Low energy concrete

Overview

Energy consumption in Switzerland

How do we bend the curve?

By sector energy consumption

Main (industrial) partners:

Our project proposition

Cut energy consumption from building materials by developing low energy products in the market

• Concrete with low clinker cement
  • Cement substitution via use of locally available materials (limestone fillers, etc.), alkali activators, synthesized superplasticizers
  • Better understanding of carbonation and steel corrosion to optimize cement substitution up to 65% (allowance as per the new SIA guideline, SIA 2049)

• Structures with reduced steel content
  • Substitution of steel, a high energy imported material, with other tensile resistant materials

Research focus:

• The balance between the benefits of eliminating steel and the potential disadvantages of using alternative materials needs to be assessed in order to maintain the overall focus of the joint project on sustainable construction.

• Another challenging question to be answered by this joint project concerns ways in which these radical innovations can be implemented in frame structures.

Subprojects

The project is composed of five work packages that looks into improvement potentials in buildings construction, from material up to structural level, and an umbrella project that takes care of the sustainability assessment.

Energy Turnaround

‘Low energy concrete’ focuses on low energy constructive system that presents huge energy and emission savings potential for Swiss Energy Turnaround.

Contact

Prof. Guillaume Habert
Joint Project Leader
ETH Zurich
habertg@ethz.ch

Sharon Zingg (Sharon Estadola)
Project Coordinator
ETH Zurich
zingg@ibi.baug.ethz.ch

ETH Zurich
IBI / Professur für Nachhaltiges Bauen
Stefano-Franscini-Platz 5
8093 Zürich

Source: BFE, 2013

Data on energy consumption per sector are as follows:

- Buildings: 46%
- Industry: 18%
- Transport: 35%
- Others: 1%

By sector energy consumption table for the year 2010, outlook to 2050.

Source: BAFU, 2014

<table>
<thead>
<tr>
<th>Sector</th>
<th>2010</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>27</td>
<td>17</td>
</tr>
<tr>
<td>Transport</td>
<td>31</td>
<td>28</td>
</tr>
<tr>
<td>Industry</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Overview of the five work packages and the umbrella project

- WP1: Low clinker concrete
  - Lead: Prof. Robert Fratt, ETH Zurich
  - Prof. Karen Schönwiese, EMPA; Prof. Bernard Flinner, ETH Zurich; Dr. Marta Palacios, ETH Zurich

- WP2: Wood concrete hybrid structure
  - Lead: Prof. Andrea Franz, ETH Zurich
  - Prof. Ingo Burget, ETH Zurich

- WP3: Carbon fiber reinforced high performance concrete
  - Lead: Prof. Pietro Lura, EMPA
  - Dr. Giovanni Terrasi, EMPA

- WP4: Ultra high performance fiber reinforced concrete
  - Lead: Dr. Emmanuel Denarié, EPFL
  - Prof. Eugen Brühwiler, EPFL

- WP5: Monitoring and simulation of innovative frame structures
  - Lead: Prof. Eleni Chatzi, ETH Zurich
  - Low clinker concrete
  - Prof. Guillaume Habert, ETH Zurich

Material level

Structural level

Umbrella

Sustainability assessment

Lead: Prof. Guillaume Habert, ETH Zurich

Outlook 2050

Buildings

Electricity supply

Industry

Transport

'Low energy concrete' focuses on low energy constructive system that presents huge energy and emission savings potential for Swiss Energy Turnaround.

Contact

Prof. Guillaume Habert
Joint Project Leader
ETH Zurich
habertg@ethz.ch

Sharon Zingg (Sharon Estadola)
Project Coordinator
ETH Zurich
zingg@ibi.baug.ethz.ch

ETH Zurich
IBI / Professur für Nachhaltiges Bauen
Stefano-Franscini-Platz 5
8093 Zürich

Source: BAFU, 2014

Data on energy consumption per sector are as follows:

- Buildings: 46%
- Industry: 18%
- Transport: 35%
- Others: 1%

By sector energy consumption table for the year 2010, outlook to 2050.

Source: BAFU, 2014

<table>
<thead>
<tr>
<th>Sector</th>
<th>2010</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>27</td>
<td>17</td>
</tr>
<tr>
<td>Transport</td>
<td>31</td>
<td>28</td>
</tr>
<tr>
<td>Industry</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Overview of the five work packages and the umbrella project

- WP1: Low clinker concrete
  - Lead: Prof. Robert Fratt, ETH Zurich
  - Prof. Karen Schönwiese, EMPA; Prof. Bernard Flinner, ETH Zurich; Dr. Marta Palacios, ETH Zurich

- WP2: Wood concrete hybrid structure
  - Lead: Prof. Andrea Franz, ETH Zurich
  - Prof. Ingo Burget, ETH Zurich

- WP3: Carbon fiber reinforced high performance concrete
  - Lead: Prof. Pietro Lura, EMPA
  - Dr. Giovanni Terrasi, EMPA

- WP4: Ultra high performance fiber reinforced concrete
  - Lead: Dr. Emmanuel Denarié, EPFL
  - Prof. Eugen Brühwiler, EPFL

- WP5: Monitoring and simulation of innovative frame structures
  - Lead: Prof. Eleni Chatzi, ETH Zurich
  - Low clinker concrete
  - Prof. Guillaume Habert, ETH Zurich

Material level

Structural level

Umbrella

Sustainability assessment

Lead: Prof. Guillaume Habert, ETH Zurich

Outlook 2050

Buildings

Electricity supply

Industry

Transport

'Low energy concrete' focuses on low energy constructive system that presents huge energy and emission savings potential for Swiss Energy Turnaround.

Contact

Prof. Guillaume Habert
Joint Project Leader
ETH Zurich
habertg@ethz.ch

Sharon Zingg (Sharon Estadola)
Project Coordinator
ETH Zurich
zingg@ibi.baug.ethz.ch

ETH Zurich
IBI / Professur für Nachhaltiges Bauen
Stefano-Franscini-Platz 5
8093 Zürich

Source: BAFU, 2014

Data on energy consumption per sector are as follows:

- Buildings: 46%
- Industry: 18%
- Transport: 35%
- Others: 1%

By sector energy consumption table for the year 2010, outlook to 2050.

Source: BAFU, 2014

<table>
<thead>
<tr>
<th>Sector</th>
<th>2010</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>27</td>
<td>17</td>
</tr>
<tr>
<td>Transport</td>
<td>31</td>
<td>28</td>
</tr>
<tr>
<td>Industry</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Overview of the five work packages and the umbrella project

- WP1: Low clinker concrete
  - Lead: Prof. Robert Fratt, ETH Zurich
  - Prof. Karen Schönwiese, EMPA; Prof. Bernard Flinner, ETH Zurich; Dr. Marta Palacios, ETH Zurich

- WP2: Wood concrete hybrid structure
  - Lead: Prof. Andrea Franz, ETH Zurich
  - Prof. Ingo Burget, ETH Zurich

- WP3: Carbon fiber reinforced high performance concrete
  - Lead: Prof. Pietro Lura, EMPA
  - Dr. Giovanni Terrasi, EMPA

- WP4: Ultra high performance fiber reinforced concrete
  - Lead: Dr. Emmanuel Denarié, EPFL
  - Prof. Eugen Brühwiler, EPFL

- WP5: Monitoring and simulation of innovative frame structures
  - Lead: Prof. Eleni Chatzi, ETH Zurich
  - Low clinker concrete
  - Prof. Guillaume Habert, ETH Zurich

Material level

Structural level

Umbrella

Sustainability assessment

Lead: Prof. Guillaume Habert, ETH Zurich

Outlook 2050

Buildings

Electricity supply

Industry

Transport

'Low energy concrete' focuses on low energy constructive system that presents huge energy and emission savings potential for Swiss Energy Turnaround.

Contact

Prof. Guillaume Habert
Joint Project Leader
ETH Zurich
habertg@ethz.ch

Sharon Zingg (Sharon Estadola)
Project Coordinator
ETH Zurich
zingg@ibi.baug.ethz.ch

ETH Zurich
IBI / Professur für Nachhaltiges Bauen
Stefano-Franscini-Platz 5
8093 Zürich

Source: BAFU, 2014

Data on energy consumption per sector are as follows:

- Buildings: 46%
- Industry: 18%
- Transport: 35%
- Others: 1%

By sector energy consumption table for the year 2010, outlook to 2050.

Source: BAFU, 2014

<table>
<thead>
<tr>
<th>Sector</th>
<th>2010</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>27</td>
<td>17</td>
</tr>
<tr>
<td>Transport</td>
<td>31</td>
<td>28</td>
</tr>
<tr>
<td>Industry</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Overview of the five work packages and the umbrella project

- WP1: Low clinker concrete
  - Lead: Prof. Robert Fratt, ETH Zurich
  - Prof. Karen Schönwiese, EMPA; Prof. Bernard Flinner, ETH Zurich; Dr. Marta Palacios, ETH Zurich

- WP2: Wood concrete hybrid structure
  - Lead: Prof. Andrea Franz, ETH Zurich
  - Prof. Ingo Burget, ETH Zurich

- WP3: Carbon fiber reinforced high performance concrete
  - Lead: Prof. Pietro Lura, EMPA
  - Dr. Giovanni Terrasi, EMPA

- WP4: Ultra high performance fiber reinforced concrete
  - Lead: Dr. Emmanuel Denarié, EPFL
  - Prof. Eugen Brühwiler, EPFL

- WP5: Monitoring and simulation of innovative frame structures
  - Lead: Prof. Eleni Chatzi, ETH Zurich
  - Low clinker concrete
  - Prof. Guillaume Habert, ETH Zurich

Material level

Structural level

Umbrella

Sustainability assessment

Lead: Prof. Guillaume Habert, ETH Zurich

Outlook 2050

Buildings

Electricity supply

Industry

Transport

'Low energy concrete' focuses on low energy constructive system that presents huge energy and emission savings potential for Swiss Energy Turnaround.

Contact

Prof. Guillaume Habert
Joint Project Leader
ETH Zurich
habertg@ethz.ch

Sharon Zingg (Sharon Estadola)
Project Coordinator
ETH Zurich
zingg@ibi.baug.ethz.ch

ETH Zurich
IBI / Professur für Nachhaltiges Bauen
Stefano-Franscini-Platz 5
8093 Zürich

Source: BAFU, 2014

Data on energy consumption per sector are as follows:

- Buildings: 46%
- Industry: 18%
- Transport: 35%
- Others: 1%

By sector energy consumption table for the year 2010, outlook to 2050.

Source: BAFU, 2014

<table>
<thead>
<tr>
<th>Sector</th>
<th>2010</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings</td>
<td>27</td>
<td>17</td>
</tr>
<tr>
<td>Transport</td>
<td>31</td>
<td>28</td>
</tr>
<tr>
<td>Industry</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>