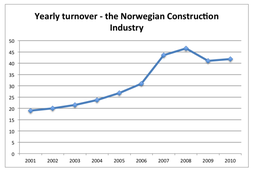
Build Up Skills Norway: Status Quo Analysis 11.05.2012

1. The Norwegian Construction Industry

A. Turnover



- The construction industry in Norway is perceived as a relatively attractive and solid industry with regard to criteria such as pay, operating margins and return on investment.
- Turnover in building and construction has more than doubled over the last 10 years.
- Vulnerable to economic conjunctures.

B. Structure

- Around 190,000 employees in 2011, distributed around approximately 50,000 companies.
- High percentage of small and medium sized companies. 90% of the companies have fewer than 10 employees, while 96% have fewer than 20 employees.
- Craft workers represented less than 60% of the total employed in the building and construction industry. The number of tradesmen employed went down by about 20,000 from 2008 until 2010. (due to the economic turndown that occurred in building and construction during these years).

Employed tradesmen in selected vocational groups

Vocation	Total employed Q4 2010
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Auxiliary workers in building, construction, maintenance, etc.	11,530

- Increase of foreign craft workers and hired-in workers in recent years.
- High proportion of undeclared work for building worker services, especially painters, bricklayers and carpenters in the housing market.
- Lower proportion of undeclared works with higher risks related to incorrect execution.

2. Norwegian goals on renewable energy and energy efficiency in Buildings

- The Norwegian government has adopted an objective of a 30TWh increase in renewable energy production and energy efficiency measures between 2001 and 2016.
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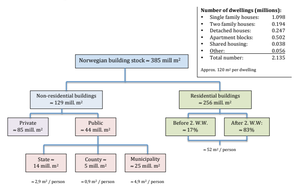
3. Norwegian building stock and energy use in buildings

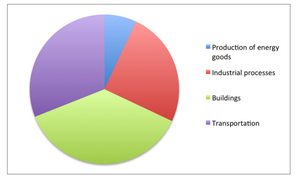
A. Building stock



- The total (gross) built-up area in Norway is estimated to be about 385 million m2.
- 256 million m2 is residential, of which about 3.5 million m2 is public sector. 129 million m2 is non-residential, of which 44 million m2 is public sector.
- The greater part of Norway's buildings is owned by private individuals. About half of the built-up area is wholly owned by private individuals (detached and terraced houses).
- Low demolition and refurbishment rate.

B. Energy use

- The consumption of energy in homes and non-residential buildings in 2009 was 83 TWh.
- This equals 37% of total energy consumption in mainland Norway (222 TWh).



- Energy consumption in buildings was made up of 46 TWh in housing and leisure buildings, 29 TWh in non-residential buildings in the service industries, about 4 TWh in industrial buildings and 4 TWh in non-residential buildings in the primary industries and construction sector.
- Electricity is the dominant form of energy in both households and non-residential buildings. In 2009, electricity represented about 80% of energy consumption in buildings.
- The long-term trend for energy consumption is that fuel for transport and electricity for the energy sector are increasing, while energy consumption in other sectors is levelling off.

4. Need for labour towards 2020

Projections of workforce needs in building and construction.

Scenario	Annual need for new employees 2010-2014	Annual need for new employees 2015-2017	Annual need for new employees 2018-2020	Number employed in 2020
Continued growth	+8,000	+12,000	+9,000	260,000
Stability	+4,000	+4,000	+4,000	197,000
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- Increased need for building and construction workforce towards 2020/2030, including the need for skilled craft workers.
- Important to get the oldest workers to remain in the industry until retirement age while recruiting in the younger age groups.
- High dropout rate among students in upper secondary schools taking building, construction and electrical subjects, compared with many other lines of study.

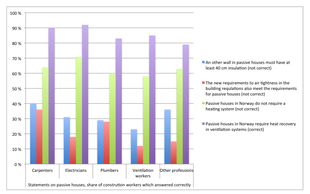
5. Skills and gaps analysis

A. Skills analysis

- There are defined competence goals for what various executing professionals in the building industry must know so as to erect new buildings to passive/near-zero energy levels, renovate existing buildings to a very high energy standard, install renewable heating and cooling systems.
- Work in existing buildings will be more demanding in execution than new building to passive/near-zero energy levels.
- The most important competence goals are connected to the following working operations:
  - Planning risk-reducing measures to avoid damp damage to buildings.
  - Tasks intended to achieve low leakage figures.
  - Tasks connected with insulation and avoiding thermal bridges.
  - Insulating heat generating pipes and components so as not to give off excessive heat.
  - Adjustment of air volumes in ventilation systems and executing ducting systems so as to achieve the lowest possible Specific Fan Power (SFP) factor.
  - Design, execution and adjustment of heating systems.
  - Extending and post-insulating existing structures.

B. Gaps

- Surveys carried out among skilled construction workers tend to indicate that knowledge relevant to passive building is varied and in some cases lacking.
- Compared with normal energy standards, buildings with high ambitions for energy consumption must have particular attention paid to the indoor climate and securing against damp.
- It is important to reduce the risk of high temperatures, ensure that no damp enters the structures, limit air leakage and avoid cold bridges.



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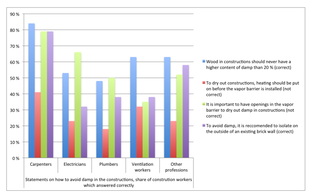
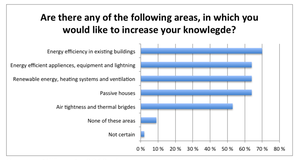


Source: Eidset, I., 2012: Awareness and knowledge of low energy and passive houses. Respons Analyse AS. Poll conducted amongst 600 workers/project managers on construction site.

6. Participation in life-long learning

- According to the Federation of Norwegian Construction Industries, craft workers are the group of employees in the building industry who currently have the poorest opportunities for further education or in-service training.
  - No national system or offer of systematic education or craft or journeyman's certificates.
  - No official approval, accreditation or certification of courses offered or any national goals for content, quality or evaluation.
- Falling participation in both training and further education; Less than half of all those employed now take part in courses or training during the course of a year.
  - Building and construction scores lower for all forms of lifelong learning than a number of other sectors.
- However many tradesmen and skilled workers interested in acquiring more knowledge in the energy field.
- Preferred ways of raising competence are courses organised by building supplies companies and industry organisations, as well as the use of the construction details from SINTEF Building and Infrastructure (national research institute).



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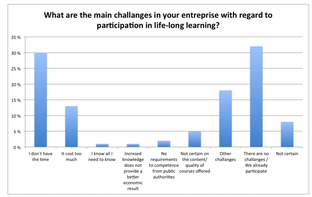
7. Barriers

- Generally low and sometimes zero attention given to energy use and energy related measures.
- A low energy price will tend to maintain that barrier.
- Potential for energy efficiency in buildings depends on whether the owners of buildings and homes consider these measures to be financially beneficial.
- Important for triggering the potential for owners open to renovating or upgrading their buildings. It is therefore important to reach the home owners or owners of non-residential buildings who are preparing for renovation or upgrade activity.
- Lack of competence might prevent energy measures from being taken: Craft workers who come into contact with households must have knowledge to sell up to ambitious renovation at low-energy or passive building level instead of simple renovation.
- Lack of knowledge and competence might also affect the financial, technical and practical conditions that next prevent energy efficiency measures, especially in non-residential buildings.
- Lack of time and high course costs stand out as the most important barriers to tradesmen's participation in courses. Other factors that may be mentioned in previous studies are a lack of motivation and that the courses are mainly found in cities rather than locally.



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8. Conclusions

- Competence among craft workers in the construction industry in passive house building, renovation with ambitious energy goals and installation of renewable heating is a barrier to achieving more rapid energy efficiency and energy remodelling of buildings.
- Surveys that have been carried out show that the present day competence level in the field of energy among craft workers is variable and in some cases lacking altogether.
- Workers in the building and construction industry are less involved in formal further education, continuing education and learning-intensive work than many other industries. It is still positive however that there is a widespread willingness among craft workers in the building and construction industry to acquire more competence in the energy field.
- Lack of time, high costs and centralised courses appear to be the biggest barriers to achieving organised learning among craft workers. The Norwegian building industry is however solid and profitable, with expectations of further growth. This gives opportunities to invest in increasing the competence in the construction workforce and to achieve higher course attendance.
- Worker immigration into the building and construction industry has increased rapidly in recent years and this will continue to be needed in future, given a continued high level of activity. This may require measures to increase knowledge of Norwegian building practice among immigrant workers so as to ensure quality of execution.
- More work also needs to be done on recruitment from the school system, so as to meet the building industry's workforce needs. This involves both getting more students to choose building as their course of study and reducing the numbers dropping out of vocational training.
- Since few seem to spend much time in further education and training in the building industry, it could be a good competence-raising measure to ensure that those who are undertaking education are given knowledge about passive building and energy-efficient building solutions.
- There is currently no system for monitoring the level of knowledge in the building industry or measuring the effect of competence-raising measures. Neither is there any system for achieving systematic continuing education and training for craft workers in the building industry or schemes for ensuring the quality of the courses offered.

BUILD UP SKILLS
ENERGY TRAINING FOR BUILDERS

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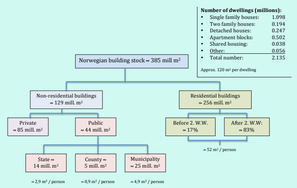

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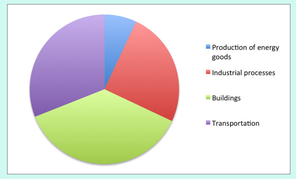

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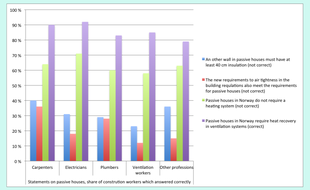

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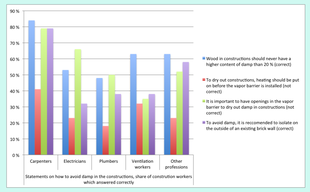

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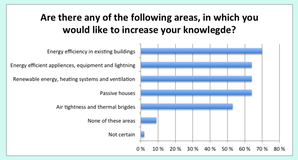

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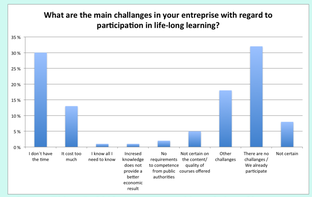

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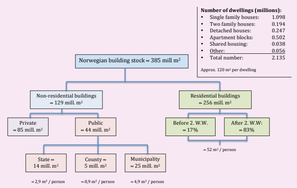

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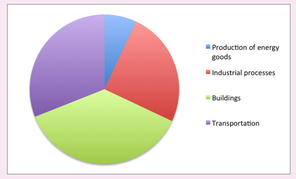

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Projections of workforce needs in building and construction.

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5. Skills and gaps analysis

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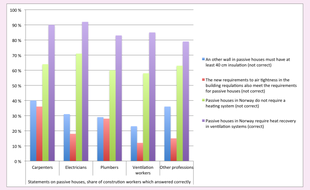

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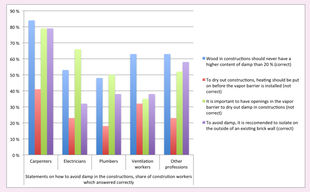

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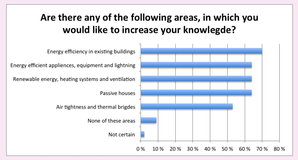

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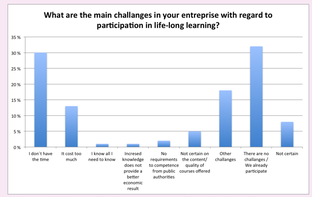

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8. Conclusions

- Competence among craft workers in the construction industry in passive house building, renovation with ambitious energy goals and installation of renewable heating is a barrier to achieving more rapid energy efficiency and energy remodelling of buildings.
- Surveys that have been carried out show that the present day competence level in the field of energy among craft workers is variable and in some cases lacking altogether.
- Workers in the building and construction industry are less involved in formal further education, continuing education and learning-intensive work than many other industries. It is still positive however that there is a widespread willingness among craft workers in the building and construction industry to acquire more competence in the energy field.
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- Worker immigration into the building and construction industry has increased rapidly in recent years and this will continue to be needed in future, given a continued high level of activity. This may require measures to increase knowledge of Norwegian building practice among immigrant workers so as to ensure quality of execution.
- More work also needs to be done on recruitment from the school system, so as to meet the building industry's workforce needs. This involves both getting more students to choose building as their course of study and reducing the numbers dropping out of vocational training.
- Since few seem to spend much time in further education and training in the building industry, it could be a good competence-raising measure to ensure that those who are undertaking education are given knowledge about passive building and energy-efficient building solutions.
- There is currently no system for monitoring the level of knowledge in the building industry or measuring the effect of competence-raising measures. Neither is there any system for achieving systematic continuing education and training for craft workers in the building industry or schemes for ensuring the quality of the courses offered.

BUILD UP SKILLS
ENERGY TRAINING FOR BUILDERS

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Contacts Build Up Skills Norway Mathieu Veulemans (co-ordinator): mathieu.veulemans@dibk.no Guro Hauge (project manager): guro@lep.no

Build Up Skills Norway: Status Quo Analysis 11.05.2012

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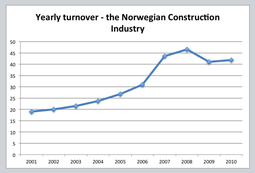

- The construction industry in Norway is perceived as a relatively attractive and solid industry with regard to criteria such as pay, operating margins and return on investment.
- Turnover in building and construction has more than doubled over the last 10 years.
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B. Structure

- Around 190,000 employees in 2011, distributed around approximately 50,000 companies.
- High percentage of small and medium sized companies. 90% of the companies have fewer than 10 employees, while 96% have fewer than 20 employees.
- Craft workers represented less than 60% of the total employed in the building and construction industry. The number of tradesmen employed went down by about 20,000 from 2008 until 2010. (due to the economic turndown that occurred in building and construction during these years).

Employed tradesmen in selected vocational groups

Vocation	Total employed Q4 2010
Bricklayers etc.	6,370
Concrete/foundation workers, building	3,340
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- The Norwegian government has adopted an objective of a 30TWh increase in renewable energy production and energy efficiency measures between 2001 and 2016.
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Example: Energy consumption at different ambition levels for buildings.

Ambition level	Non-residential building	Residential building
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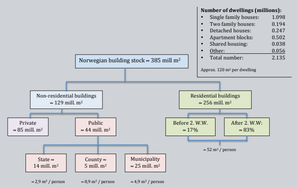

- The total (gross) built-up area in Norway is estimated to be about 385 million m2.
- 256 million m2 is residential, of which about 3.5 million m2 is public sector. 129 million m2 is non-residential, of which 44 million m2 is public sector.
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- The consumption of energy in homes and non-residential buildings in 2009 was 83 TWh.
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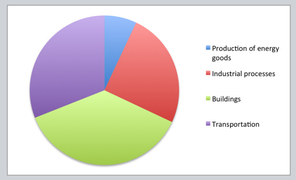

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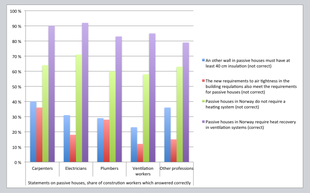

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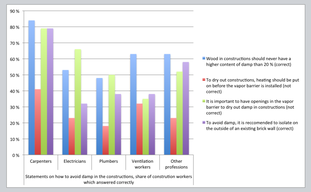

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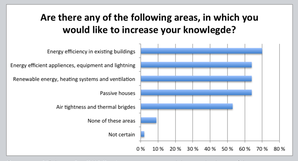

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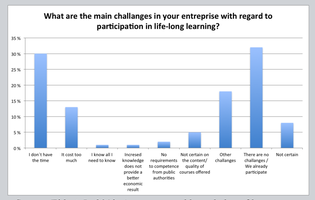

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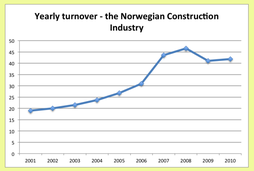

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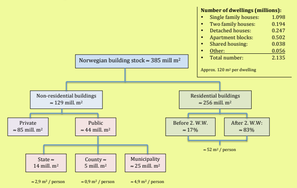

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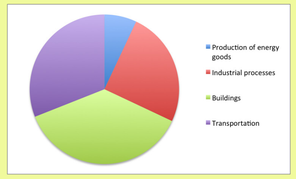

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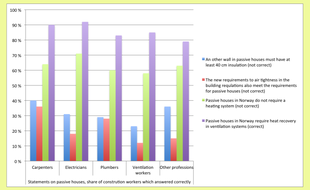

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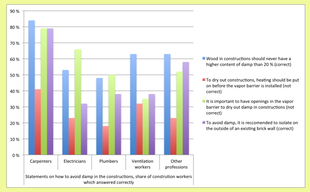

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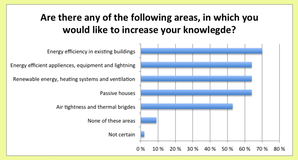

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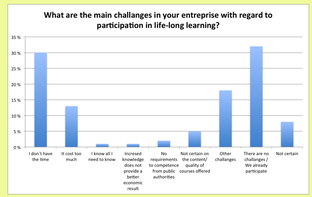

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- Surveys that have been carried out show that the present day competence level in the field of energy among craft workers is variable and in some cases lacking altogether.
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- Lack of time, high costs and centralised courses appear to be the biggest barriers to achieving organised learning among craft workers. The Norwegian building industry is however solid and profitable, with expectations of further growth. This gives opportunities to invest in increasing the competence in the construction workforce and to achieve higher course attendance.
- Worker immigration into the building and construction industry has increased rapidly in recent years and this will continue to be needed in future, given a continued high level of activity. This may require measures to increase knowledge of Norwegian building practice among immigrant workers so as to ensure quality of execution.
- More work also needs to be done on recruitment from the school system, so as to meet the building industry's workforce needs. This involves both getting more students to choose building as their course of study and reducing the numbers dropping out of vocational training.
- Since few seem to spend much time in further education and training in the building industry, it could be a good competence-raising measure to ensure that those who are undertaking education are given knowledge about passive building and energy-efficient building solutions.
- There is currently no system for monitoring the level of knowledge in the building industry or measuring the effect of competence-raising measures. Neither is there any system for achieving systematic continuing education and training for craft workers in the building industry or schemes for ensuring the quality of the courses offered.

BUILD UP SKILLS
ENERGY TRAINING FOR BUILDERS

Supported by INTELLIGENT ENERGY EUROPE

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Build Up Skills Norway: Status Quo Analysis 11.05.2012

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- Vulnerable to economic conjunctures.

B. Structure

- Around 190,000 employees in 2011, distributed around approximately 50,000 companies.
- High percentage of small and medium sized companies. 90% of the companies have fewer than 10 employees, while 96% have fewer than 20 employees.
- Craft workers represented less than 60% of the total employed in the building and construction industry. The number of tradesmen employed went down by about 20,000 from 2008 until 2010. (due to the economic turndown that occurred in building and construction during these years).

Employed tradesmen in selected vocational groups

Vocation	Total employed Q4 2010
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- High proportion of undeclared work for building worker services, especially painters, bricklayers and carpenters in the housing market.
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- The Norwegian government has adopted an objective of a 30TWh increase in renewable energy production and energy efficiency measures between 2001 and 2016.
- The government will also introduce the passive building level as the building standard in 2015, near zero energy level as the building standard in 2020 and component requirements for existing buildings.
- It has been estimated that it is possible to save 10 TWh by energy efficiency measures in buildings by 2020 and to achieve a halving of energy consumption in buildings by 2040

Example: Energy consumption at different ambition levels for buildings.

Ambition level	Non-residential building	Residential building
Average existing buildings	283 kWh/m2	201 kWh/m2
Estimated energy consumption after conventional renovation	215 kWh/m2	160 kWh/m2
Present regulatory level (TEK 10)	150 kWh/m2	120 kWh/m2
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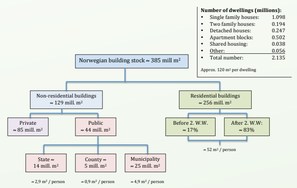
3. Norwegian building stock and energy use in buildings

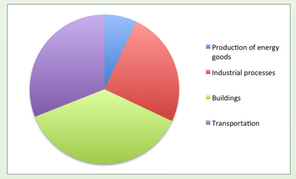
A. Building stock



- The total (gross) built-up area in Norway is estimated to be about 385 million m2.
- 256 million m2 is residential, of which about 3.5 million m2 is public sector. 129 million m2 is non-residential, of which 44 million m2 is public sector.
- The greater part of Norway's buildings is owned by private individuals. About half of the built-up area is wholly owned by private individuals (detached and terraced houses).
- Low demolition and refurbishment rate.

B. Energy use

- The consumption of energy in homes and non-residential buildings in 2009 was 83 TWh.
- This equals 37% of total energy consumption in mainland Norway (222 TWh).



- Energy consumption in buildings was made up of 46 TWh in housing and leisure buildings, 29 TWh in non-residential buildings in the service industries, about 4 TWh in industrial buildings and 4 TWh in non-residential buildings in the primary industries and construction sector.
- Electricity is the dominant form of energy in both households and non-residential buildings. In 2009, electricity represented about 80% of energy consumption in buildings.
- The long-term trend for energy consumption is that fuel for transport and electricity for the energy sector are increasing, while energy consumption in other sectors is levelling off.

4. Need for labour towards 2020

Projections of workforce needs in building and construction.

Scenario	Annual need for new employees 2010-2014	Annual need for new employees 2015-2017	Annual need for new employees 2018-2020	Number employed in 2020
Continued growth	+8,000	+12,000	+9,000	260,000
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- Increased need for building and construction workforce towards 2020/2030, including the need for skilled craft workers.
- Important to get the oldest workers to remain in the industry until retirement age while recruiting in the younger age groups.
- High dropout rate among students in upper secondary schools taking building, construction and electrical subjects, compared with many other lines of study.

5. Skills and gaps analysis

A. Skills analysis

- There are defined competence goals for what various executing professionals in the building industry must know so as to erect new buildings to passive/near-zero energy levels, renovate existing buildings to a very high energy standard, install renewable heating and cooling systems.
- Work in existing buildings will be more demanding in execution than new building to passive/near-zero energy levels.
- The most important competence goals are connected to the following working operations:
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- Surveys carried out among skilled construction workers tend to indicate that knowledge relevant to passive building is varied and in some cases lacking.
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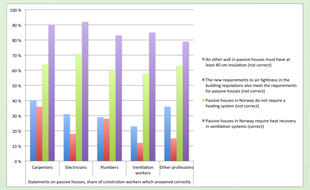

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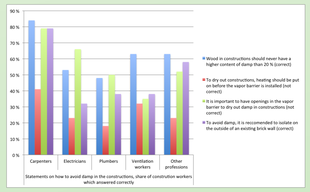

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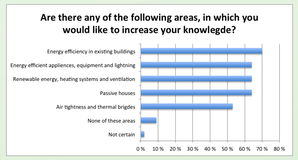

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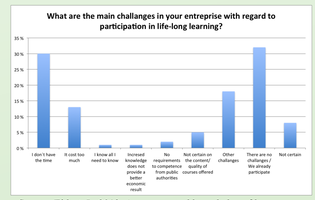

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ENERGY TRAINING FOR BUILDERS

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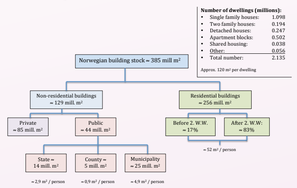

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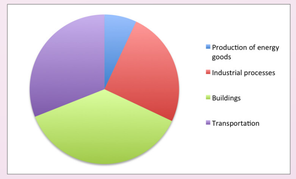

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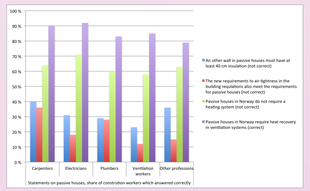

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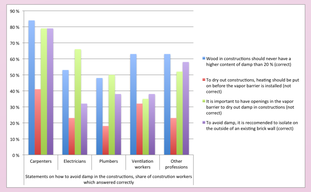

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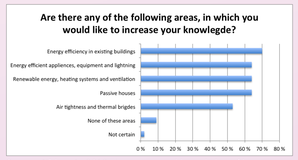

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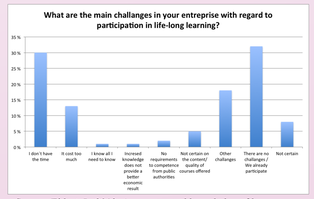

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- Worker immigration into the building and construction industry has increased rapidly in recent years and this will continue to be needed in future, given a continued high level of activity. This may require measures to increase knowledge of Norwegian building practice among immigrant workers so as to ensure quality of execution.
- More work also needs to be done on recruitment from the school system, so as to meet the building industry's workforce needs. This involves both getting more students to choose building as their course of study and reducing the numbers dropping out of vocational training.
- Since few seem to spend much time in further education and training in the building industry, it could be a good competence-raising measure to ensure that those who are undertaking education are given knowledge about passive building and energy-efficient building solutions.
- There is currently no system for monitoring the level of knowledge in the building industry or measuring the effect of competence-raising measures. Neither is there any system for achieving systematic continuing education and training for craft workers in the building industry or schemes for ensuring the quality of the courses offered.

BUILD UP SKILLS
ENERGY TRAINING FOR BUILDERS

Supported by INTELLIGENT ENERGY EUROPE

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Build Up Skills Norway: Status Quo Analysis 11.05.2012

1. The Norwegian Construction Industry

A. Turnover

- The construction industry in Norway is perceived as a relatively attractive and solid industry with regard to criteria such as pay, operating margins and return on investment.
- Turnover in building and construction has more than doubled over the last 10 years.
- Vulnerable to economic conjunctures.

B. Structure

- Around 190,000 employees in 2011, distributed around approximately 50,000 companies.
- High percentage of small and medium sized companies. 90% of the companies have fewer than 10 employees, while 96% have fewer than 20 employees.
- Craft workers represented less than 60% of the total employed in the building and construction industry. The number of tradesmen employed went down by about 20,000 from 2008 until 2010. (due to the economic turndown that occurred in building and construction during these years).

Employed tradesmen in selected vocational groups

Vocation	Total employed Q4 2010
Bricklayers etc.	6,370
Concrete/foundation workers, building	3,340
Carpenters/joiners	56,850
Roofers	1,170
Insulators	1,300
Glass workers	1,460
Plumbers and HVAC fitters	16,660
Tinsmiths	3,590
Electricians and similar	32,670
Auxiliary workers in building, construction, maintenance, etc.	11,530

- Increase of foreign craft workers and hired-in workers in recent years.
- High proportion of undeclared work for building worker services, especially painters, bricklayers and carpenters in the housing market.
- Lower proportion of undeclared works with higher risks related to incorrect execution.

2. Norwegian goals on renewable energy and energy efficiency in Buildings

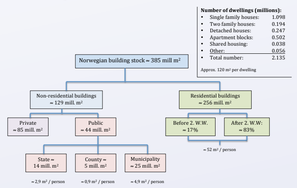
- The Norwegian government has adopted an objective of a 30TWh increase in renewable energy production and energy efficiency measures between 2001 and 2016.
- The government will also introduce the passive building level as the building standard in 2015, near zero energy level as the building standard in 2020 and component requirements for existing buildings.
- It has been estimated that it is possible to save 10 TWh by energy efficiency measures in buildings by 2020 and to achieve a halving of energy consumption in buildings by 2040

Example: Energy consumption at different ambition levels for buildings.

Ambition level	Non-residential building	Residential building
Average existing buildings	283 kWh/m2	201 kWh/m2
Estimated energy consumption after conventional renovation	215 kWh/m2	160 kWh/m2
Present regulatory level (TEK 10)	150 kWh/m2	120 kWh/m2
Low-energy level (according to NS 3700 and NS 3701)	115 kWh/m2	95 kWh/m2
Passive building level (according to NS 3700 and NS 3701)	80 kWh/m2	70 kWh/m2
Near zero energy level	60 kWh/m2	55 kWh/m2

3. Norwegian building stock and energy use in buildings

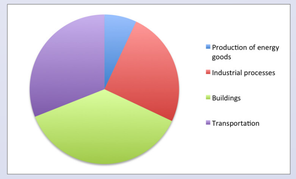
A. Building stock



- The total (gross) built-up area in Norway is estimated to be about 385 million m2.
- 256 million m2 is residential, of which about 3.5 million m2 is public sector. 129 million m2 is non-residential, of which 44 million m2 is public sector.
- The greater part of Norway's buildings is owned by private individuals. About half of the built-up area is wholly owned by private individuals (detached and terraced houses).
- Low demolition and refurbishment rate.

B. Energy use

- The consumption of energy in homes and non-residential buildings in 2009 was 83 TWh.
- This equals 37% of total energy consumption in mainland Norway (222 TWh).



- Energy consumption in buildings was made up of 46 TWh in housing and leisure buildings, 29 TWh in non-residential buildings in the service industries, about 4 TWh in industrial buildings and 4 TWh in non-residential buildings in the primary industries and construction sector.
- Electricity is the dominant form of energy in both households and non-residential buildings. In 2009, electricity represented about 80% of energy consumption in buildings.
- The long-term trend for energy consumption is that fuel for transport and electricity for the energy sector are increasing, while energy consumption in other sectors is levelling off.

4. Need for labour towards 2020

Projections of workforce needs in building and construction.

Scenario	Annual need for new employees 2010-2014	Annual need for new employees 2015-2017	Annual need for new employees 2018-2020	Number employed in 2020
Continued growth	+8,000	+12,000	+9,000	260,000
Stability	+4,000	+4,000	+4,000	197,000
Decline	+1,200	- 5,000 / -6,000	+1,500	145,000

- Increased need for building and construction workforce towards 2020/2030, including the need for skilled craft workers.
- Important to get the oldest workers to remain in the industry until retirement age while recruiting in the younger age groups.
- High dropout rate among students in upper secondary schools taking building, construction and electrical subjects, compared with many other lines of study.

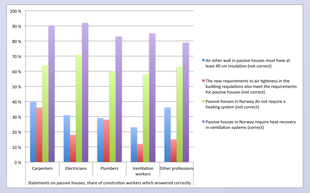
5. Skills and gaps analysis

A. Skills analysis

- There are defined competence goals for what various executing professionals in the building industry must know so as to erect new buildings to passive/near-zero energy levels, renovate existing buildings to a very high energy standard, install renewable heating and cooling systems.
- Work in existing buildings will be more demanding in execution than new building to passive/near-zero energy levels.
- The most important competence goals are connected to the following working operations:
  - Planning risk-reducing measures to avoid damp damage to buildings.
  - Tasks intended to achieve low leakage figures.
  - Tasks connected with insulation and avoiding thermal bridges.
  - Insulating heat generating pipes and components so as not to give off excessive heat.
  - Adjustment of air volumes in ventilation systems and executing ducting systems so as to achieve the lowest possible Specific Fan Power (SFP) factor.
  - Design, execution and adjustment of heating systems.
  - Extending and post-insulating existing structures.

B. Gaps

- Surveys carried out among skilled construction workers tend to indicate that knowledge relevant to passive building is varied and in some cases lacking.
- Compared with normal energy standards, buildings with high ambitions for energy consumption must have particular attention paid to the indoor climate and securing against damp.
- It is important to reduce the risk of high temperatures, ensure that no damp enters the structures, limit air leakage and avoid cold bridges.



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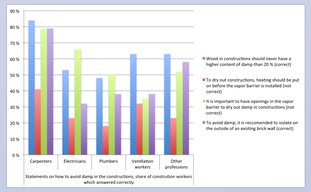
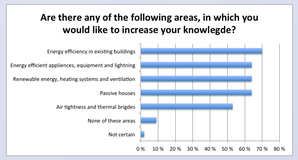


Source: Eidset, I., 2012: Awareness and knowledge of low energy and passive houses. Respons Analyse AS. Poll conducted amongst 600 workers/project managers on construction site.

6. Participation in life-long learning

- According to the Federation of Norwegian Construction Industries, craft workers are the group of employees in the building industry who currently have the poorest opportunities for further education or in-service training.
  - No national system or offer of systematic education or craft or journeyman's certificates.
  - No official approval, accreditation or certification of courses offered or any national goals for content, quality or evaluation.
- Falling participation in both training and further education; Less than half of all those employed now take part in courses or training during the course of a year.
  - Building and construction scores lower for all forms of lifelong learning than a number of other sectors.
- However many tradesmen and skilled workers interested in acquiring more knowledge in the energy field.
- Preferred ways of raising competence are courses organised by building supplies companies and industry organisations, as well as the use of the construction details from SINTEF Building and Infrastructure (national research institute).



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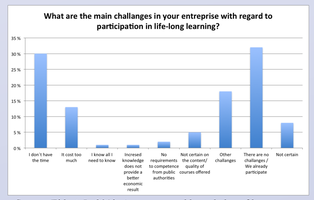

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7. Barriers

- Generally low and sometimes zero attention given to energy use and energy related measures.
- A low energy price will tend to maintain that barrier.
- Potential for energy efficiency in buildings depends on whether the owners of buildings and homes consider these measures to be financially beneficial.
- Important for triggering the potential for owners open to renovating or upgrading their buildings. It is therefore important to reach the home owners or owners of non-residential buildings who are preparing for renovation or upgrade activity.
- Lack of competence might prevent energy measures from being taken: Craft workers who come into contact with households must have knowledge to sell up to ambitious renovation at low-energy or passive building level instead of simple renovation.
- Lack of knowledge and competence might also affect the financial, technical and practical conditions that next prevent energy efficiency measures, especially in non-residential buildings.
- Lack of time and high course costs stand out as the most important barriers to tradesmen's participation in courses. Other factors that may be mentioned in previous studies are a lack of motivation and that the courses are mainly found in cities rather than locally.

8. Conclusions

- Competence among craft workers in the construction industry in passive house building, renovation with ambitious energy goals and installation of renewable heating is a barrier to achieving more rapid energy efficiency and energy remodelling of buildings.
- Surveys that have been carried out show that the present day competence level in the field of energy among craft workers is variable and in some cases lacking altogether.
- Workers in the building and construction industry are less involved in formal further education, continuing education and learning-intensive work than many other industries. It is still positive however that there is a widespread willingness among craft workers in the building and construction industry to acquire more competence in the energy field.
- Lack of time, high costs and centralised courses appear to be the biggest barriers to achieving organised learning among craft workers. The Norwegian building industry is however solid and profitable, with expectations of further growth. This gives opportunities to invest in increasing the competence in the construction workforce and to achieve higher course attendance.
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