covenant of mayors, Fürstenfeldbruck will prepare an implementation report including the monitoring emission inventory. In addition, yearly energy reports are planned for the municipal buildings.
2. Starting Point: Baseline Emission Inventory 2005

The so-called baseline emission inventory describes

- where in the municipal area how much energy is used and produced and
- how much CO\(_2\) is emitted as a consequence.

As the base year Fürstenfeldbruck chose 2005, because for this year a CO\(_2\) inventory\(^4\) has already been compiled using the software ECORegion\(^5\). However, parts of the inventory had to be adapted and extended to meet the requirements of the covenant of mayors. For example, we restricted the values in the transport sector to the municipal area, added the electricity demand in the distribution network of E.ON and calculated the CO\(_2\) emission factor of district heating according to the formula prescribed by the covenant.

2.1 Overall CO\(_2\) Emissions

In total, 212000 tons of CO\(_2\) were emitted due to energy in the year 2005 (per capita: 6.32 tons). About a third stems from the electricity sector, more than half from the heat sector and 14 percent from the transport sector.

We used the standard emission factors for the energy sources\(^6\), thus disregarding the energy used for the production, transport etc. of the energy sources. For the electricity sector, the locally produced electricity was completely deducted from the demand first. Using the national emission factor\(^7\), the rest was converted into CO\(_2\) emissions\(^8\). Finally, the CO\(_2\) emissions of the local electricity production were added.

The municipal facilities were responsible for about six percent of the electricity, one percent of the heat, one percent of the fuel demand and all together for three percent of the CO\(_2\) emissions.

2.2 Electricity

In the electricity sector, very good data is available for the demand as well as for the production side.

More than half of the electricity was used in the industrial and in the tertiary sector, almost 40 percent in the residential buildings (corresponding to a per-capita demand of about 1500 kWh per year) and six percent in the municipal buildings and facilities, almost a fourth of this by the municipal public lighting.

One fifth of the electricity demand was covered by local production. Of this, two thirds stemmed from a natural-gas-fired combined heat-and-power plant (CHPP) and the rest from hydropower. Photovoltaic systems contributed less than half a percent in 2005. In the meantime, they produce five times as much and cover two percent of the electricity demand.
2.2 Heat

In the heat sector, exact data is only available for the demand of natural gas and district heat. The rest must be estimated based on average values. For this, the software ECORegion provides the necessary information. In the CO$_2$ inventory 2005/2006, the demand for heating oil was adapted to the one of natural gas based on informations gathered from the chimney sweeps.

Above half of the CO$_2$ emissions of the heat sector stemmed from the residential buildings, less than half from the industrial and the tertiary sector and only one percent from the municipal buildings and facilities.

Three quarters of the heat was produced using natural gas and heating oil, the share of natural gas being on the rise. Solarthermal systems and heat pumps covered only 0.2 percent of the heat demand in 2005. The share of wood-based heating systems is an average value and therefore was not counted as “CO$_2$-emission free”. The locally produced district heat covered in 2005 - i.e., before the building of the district heating plant “Energiezentrale West” - six percent of the demand.

2.2 Transport

For the transport sector, no exact data was available, all values had to be estimated. Since ECORegion and the estimations in the CO$_2$ inventory 2005/2006 also counted the transport outside of the municipal area, these values were only taken as a starting base and were limited to the municipal area using further information.

The motorized individual travel is responsible for almost 90 percent of the CO$_2$ emissions of the transport sector. Almost all of it stems from cars (estimation: 140 million kilometers per year, corresponding to about eleven kilometers per day and head). Motorcycles account for less than two percent. The share of lorries (light- and heavy-duty vehicles) is seven percent, the one of public transport (busses, suburban trains “S-Bahn”) four percent. The municipal fleet is only responsible for one percent of the CO$_2$ emissions of the transport sector.

The main energy source was gasoline, followed by diesel. Electricity for the suburban trains ("S-Bahn") accounted for one percent.

The detailed baseline emission inventory can be found in appendix A.
3. Potentials for Reducing CO₂ Emissions and Strategic Goals

Energy-related CO₂ emissions can be reduced in three ways:

- by reducing the demand for energy
- by increasing the use of renewable energies
- by switching to energy sources with a lower CO₂ emission factor (e.g., from heating oil to natural gas)

In the following, the potential of these methods are analyzed for the three sectors electricity, heat and transport. This results in twelve “strategic goals” for reducing CO₂ emissions until 2020. Main source of information is the Energy Use Plan¹¹ (“Energienutzungsplan”, EUP) developed by the TU München for Fürstenfeldbruck.

### 3.1 Electricity

1. **Reduce demand by 10 %**
   
   This corresponds to the goal in the national energy concept¹². Since 2005, the total electricity demand in Fürstenfeldbruck is almost constant, in spite of the increasing number of inhabitants and jobs.

2. **Photovoltaics: 12 GWh (10 % of the demand)**
   
   This is a fourth of the potential according to the solar cadaster and the EUP. Current value: 3 GWh.

3. **Wind power plant (6 GWh)**
   
   The Stadtwerke already plan a plant near Puch.

4. **Biomethane CHPP (6.7 GWh)**
   
   This plant was installed in 2011.

5. **Municipal purchase of green electricity (6 GWh)**
   
   This makes the municipal electricity demand “CO₂-emission free”. Additional costs: about 10000 €/a.

### 3.2 Heat

6. **Reduce heat demand by 20 %**
   
   This corresponds to the goal in the national energy concept and implies a small increase relative to the minimum scenario of the EUP (refurbishment just along current regulation and with current rate).

7. **27 GWh renewable heat (solarth., heat pumps)**
   
   The potential is realistic according to the EUP. State 2010: about 4 GWh.

8. **68 GWh district heat, 70 g CO₂ / kWh**
   
   The amount of heat is realistic according to the EUP. The CO₂ emission factor of the district heat was already significantly reduced by the new heating plant.

9. **60 GWh low-emission heating systems**
   
   Example: Substitute old systems using heating oil by modern ones using natural gas or pellets or by small-sized CHPPs. The share of heating oil has decreased continuously, the rising price of heating oil further supports this trend.
### 3.3 Transport

#### 10. 15 % car travel -> bicycles

This corresponds to the goal of Fürstenfeldbruck's Bicycle Transport Plan\textsuperscript{13} to increase the share of bicycle travel to 20 percent. 15 percent correspond, for example, to one third of the ways traveled by car with a length of up to 3 kilometers.

#### 11. 3 % electric vehicles

As a comparison, the goal of the German government - one million electric vehicles until 2020\textsuperscript{14} - corresponds to a share of 2.3 percent. To reduce CO$_2$ emissions as far as possible, the electric vehicles should be charged with certified green electricity.

#### 12. Low-emission fossil engines (5 % natural gas vehicles, CO$_2$ emission factor of other cars: -15 %)

This goal is supported by the high gasoline price and by European goal\textsuperscript{15} that new cars emit less than 95 g CO$_2$/km in the year 2020. The average fuel consumption of cars has already decreased by four percent from 2005 bis 2009\textsuperscript{16}.

### 3.4 Overall Potential for Reducing CO$_2$ Emissions until 2020

The twelve strategic goals together reduce the CO$_2$ emissions by 36 percent, from 212000 to 135000 tons of CO$_2$. The largest contributions stem from decreased heat demand (10.3 percent), district heat (4.7 percent), decreased electricity demand (3.9 percent) and photovoltaic systems (3.4 percent).

The goals are ambitious insofar as they cannot be reached by just continuing with “business as usual”. At the same time, the goals are realistic, because they require only a moderate increase of activities. In particular, the reduction of heat and electricity demand is “covered” by identical goals of the German government. Thus, Fürstenfeldbruck can count on external help in the form of national support programs and other initiatives.

In addition to the strategic goals, there are further potentials for reducing CO$_2$ emissions, for example a fuel-saving driving style. The reason for not using them as strategic goals is in most cases that their progress would be difficult to measure. Another typical activity of action plans - extending or optimizing the public transport - was not used as a strategic goal, because the responsibility for it lies on the county not the city of Fürstenfeldbruck.

Besides additional reduction potentials, there are also “risks”, for example if development areas lead to an increase of living space per capita.
4. Implementation: Measures, Indicators, Budget

With the public utility company ("Stadtwerke"), Fürstenfeldbruck has an important partner for extending the production of renewable electricity and heat/cooling in the municipal area. When it comes to saving energy, however, the city possesses only a small direct influence: Even if the CO₂ emissions of all municipal buildings and facilities would be reduced to zero, the total emissions would only decrease by three percent.

To reach the reduction goal, the city therefore must motivate and help its citizens and companies to save energy and CO₂ emissions. For this, the city can use its indirect influence, for example

- set a good example in municipal buildings and facilities
  - use efficient electrical equipment and efficient illumination technologies
  - build and refurbish “better than EnEV”, i.e., with a higher efficiency standard as required by regulation
  - install photovoltaic systems on municipal buildings
  - use district heating, solarthermal systems or heat pumps
  - substitute cars in the municipal fleet by electric or natural gas vehicles, or at least by gasoline or diesel cars with a very low fuel consumption
  - travel to work using bicycles or public transport

- include CO₂ emission reduction in the objectives of urban and transport planning
  - specify standards for energy efficiency and use of renewable energies or district heat in urban-planning contracts
  - strengthen bicycle travel in transport planning

- financial support
  - support program for refurbishment, substitution of heating pumps etc.
  - free or low-cost lease of municipal roofs for private photovoltaic systems

- public relations
  - information  (monthly journal “RathausReport”, online energy portal, press, energy fair “Energietage“, school projects etc.)
  - consulting service (saving electricity / efficient equipment, refurbishment / new buildings, mobility etc.)
  - motivation (competitions, honors, festivals etc.)

The following chapter contains an overview of current and planned measures, grouped by the strategic goals. The IDs can be used to locate the measures in the detailed action plan (see appendix B). Note that measures regarding public relations typically appear at multiple strategic goals. Since for many measures, the contribution to energy saving, energy production or CO₂ emission reduction is difficult to measure, chapter 4.2 shows which indicators will be used to monitor the progress in reaching the strategic goals. Chapter 4.3 contains information about the budget.

The targets for energy saving, energy production and CO₂ emission reduction of the sectors in the detailed action plan were calculated from the strategic goals as follows:

<table>
<thead>
<tr>
<th>sector</th>
<th>energy saving</th>
<th>energy production</th>
<th>CO₂ reduction</th>
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<td>buildings</td>
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<td>goal 7</td>
<td>goal 1, 5, 6, 7, 9</td>
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<td>goal 10</td>
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<td>goal 10, 11, 12</td>
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<td>goal 2, 3, 4</td>
<td></td>
<td>goal 2, 3, 4</td>
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<tr>
<td>production of heat/cooling</td>
<td>goal 8</td>
<td></td>
<td>goal 8</td>
</tr>
</tbody>
</table>
4.1 Measures

1. Reduce electricity demand by 10 % (CO₂ emission reduction: ca. 8200 t / 3.9 %)

finished or ongoing:
- G 1.1 IT: virtualize servers for higher efficiency
- G 1.5 sewage facility: reduce electricity consumption
- G 1.6 cultural center “Veranstaltungsforum”: energy-efficient and intelligent lighting
- G 4.1 municipal public lighting: substitute high-pressure mercury by high-pressure sodium lamps
- G 4.2 municipal public lighting: test tracks for LED and solar technologies
- ÖA 1.1 energy consulting by ZIEL 21 and Stadtwerke (for citizens and companies)
- ÖA 1.2 participate in yearly energy fair “Energietage Fürstenfeldbruck”
- ÖA 3.5 participate in “Earth Hour”

planned:
- G 1.2 IT: automatically switch off servers during low loads
- G 1.3 school “Schule Nord”: energy-efficient and intelligent lighting
- G 1.4 school “Schule Mitte”: energy-efficient and intelligent lighting
- ÖB 1.1 municipal procurement: gradually switch to energy-efficient products
- G 4.3 municipal public lighting: substitute high pressure sodium lamps, e.g. by LED technology
- ÖA 1.5 new (municipal) internet portal: energy (incl. mobility)
- ÖA 1.9 Stadtwerke: electricity bill with extensive Information
- ÖA 1.10 evaluation: offer program “ÖKOPROFIT” again via county / “Aktivsenioren”?
- ÖA 2.1 campaign for modernizing heating pumps
- ÖA 3.3 sustainable energy “regular’s table”

2. Photovoltaic systems: 12 GWh (CO₂ emission reduction: ca. 7200 t / 3.4 %)

finished or ongoing:
- S 3.2 solar cadaster (online)
- S 3.1 PV on municipal roofs: “Schule Nord”, “Jahnhalle”
- ÖA 1.2 participate in yearly energy fair “Energietage Fürstenfeldbruck”

planned:
- S 3.3 PV on municipal roofs: “Schulzentrum West“, “KiGa Frühlingsstr.“
- S 3.4 PV on county-owned buildings in the municipal area
- RP 1.3 extension of development area “Krebsenbach”: innovative concepts
- RP 1.5 development area “Hochfeld Os”: provide regulatory prerequisites (partial) “Solarsiedlung”
- ÖB 2.1 mun. refurbishing / new buildings: if possible with solar energy, district heating, heat pumps ...
- ÖA 1.5 new (municipal) internet portal: energy (incl. mobility)
- ÖA 5.1 foundation of an energy collective
- ÖA 1.7 photovoltaics: information campaign in quarters with high potential roofs
- ÖA 3.3 sustainable energy “regular’s table”
- ÖA 3.4 campaigns for various energy-related issues, e.g. structural analysis of roofs

3. Wind power plant: 6 GWh (CO₂ emission reduction: ca. 3600 t / 1.7 %)

planned:
- S 2.1 wind power plant
- ÖA 5.1 foundation of an energy collective

4. Biomethane CHPP: 6.7 GWh (CO₂ emission reduction: ca. 4000 t / 1.9 %)

finished or ongoing:
- S 4.1 CHPP “Auf der Lände”: new cogeneration module using biomethane
planned:
S 4.2 sewage facility: extend cogeneration modules (biogas from sewage)
S 4.3 district heating plant “Energiezentrale West”: new cogeneration plant

5. Municipal purchase of certified green electricity  (CO₂ emission reduction: ca. 3600 t / 1.7 %)
planned:
G 1.7 purchase certified green electricity for municipal buildings
G 4.4 purchase certified green electricity for municipal public lighting

6. Reduce demand for heat by 20 %  (CO₂ emission reduction: ca. 21800 t / 10.3 %)
finished or ongoing:
G 1.8 analysis and “ranking“ of municipal buildings
G 1.9 school “Schule Nord”: energy-efficient refurbishment
G 1.11, ÖA 4.1 municipal energy management: “energy guide”, trainings
G 1.14, extend the use of building control systems in: schools,
G 2.1, tertiary sector,
G 5.1 industry & SMEs
G 1.15 sewage facility: reduce heat demand
RP 1.1 resolution: use results of the energy use plan as base for specifying energy efficiency standards
and energy supply in urban-planning contracts etc.
RP 1.2 development area “Hochfeld West”: partly several passive houses (other: district heating)
ÖB 1.2 renovation / new buildings: if possible “better than current legislation (EnEV)“
ÖA 1.1 energy consulting by ZIEL 21 and Stadtwerke (for citizens and companies)
ÖA 1.2 participate in yearly energy fair “Energietage Fürstenfeldbruck“
ÖA 2.3 support program for refurbishment
planned:
G 1.10 school “Schule Mitte“: energy-efficient refurbishment
G 1.12 municipal energy management: yearly energy report
G 1.13 municipal energy management: software tool
RP 1.3 extension of development area “Krebsenbach“: innovative concepts
RP 1.4 evaluate the designation of urban renovation areas
ÖA 1.5 new (municipal) internet portal: energy (incl. mobility)
ÖA 3.9 research project with TU München: how to motivate homeowners to renovate?
RP 3.1 standards for refurbishing / new buildings: concept and resolution by city council
RP 1.5 development area “Hochfeld Os“: provide regulatory prerequisites (partial) “ Solarsiedlung“
ÖA 1.5 new (municipal) internet portal: energy (incl. mobility)
ÖA 1.6 refurbishment: information campaign in quarters with high potential
ÖA 1.8 update brochure with information for builder-owners (“Bauherrenmappe“)
ÖA 1.9 update flyers about energy saving (electricity, heat, mobility)
ÖA 1.10 evaluation: offer program “ÖKOPROFIT“ again via county / “Aktivsenioren“?
ÖA 2.4 support program for refurbishing: adapt to SEAP
ÖA 3.3 sustainable energy “regular's table“
ÖA 3.4 campaigns for various energy-related issues, e.g. thermographic analysis

7. Renewable heat (solarthermal, heat pumps etc.): 27 GWh  (CO₂ emission reduction: ca. 5900 t / 2.8 %)
finished or ongoing:
S 3.2 solar cadaster (online)
ÖB 2.1 mun. refurbishing / new buildings: if possible with solar energy, district heating, heat pumps ...
ÖA 1.1 energy consulting by ZIEL 21 and Stadtwerke (for citizens and companies)
ÖA 1.2 participate in yearly energy fair “Energietage Fürstenfeldbruck“
planned:

G 1.18  new crèche “Sonnenplatz”: install heat pump
RP 1.3  extension of development area “Krebsenbach”: innovative concepts
RP 1.5  development area “Hochfeld Os”: provide regulatory prerequisites (partial) “ Solarsiedlung”
ÖA 1.5  new (municipal) internet portal: energy (incl. mobility)
ÖA 1.8  update brochure with information for builder-owners (“Bauherrenmappe“)
ÖA 2.5  support program for refurbishing: extend to heating technologies
ÖA 3.3  sustainable energy “regular’s table”
ÖA 3.4  campaigns for various energy-related issues, e.g. structural analysis of roofs

8. More district heat with better CO₂ emission factor  (CO₂ emission reduction: ca. 10100 t / 4.7 %)

finished or ongoing:

W 1.1  CHPP “Auf der Lände”: new cogeneration module with biomethane (see above)
W 2.1  “Energiezentrale West”: new district heating plant, based on wood chips
W 2.2  “Energiezentrale West”: wood chips from municipal tree- and shrub-cut
W 3.1  extend district heating network “West”
RP 1.1  resolution: use results of the energy use plan as base for specifying energy efficiency standards
and energy supply in urban-planning contracts etc.
RP 1.2  development area “Hochfeld West”: compulsory connection to district heating
ÖB 2.1  mun. refurbishing / new buildings: if possible with solar energy, district heating, heat pumps ... 
ÖA 1.2  participate in yearly energy fair “Energietage Fürstenfeldbruck”

planned:

G 1.16  sports hall “Theresianumweg”: switch to district heating
G 1.17  school “Grundschule/Hort West”: switch to district heating
W 1.2  CHPP “Auf der Lände”: extend thermal power
W 1.3  district heating plant “Energiezentrale West”: new cogeneration plant
W 1.4  CHPP “Sparkasse”: modernize motors
W 3.2  connection pipeline between the two district heating networks
ÖA 1.5  new (municipal) internet portal: energy (incl. mobility)
ÖA 1.8  update brochure with information for builder-owners (“Bauherrenmappe“)
ÖA 2.5  support program for refurbishing: extend to heating technologies
ÖA 3.3  sustainable energy “regular’s table”

9. 60 GWh low-emission heating systems  (CO₂ emission reduction: ca. 3900 t / 1.8 %)

finished or ongoing:

ÖB 2.1  mun. refurbishing / new buildings: if possible with solar energy, district heating, heat pumps ...
ÖA 1.2  participate in yearly energy fair “Energietage Fürstenfeldbruck”

planned:

ÖÖ 1.5  new (municipal) internet portal: energy (incl. mobility)
ÖA 1.8  update brochure with information for builder-owners (“Bauherrenmappe“)
ÖA 2.5  support program for refurbishing: extend to heating technologies
ÖA 3.3  sustainable energy “regular’s table”
ÖA 2.2  contracting for small-sized CHPPs (“Mini-BHKWs“)

10. 15 % car travel -> bicycle travel  (CO₂ emission reduction: ca. 4100 t / 1.9 %)

finished or ongoing:

V 1.3  city employees participate in campaign “Mit dem Rad zur Arbeit “ (-> bicycle to work)
V 3.1  budget for measures to encourage bicycle travel (constructional etc.)
RP 1.6 reduced requirements for the number of parking spaces of new developments in the city center
RP 2.1a transport planning: working group "Traffic", round table "Bicycle Traffic", traffic survey
ÖA 1.4 new (municipal) internet portal: bicycle traffic

planned:
V 3.1a encourage bicycle travel: reshape bicycle lanes near county office ("Landratsamt")
V 3.1b encourage bicycle travel: bicycle lane “Augsburger Straße”
V 3.2 participate in Germany-wide campaign "Stadtradeln"
RP 2.1b transport planning: assessment roundabout traffic “Augsburger Straße”
RP 2.2 Planung Verbesserung Rad/Fußverkehr Münchner Straße
ÖA 1.5 new (municipal) internet portal: energy (incl. mobility)
ÖA 1.9 update flyers about energy saving (electricity, heat, mobility)
ÖA 3.3 sustainable energy “regular's table”
ÖA 3.4 campaigns for various energy-related issues, e.g. pedelecs

11. Electric vehicles: 3 % (CO₂ emission reduction: ca. 700 t / 0.4 %)

finished or ongoing:
V 3.5 Stadtwerke: action day “electromobility“
V 3.6 Stadtwerke: acquire electric vehicle
V 3.7 Stadtwerke: charging station, participation in ladenetz.de
ÖA 1.2 participate in yearly energy fair “Energietage Fürstenfeldbruck“
ÖA 2.6 Stadtwerke: support program electromobility

planned:
V 1.4 municipal fleet: acquire electric vehicle
V 3.8 allow for charging infrastructure during other infrastructure projects
ÖA 1.5 new (municipal) internet portal: energy (incl. mobility)
V 1.5 municipal fleet: gradually replace gasoline and diesel cars with electric / natural gas / low-emission cars
ÖA 3.3 sustainable energy “regular's table”

12. Low-emission fossil engines: 5 % natural gas vehicles, CO₂ emission factor gasoline/diesel cars -> - 15 %
(CO₂ emission reduction: ca. 4000 t / 1.9 %)

planned:
ÖA 1.5 new (municipal) internet portal: energy (incl. mobility)
V 1.5 municipal fleet: gradually replace gasoline and diesel cars with electric / natural gas / low-emission cars
ÖA 3.3 sustainable energy “regular's table”
ÖA 3.4 campaigns for various energy-related issues, e.g. low-emission cars

13. Miscellaneous
The following measures cannot be assigned easily to the strategic goals:

finished or ongoing:
S 5.1 Stadtwerke: certified green electricity tariff "FFBNaturStrom", investing in regional renewables
S 5.2 market observation for pilot projects for Smart Grids / Smart Metering / energy storage
V 1.1 directives for use of municipal vehicles: inform about fuel-saving driving style
V 1.2 official trips of city employees to München: mandatory use of public transport
V 2.1 municipal extensions to (county-operated) bus lines
ÖA 1.3 public informative events regarding energy use plan, SEAP etc.
ÖA 3.1 additional environmental education about energy and water
ÖA 3.1 monthly information about energy-related issues in city journal “RathausReport”
planned:
ÖA 3.2 display case climate protection and sustainable energy in town hall
V 3.3 pedestrian-friendly reshaping of the “Kirchstraße”
V 3.4 pedestrian path connecting “Hauptstraße” and “Viehmarktplatz”
ÖB 1.3 consideration of grey energy of building materials: concept
V 2.2, in the context of the county-wide climate protection action plan: initiatives for low-emission
V 2.3, busses and for certified green electricity for S-Bahn (suburban trains) and
V 3.9 further initiatives regarding mobility (car sharing, information center “mobility” ...)
ÖA 3.6 city information brochure etc.: integrate text related to energy (upon revision)
ÖA 3.7 honor activities of citizens, companies, associations etc., e.g. at new year’s reception
(“Neujahrsempfang”) or “Wirtschaftsempfang”, potentially with awards

4.2 Indicators for Measuring the Progress in Reaching the Strategic goals

Goals 1-5 (electricity demand, electricity production, certified green energy for municipal facilities):
data on electricity demand and production (source: Stadtwerke Fürstenfeldbruck, E.ON)

Goals 6 and 9 (heat demand, climate-friendly heating technologies):
number and power of the different types of firing systems (source: chimney sweepers)
data on demand of natural gas and district heat (source: Energienetze Bayern, Stadtwerke Fürstenfeldbruck),

Goal 7 (solarthermal collectors, heat pumps):
area of government-funded solarthermal systems (source: BAFA),
data on heat pumps that are subject to registration (source: county office)

Goal 8 (district heating):
data on demand of district heat, electricity production in CHPPs and use of fuel (source: Stadtwerke)

Goal 10 (car travel -> bicycles):
traffic census, repeat survey of bicycle transport

Goals 11 and 12 (electric vehicles, climate-friendly fossil engines):
data on registered cars (source: Kraftfahrbundesamt)

4.3 Budget for Developing and Implementing the Overall Strategy

From 2007 until the development of the Sustainable Energy Action Plan in this year, city and Stadtwerke
Fürstenfeldbruck have spent about 700,000 € for climate-protection activities. The personnel expenditures for
the climate protection and energy agent amounted to ca. 400,000 €. Almost 100,000 € went to different
external companies for developing the energy use plan, a CO2 inventory for 2010 and the Action Plan. Another
100,000 € were provided for support programs (refurbishment, electromobility). Public relations and planning
activities also cost about 100,000 €.

For the years 2013 until 2020, the budget cannot be specified with certainty, because most financial means
must be requested each year anew and, generally spoken, the financial situation is tight. If the means allotted
for 2012 can also be provided in the following years, this would amount to a yearly budget for climate
protection of well above 300,000 €. One third of it cover the personnel expenditures for the climate protection
and energy agent, another third goes into infrastructure for bicycle transport. 30 percent are provided for
support programs and the rest for public relations and planning activities.

The cited amounts do not include investments in refurbishment and energy production. The costs for those
activities are - if known - specified in the detailed Action Plan (see Appendix B).
## Appendix A: Detailed Baseline Emission Inventory

### A. Final energy consumption

#### Table 1: Final Energy Consumption (t/yr)

<table>
<thead>
<tr>
<th>Category</th>
<th>Fuel/heat</th>
<th>Natural gas</th>
<th>Liquid gas</th>
<th>Heating/Oil</th>
<th>Diesel</th>
<th>Gasoline</th>
<th>Lignite</th>
<th>Coal</th>
<th>Other fossil fuels</th>
<th>Plantoil</th>
<th>Biofuel</th>
<th>Other or biomass</th>
<th>Solar thermal</th>
<th>Geo thermal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Buildings, equipment/facilities</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Municipal buildings, equipment/facilities</td>
<td>6105.28</td>
<td>3111.88</td>
<td>3695.79</td>
<td>0.00</td>
<td>1486.47</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>10306.92</td>
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<tr>
<td>Public transport</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
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<td>2513.38</td>
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<tr>
<td><strong>Total</strong></td>
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<td>8618.66</td>
<td>3111.88</td>
<td>3695.79</td>
<td>0.00</td>
<td>1486.47</td>
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</table>

### B. CO2 or CO2 equivalent emissions

#### Table 2: CO2 or CO2 equivalent emissions

<table>
<thead>
<tr>
<th>Category</th>
<th>Fuel/heat</th>
<th>Natural gas</th>
<th>Liquid gas</th>
<th>Heating/Oil</th>
<th>Diesel</th>
<th>Gasoline</th>
<th>Lignite</th>
<th>Coal</th>
<th>Other fossil fuels</th>
<th>Plantoil</th>
<th>Biofuel</th>
<th>Other or biomass</th>
<th>Solar thermal</th>
<th>Geo thermal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Buildings, equipment/facilities</strong></td>
<td></td>
<td></td>
<td></td>
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<td>Municipal buildings, equipment/facilities</td>
<td>3409.04</td>
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<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>3409.04</td>
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<tr>
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<td>0.00</td>
<td>0.00</td>
<td>5040.16</td>
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</table>

#### Additional notes
- Municipal public lighting: 0.00 t/yr
- Public transport: 30579.55 t/yr
- Residential buildings: 27405.27 t/yr
- Residential buildings and communal heat in transport: 1472.14 t/yr
- Municipal public lighting: 11719.00 t/yr

### Corresponding CO2 emission factors

- CO2 emission factor for electricity not produced locally (tCO2/MWh): 0.597
### C. Local electricity production and corresponding CO2 emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

<table>
<thead>
<tr>
<th>Energy carrier input [MWh]</th>
<th>Locally generated electricity (excluding ETS plants, and all plants/units &gt; 20 MW)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Locally generated electricity (total)</td>
</tr>
<tr>
<td></td>
<td>Natural gas</td>
</tr>
<tr>
<td>Wind power</td>
<td>0</td>
</tr>
<tr>
<td>Hydroelectric power</td>
<td>8447,31</td>
</tr>
<tr>
<td>Photovoltaic</td>
<td>630,6</td>
</tr>
<tr>
<td>Combined Heat and Power</td>
<td>18917,51</td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>Combined Heat and Power at sewage facility</td>
<td>942,62</td>
</tr>
<tr>
<td>Total</td>
<td>29945,415</td>
</tr>
</tbody>
</table>

### D. Local heat/cold production (district heating/cooling, CHPs...) and corresponding CO2 emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

<table>
<thead>
<tr>
<th>Energy carrier input [MWh]</th>
<th>Locally generated heat/cold (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Locally generated heat/cold (total)</td>
</tr>
<tr>
<td></td>
<td>Natural gas</td>
</tr>
<tr>
<td>Combined Heat and Power</td>
<td>25945,415</td>
</tr>
<tr>
<td>District Heating plants(s)</td>
<td>942,62</td>
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<tr>
<td>Other</td>
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<tr>
<td>Please specify:</td>
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<tr>
<td>Total</td>
<td>29945,415</td>
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</table>
### Appendix B: Detailed Action Plan

#### SECTORS & Fields of Action

<table>
<thead>
<tr>
<th>SECTORS &amp; Fields of Action</th>
<th>(Key Action)</th>
<th>Action/Measure</th>
<th>Responsible Department</th>
<th>Estimated Costs</th>
<th>SECTOR</th>
<th>Expected Energy Saving</th>
<th>CO2 Emission Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUILDINGS, EQUIPMENT/FACILITIES</td>
<td>G1.1 Municipal buildings</td>
<td>Energy efficient refurbishment</td>
<td>Stadtwerke</td>
<td>80.000 MWh/a</td>
<td>MWh</td>
<td>113900,8</td>
<td>27000,0</td>
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<tr>
<td></td>
<td>G1.2 Schools</td>
<td>Energy efficient refurbishment</td>
<td>Stadtwerke</td>
<td>8.000.000 MWh/a</td>
<td>MWh</td>
<td>43379,8</td>
<td>27000,0</td>
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<tr>
<td></td>
<td>G1.3 Sewage facility</td>
<td>Reduce electricity consumption</td>
<td>Stadtwerke</td>
<td>12.900 MWh/a</td>
<td>MWh</td>
<td>200,8</td>
<td>4,5</td>
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<tr>
<td></td>
<td>G1.4 Cultural center</td>
<td>Energy efficient refurbishment</td>
<td>Stadtwerke</td>
<td>6770 MWh/a</td>
<td>MWh</td>
<td>41,0</td>
<td>1,0</td>
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<tr>
<td></td>
<td>G1.5 Schools</td>
<td>Energy efficient refurbishment</td>
<td>Stadtwerke</td>
<td>6770 MWh/a</td>
<td>MWh</td>
<td>41,0</td>
<td>1,0</td>
</tr>
<tr>
<td></td>
<td>G1.6 Cultural center</td>
<td>Energy efficient refurbishment</td>
<td>Stadtwerke</td>
<td>6770 MWh/a</td>
<td>MWh</td>
<td>41,0</td>
<td>1,0</td>
</tr>
<tr>
<td></td>
<td>G1.7 Schools</td>
<td>Energy efficient refurbishment</td>
<td>Stadtwerke</td>
<td>6770 MWh/a</td>
<td>MWh</td>
<td>41,0</td>
<td>1,0</td>
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<td>G1.8 Schools</td>
<td>Energy efficient refurbishment</td>
<td>Stadtwerke</td>
<td>6770 MWh/a</td>
<td>MWh</td>
<td>41,0</td>
<td>1,0</td>
</tr>
</tbody>
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### Strategic Goals

1. Reduce electricity demand
2. Reduce heating demand
3. More renewable heat
4. More district heating
5. Indirect actions: see "Working with Citizens and Stakeholders"
6. Municipal public lighting
7. Municipal buildings, equipment/facilities
8. Tertiary buildings, non-municipal buildings

### Key Actions

- Substitute high-pressure mercury by high-pressure sodium lamps
- Test tracks for LED and solar technologies
- Municipal purchase of certified green electricity
- Municipal buildings, equipment/facilities
- Tertiary buildings, non-municipal buildings
- Municipal public lighting
- Municipal buildings, equipment/facilities
- Tertiary buildings, non-municipal buildings
- Municipal purchase of certified green electricity
- Municipal buildings, equipment/facilities
- Tertiary buildings, non-municipal buildings
### SUSTAINABLE ENERGY ACTION PLAN, FÜRSTENFELDBRUCK  MAY 2012

#### APPENDIX B: DETAILED ACTION PLAN

**TRANSPORT**

In addition to strategic goals:

<table>
<thead>
<tr>
<th>Strategic goal</th>
<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1: Municipal</td>
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</table>

**Strategic goal 10: 10 Year Plan: Green Transportation**

<table>
<thead>
<tr>
<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
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</table>

**Public transport**

In addition to strategic goals:

<table>
<thead>
<tr>
<th>Strategic goal</th>
<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>V2: Public</td>
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</table>

**Private and commercial transport**

In addition to strategic goals:

<table>
<thead>
<tr>
<th>Strategic goal</th>
<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>V3: Private</td>
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</table>

### SOCIAL ELECTRITY PRODUCTION

**Hydroelectric power**

<table>
<thead>
<tr>
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<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1: 100% clean power</td>
<td></td>
<td></td>
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</tbody>
</table>

**Wind power**

<table>
<thead>
<tr>
<th>Strategic goal</th>
<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2: 100% clean power</td>
<td></td>
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</table>

**Photovoltaic**

<table>
<thead>
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<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3: 100% clean power</td>
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</tbody>
</table>

**Combined Heat and Power**

<table>
<thead>
<tr>
<th>Strategic goal</th>
<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S4: 100% clean power</td>
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</table>

**别的**

<table>
<thead>
<tr>
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<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>S5: 100% clean power</td>
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</table>

### LOCAL DISTRICT HEATING / CODING, CHPs

**CHP plant and power generation with low CO₂ emissions**

<table>
<thead>
<tr>
<th>Strategic goal</th>
<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1: Combined</td>
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</tbody>
</table>

**District heating plant**

<table>
<thead>
<tr>
<th>Strategic goal</th>
<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>W2: District</td>
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</table>

**District heating network**

<table>
<thead>
<tr>
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<th>Action</th>
<th>Date</th>
<th>Current Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>W3: District</td>
<td></td>
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</tr>
</tbody>
</table>
Strategic goals 6, 7 and 8: reduce heating demand, more renewable heat, more district heating with less CO2 emissions

RP#1: Strategic urban planning

- RP21.3: Extension of development area "Krebsenbach": Innovative concepts from 2013 (n.s.)
- RP21.4: Evaluation of the designation of urban renovation areas from 2016 (n.s.)
- RP21.6: Reduced requirements for the number of parking spaces of new developments in 2012 (n.s.)

RP#2: Transport / mobility planning

- RP22.1: Transport planning activities (n.s.)
- RP22.2: Facilitated bicycle and pedestrian traffic on "Münchner Straße": Planning phase (n.s.)

RP#3: Standards for refurbishment and new development

- RP23.1: Concept and resolution by city council (n.s.)

PUBLIC PROCUREMENT OF PRODUCTS AND SERVICES

- ÖB#2: Renewable energy requirements/standards
  - ÖB22.1: Refurbishing/new buildings: if possible using solar energy, district heating, heat (continuously)

ORGANIZING THE CITIZENS AND STAKEHOLDERS

- ÖA#1: Advisory services
  - ÖA21.1: Energy consulting by ZIEL and Stadtwerke (for citizens and companies)
  - ÖA21.2: Participation in annual energy fair "Energietage Fürstenfeldbruck" 17.000 persons
  - ÖA21.3: Public informative events regarding energy use plan ("Energienutzungsplan"); Klimaschutzbeauftragte (n.s.)
  - ÖA21.5: New (municipal) internet portal: energy (incl. mobility) since 2012 and 2013
  - ÖA21.7: Photovoltaics: information campaign in quarters with high potential roofs from 2013 (from budget)
  - ÖA21.8: Update brochure with information for builders and owners ("Bauherrenmappe") 2012 & 2013
  - ÖA21.9: Update flyers about energy saving (electricity, heat, mobility) 2012 & 2013 (from budget)
  - ÖA21.10: Evaluation: offer program "ÖKOPROFIT" again via county/"Aktivsenioren"? since 2010

- ÖA#2: Financial support and grants
  - ÖA22.4: Support program for refurbishing: adapt to SEAP 2012 from budget
  - ÖA22.5: Support program for refurbishing: extend to heating technologies from 2013
  - ÖA22.6: Support program electromobility since 2011

- ÖA#3: Awareness raising and local networking
  - ÖA23.2: Display case climate protection and sustainable energy in town hall Klimaschutzbeauftragte (from 2012)
  - ÖA23.3: Monthly information about energy and related issues in city journal "RathausReport" since 2011
  - ÖA23.4: Campaigns for various energy-related issues, e.g. energy saving tips for "Wirtschaftsempfang" (n.s.)
  - ÖA23.5: Monthly newsletter "Energie und der Stadtwald" Stadtwerke since 2011
  - ÖA23.6: Updating of electric bill with extensive information since 2013
  - ÖA23.8: Research project with TU München: how to motivate homeowners to renovate? since 2012 & 2013

- ÖA#4: Training and education
  - ÖA24.2: Schools: additional environmental education about energy and water since 2009 (k.A.)

TOTALS: 129796.4 119700.0 76992.6
Appendix C: References and Comments

Please note that the referenced documents are in German. Their titles have been translated for better understanding.

Chapter 1:
2) Klima-Bündnis e. V.: [www.klimabuendnis.org](http://www.klimabuendnis.org)
3) Covenant of Mayors: [http://www.eumayors.eu](http://www.eumayors.eu)

Chapter 2
4) City of Fürstenfeldbruck: Municipal Energy and CO₂ Inventory 2006, Februar 2008
5) ECORegion: [www.ecospeed.ch](http://www.ecospeed.ch)
6) How to develop a Sustainable Energy Action Plan - Guidebook, Joint Research Centre of the European Commission, 2010
7) Emission factor of electricity for Germany: [www.umweltbundesamt.de/energie/archiv/co2-strommix.pdf](http://www.umweltbundesamt.de/energie/archiv/co2-strommix.pdf)
8) Relative to the German demand for electricity (circa 600.000 GWh), the locally produced electricity (< 30 GWh) is so small that its effect on the national emission factor can be neglected.
9) More detailed information about the assumptions and computational methods used for the transport sector can be found in the extended SEAP Excel sheets and will be included in the long version of the SEAP report.
10) Estimation of motorized individual transport: based on data by Mr. Lademacher (3.2.12), passengers eliminated.

Chapter 3
13) Bicycle-Friendly Fürstenfeldbruck - Catalog of Measures for the Bicycle Transport Plan of the City of Fürstenfeldbruck, 2010