

NORDICBUILT PROJECT

MARKET STUDY SUMMARY

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AGENDA

1. Prewords
2. Advantages & Disadvantages
3. Nordic. Built Concept
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5. Similarities & Differences
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1. PREWORDS

The term "prefabricated house" is clearly used with several different meanings in media and internet to describe a building method of houses.

In some cases it is referring to house which is build from elements prefabricated in factory, but installed on site and it is still customizable by customer in size and measures.

In some cases it is referring to house which is built in factory from building blocks like Lego and then many cases uses "container" type construction either from metal containers or wood framed ones. In this case the customizable refers to possibility to add different amount of blocks to building.

It is clearly seen that during 2016 onwards interest towards pre-fabricated house technology has been growing and local small medium players are entering the arena.

2. ADVANTAGES & DISADVANTAGES

ADVANTAGES: Prefabricated housing, sometimes referred to as modular housing, is a type of home construction in which sections of the home are manufactured in a factory and transported to the building site for assembly. The main advantage of the prefab manufacturing process is that homes can typically be constructed more quickly than a traditional home. They are environmental friendly. Off-site manufacturing processes can be optimized to reduce the amount of waste generated during fabrication and designed with energy efficiency in mind. If we add customization into prefabrication project it can then also offer individuality in design, level of features and BIM system. Also with current concepts and technology prefabrication can offer passive houses and Zero energy houses.

DISADVANTAGES: In some cases building a prefab home requires you to pay the manufacturer while the construction process is under way, with payment in full due before the home is completed. There is always the possibility of damage while in transit. Depending on how far the modules must travel, your transportation costs could also be relatively high. Precision assembly of the home is also necessary, as improper assembly can result in issues such as joint failure and leaks. Although modern prefabricated houses feature rugged, well-done constructions, with good quality of building materials, many people still perceive them as inferior, low-income housing. This could make it more difficult to sell the house when the time comes. The industry also has its share of disreputable manufacturers, which adds to the negative image. Design limitations, although every type of construction has limits on what designs are feasible to construct, certain designs may stretch the limits of the prefab components chosen for a project.

3. NORDICBUILT CONCEPT

In NordicBuilt concept the principle idea is to create a platform software, that can be used to design prefabricated houses which can be individually designed and still be constructed in a standardized way (mass customization).

Mass customization is the key principle including configuration & modularization to create the flexible production process. Modularization ensures customers possibility to add different technical solutions to buildings without jeopardizing mass productivity.

The purpose of this Nordic built project is to develop configurable Nordic homes with high export potential for Nordic market and Germany + China market together with participating Nordic companies.

4. CONCLUSION

- The potential for NordicBuilt concept platform design to fulfill passive house / Zero energy-house specification including documentation of it, is huge.
- This new platform thinking in house design for mass customizing and production is the key to ensure individual selection possibilities and in the other side mass productability to ensure economics of scale.
- The biggest market size and moneywise is Germany where (as in Denmark) the political environment is very much bias towards these kinds of ecological building over the whole lifetime of a building including also tear down / demolition including recycling of materials afterwards.
- Finland in the other end is the most virgin market where quick gains could be achieved.
- As for the convenience for the end user of the house, the BIM or intelligent management system of the whole house becomes very important. If the usability is difficult and hard, it will be a big negative impact for end user and for the utilization of all the possibilities of the house in energy saving!
- In software platform it is very important that all technical solutions are available for customers to choose eg different facades, heating systems, air purification & cooling, materials and the different levels of intelligent building management technology yet mass produced.
- There is a market for this concept in all markets and thereby good export opportunities.

5. SIMILARITIES AND DIFFERENCIES

SIMILARITIES:

Building Permits has been increasing from 2014 onwards in all Nordic countries. From that also the whole construction Industry has grown steadily and the output of whole construction industry has grown. For peoples purchase power the household Debt has been decreasing.

DIFFERENCIES:

Amount of prefabricated houses in Denmark and Norway is clearly bigger than Sweden or Finland. Home ownership rate have been increased in Denmark and Norway but decreased in Finland and Sweden. Amount of single house homes are biggest in Norway compared to the other Nordic countries. Big Construction players not present in prefabricated home industry in Finland, Sweden and Norway, but in Denmark many very strong local players are presented.

From a design point of view, there are differences between North and South part in Nordic countries. Some example pictures here. South has similarities to UK.

Pic 1 and 2. Examples of North houses.





Pic 3, 4 and 5. Examples of South houses.



6. SCANDINAVIAN DESIGN

The Nordic home in Scandinavian location meaning the climate is giving quite extreme conditions for buildings; nearly 24 hours of light, nearly 24 hours of dark, the temperature variation from -40 to +40, snow and sun with these extremes. Scandinavian architects has been making a concerted effort to design houses that make living a little easier. They recognize the importance of light, nature and comfort and design houses to be functional and modern, yet traditional and simple. Some key design principles are illustrated below:

- *Integration with nature: The house incorporates nature into its structure by using finished wood on the exterior of the home, and natural materials throughout the interior
- *The subtle beauty of Scandinavian architecture and design is in its simplicity.
- *Natural light: Large full length windows+ white and lightly colored interiors
- *Timber and other natural materials are used
- *Functional and comfortable

7. COUNTRY SPECIFIC COMMENTS WITH SOME EXAMPLE PICTURES

Estonia is the no 1 exporter of wooden prefabricated houses in Europe with an annual sales volume of over 200 m€. Nearly 90% of the total production is sold outside Estonia. The main target markets being Scandinavia, Germany, and the UK, with partners reaching as far as Japan, South Africa and South Korea.

A recent study on the global uptake of prefabricated housing has found that Sweden is a world leader in terms of number of prefabricated houses constructed. About 84% of detached houses in Sweden use prefabricated timber elements, while in developed economies such as the US, Australia and the UK, no more than 5% of permanent housing have any significant prefabrication. Countries in mainland Europe such as Germany and the Netherlands are pursuing the prefabricated technique more seriously. “Middle European countries have fallen behind because they have lacked the demand drivers of leading countries, including extreme weather, earthquakes or environmental activism”

Japan is another world leader. Up to 15% of new detached/semi-detached houses are prefabricated. In a submission to GCR Steinhardt and Manley report that “many prefabricated home builders in Japan are very large and operate advanced manufacturing facilities, with the largest producing more than 10 thousands houses annually”. Japan is pushing its housing industry towards “mass customization”.

Average per square meter prices in € of 120-sq. m. apartments located in the center of the most important city of each country

Country	House price €/m ²
Finland	6609
Sweden	6991
Norway	3540
Denmark	4279
Germany	4991

<https://www.globalpropertyguide.com/Europe>

FINLAND

In Finland the container/prefabricated houses came summer 2013 to Tuusula at House building exhibition (close to Helsinki). Still in spring 2016 there are no breakthrough of commercial container / prefabricated houses. Some of the reasons are conservative construction sector and restrictive permits The Finnish market segment is in it’s infancy. Some temporary container houses has been

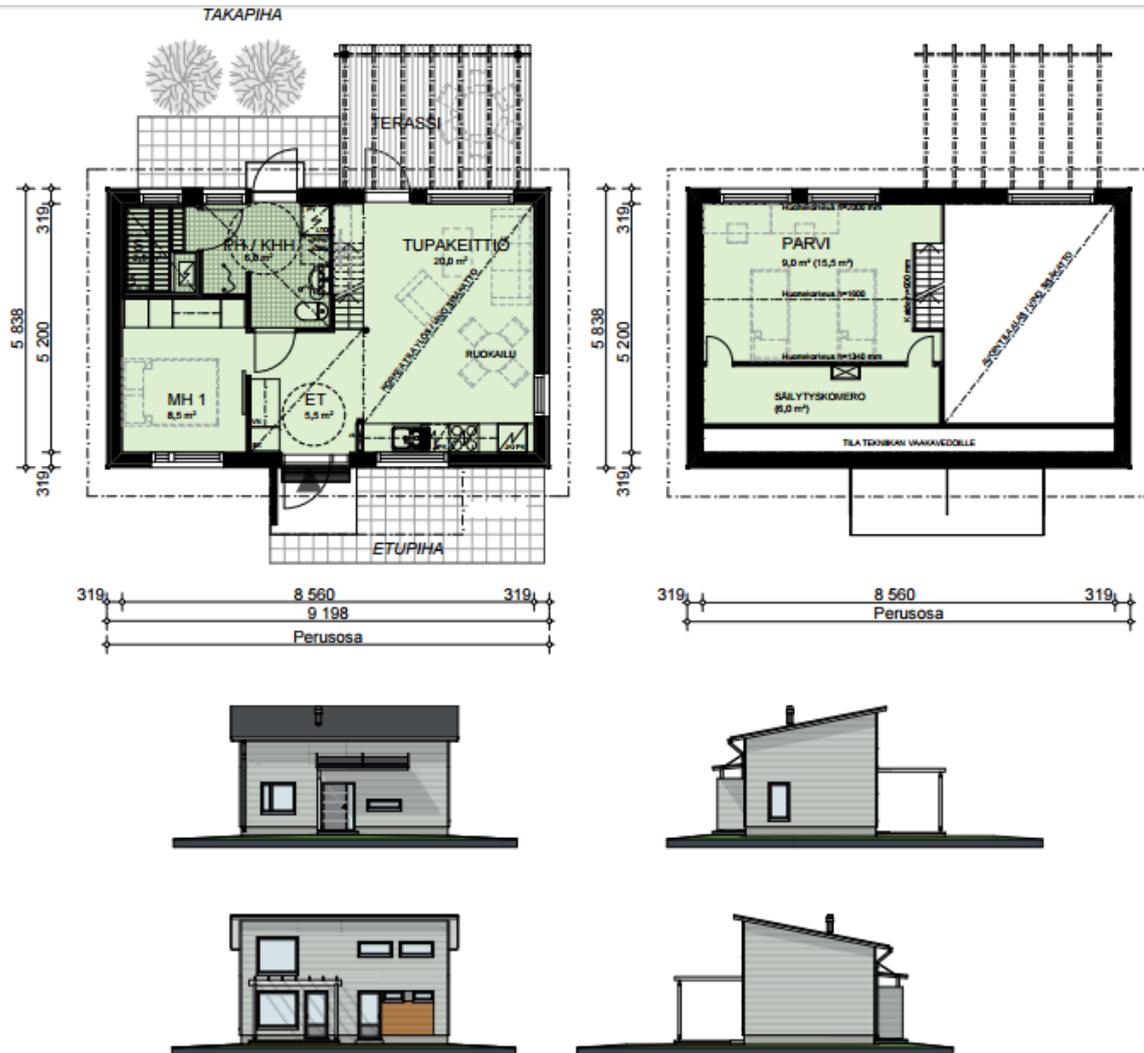
used in Olkiluoto 3 Nuclear power plant as offices / temporary houses and now used as temporary houses for refugees in Pori area, but only for a couple of weeks. There are 2 small local players: Teijo Talot and Duo Koti. Duo Koti is only a one family personal "green " project, but Teijo Talot is an operative company working with wide offerings.

No big construction companies are at the moment in prefabricated house business. But Skanska plan to deliver prefab homes in 2017. There are several local manufacturers of wooden frame buildings, villa's and townhouses, but those are more carpenter houses than prefabricated house and more based on timber / log wood. There are only some Baltic companies (Tivo Houses, Timber & Modular Houses, Qhaus) and they are small local companies in prefabrication business.

This could mean that there could be a huge possibility for a Nordic company offering Nordic homes with Nordic specifications, interior & outside design and quality.

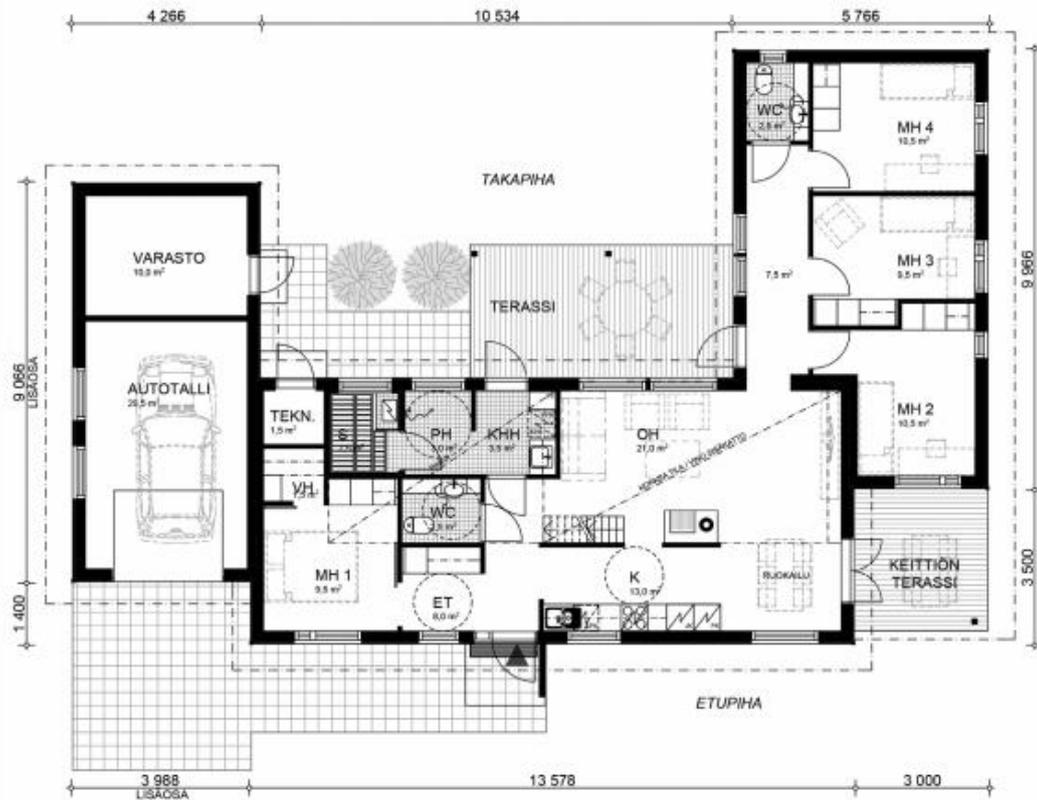
Teijo Talot has finalized their project of creating a prefabricated house during 1st half 2016. Their concept is to bring to building site a prefabricated house and also to remove it and take it back. As a business model, they offer leasing or pure time rental, like 10 years. There are also an option to purchase the house. Their main target customers have been schools, kindergarten, mainly municipalities and city authorities renting the facilities. But now they have extended this business model to cover all kinds of houses including the residential houses. .

Pic 6. Teijo Talot design and examples



By having extended this way of working to all villa's, town houses the process goes like this: After order, fabrication starts at factory and simultaneously in building site making base. When house is pre-built in factory it is transported to site. Typically they transport 1-4 modules at once. Transportation during evening/ night, so module installation starts in the morning. Installation of one module takes 1-2 hours after which water, electricity, plumbing, sewerage and other community utilities can be installed. Depending on amount of modules the final assembly can take a couple of days.

Pic 7. Teijo Talot design and examples 2



The same process is for offices and industrial use buildings for rent. During summer 2016 they have build 1st demo house in Qingdao China. They have started co-operation with EA House Oy for sales development of the concept. -> TeijoCon is the company formed for concept selling.

Skoha Oy is a young, innovative and privately owned company with special know how in developing concepts and products for transferable housing, business facilities and Health Care units. They make town houses smaller than 50 m2 and modular blocks which can be installed on roof of multi storey apartment buildings.

Pic 8. Unelmatalot 49 m2 . Skoha modular house and roof top module

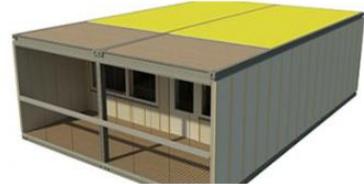
PALVELUT - SERVICES



Unelmatalo pientalot



Skoha Luhtitalo



Skoha kattomoduulit

Unelmatalot has been targeting senior citizen with their small town house of 49 m2. Their idea is to build a small community of 20-50 small houses and in the center a service center for seniors.

Pic 9. Unelmatalot 49 m2



Boklok is a latest, new concept to build reasonable cost efficient city housing in small scale. BoKlok is a groundbreaking housing concept, developed by IKEA and Skanska. Together they build blocks of flats and terraced houses for people who wants to live in a home of their own, but still have money left at the end of the month. The first building site has been started in 2017 in Siltamäki in Helsinki area. The planned apartment for 2 rooms is 44,5 m2 size. There will be the

following number of apartments: 4 pcs of 2 storey small apartment buildings, 10 pcs of 2 rooms, 10 pcs of 3 rooms and 6 pcs of 4 room apartments. In total 26 apartments. No sauna to apartments but a common sauna for all the houses will be built outdoors. Every apartment has same technical level and installations which ensures the low price level. Ikea is the supplier of kitchens etc pre-installed furnitures. In Vantaa there are 2 separate building projects which are ready to start.

Pic 10. BoKlok concepts



In Espoo and in Kerava projects has just started and in Helsinki 1 more project is under planning. They have already build in Sweden and Norway in many locations. Sold as IKEA.

There are also JukkaTalot and Kastelli manufacturing town houses in similar sizes but they are not ready made in factory, but comes to site as wall that needs to be mounted onsite.

Pic 11. Jukka Talot modular houses and layout



SWEDEN

Building houses – even high ones – in wood is one way of enabling dwellings that strike a better balance with the environment and the climate. The new building methods mean that most of the construction process takes place indoors in factories. Timber frame construction is proving to be cheaper and faster to build than equivalent buildings in concrete or steel. The time saving may be up to 80 percent and the cost benefits are substantial. Prefabricated wooden house industry comprises 520 companies with 4,300 employees, but most of these are not using container type of base but are similar as in Finland. Total exports of prefabricated wooden houses declined by 14 % and amounted to SEK 441 million SEK in the first half of 2014 compared to 2013 while imports increased by 11 %. Swedish exports were mainly to Norway, Japan, Finland, Germany and Denmark. Swedish imports were mainly from Estonia, Norway and Finland. No big construction companies is at the moment in prefabricated house business in Sweden. There are several local manufacturers of wood framed buildings, like villa's and townhouses, but those are more carpenter houses than prefabricated container based.

BoKlok is a groundbreaking housing concept, developed by IKEA and Skanska. Already in 1997 the first four BoKlok developments were completed. Together we build blocks of flats and terraced houses for people who want to live in a home of their own, but still have money left at the end of the month. Every apartment has same technical level and installations which ensures the low price level. Ikea is the supplier of kitchens etc pre-installed furnitures. They have already build in Sweden in many locations for example Älmhult a classic multi family house, Möckeln a Terraced house 108 m² and their Flex block of flats is great when there is a need for more flats than their classic block of flats can provide. The sizes of the flats can be combined to suit the need of a specific region, and the buildings can be up to four floors . Borlange town houses for 2 families. Total 8 buildings for 16 families. Hammarö Multi family houses in 2-storey. 3 buildings for 18 families and 3 buildings for 4 families. Similar projects in Göteborg, Uddevalla, Mölndal, Älvängen, Alingsås, Ystad, Visby and more than 20 other locations. Sold as IKEA.



Pic 12, 13. BoKlok examples from Sweden

There are some Baltic companies offering container based, either metal or wood frames. So this means that there could be a huge possibility for a Nordic company offering this with Nordic specification, interior & outside design and quality.

NORWAY

Most of the people live in detached one-family house or farm house. Smaller homes – larger holiday homes / cabins. Housing sizes were subsequently reduced due to the increasing proportion of apartment blocks. At the same time, the size of new holiday homes (persons of family's 2nd house, typically outside cities) has increased considerably. There were 452 000 holiday homes in Norway in 2016. Most of these were situated in Oppland (48 900) and Buskerud (45 300).

Biggest construction companies of residential and non-residential buildings are not participating in this prefabricated modular container building business, but there are companies making prefabricated houses from timber/ log wood. Duplo Element is an interesting company. Real Lego-like production modules. Can be used for villa's or townhouses. Nordhus SA (head office and factory in Poland) specialises in prefabricated timber frame houses technology, particularly the modular system. The factory produces fully "turnkey" finished spatial modules. The modules measuring approximately 16m length, 4.2m width and 3.2-3.5 m height. Modules, after "Lego brick method" assembly in few days. Timber & Modular Houses Ltd is from Latvia. UAB "Nordvila" prefab buildings in Norway and Lithuania. So out of those only Duplo is real local company, others foreign companies delivering prefab houses to Norway. BoKlok is a groundbreaking housing concept, developed by IKEA and Skanska also available in Norway. Multi family house in 2-storey was sold out in first exhibition on 11th Dec 2016 in Averstadhagen in Kløfta. It was 4 buildings consisting of 27 apartments. Leikvang was Multi family house in 2-storey consisting of 6 buildings for 16 families. Teietunet area was Multi family house in 2-storeys in Nannestad city Gjerdrum commune consisting of 7 buildings with 40 houses.



BoKlok is a collaboration between Skanska and IKEA.

Pic 14, 15, 16. BoKlok examples from Norway





So this mean, that there could be a huge possibility for a Nordic company offering home with Nordic specifications, interior & outside design and quality specially in holiday home side.

DENMARK

Local Danish companies like BM Byggeindustri are much more advanced in the prefabricated house business and development than in Finland for example. In Finland prefabricated house is considered container based / size / style only, not like BM Byggeindustri, that has made them in various looks and sizes even as block of flats apartments. This versatility is the big value proposition bringing it out from "container, cheap legacy" image. Planet huse also builds prefabricated houses but mostly for leisure time, summer cottages and out of log or wood. Nordic home is now demonstrating "Living in Light Box" in Copenhagen where the house has smart house concept by Visility and it's CO2 neutral house.

Biggest construction companies of residential and non-residential buildings are MT Højgaard, NCC Construction, Enemaerke & Petersen, Hoffmann, Enggaard, Zublin. Only MT Højgaard with Scandibyg is participating in this prefab modular container building business, but there are companies making prefab houses from wood. Foreign companies are on the market, like Houses4you.net. They offer various kinds of prefabricated houses in different styles and sizes. Huf

Haus Gmbh is the manufacturer in most of their offering. Qhaus is a company from Estonia, which exports most of it's products to other Nordic countries. Qhaus is a manufacture of prefabricated wooden structures, in particular timber-frame element houses. Modular Houses Ltd is manufacturer of prefabricated houses.

Pic 17, 18, 19. Living in the light box by Nordic Built.



Nordic home is now demonstrating "Living in Light Box" in Copenhagen



BM byggeindustri is one of the biggest prefab manufacturer for the Danish market. A Nordic home will have great market potential in Denmark, using configurable BIM tool box for mass customization of the Nordic home to project specific needs.

GERMANY

Most German houses are built in concrete and bricks. 18% of all detached houses in Germany were built with a timber-frame construction, so wooden houses are still an exception to the rule, but the use of wood as a construction material has increased during recent years. Smart home solutions is popular and help give users a general idea of energy consumption and control of indoor climate. The shortage of about 100,000 apartment units in major cities like Munich, Hamburg, Cologne and Hannover and the increasing redevelopment of buildings to improve energy efficiency gives a big market potential for Nordic homes.

WOLF system is a manufacturer of prefabricated houses, but those are based on wooden elements, not wooden frame container type. They are mostly making industrial and agricultural buildings.

Pic 20. WOLF system from Germany



Hanlo, Beaver houses Germany, Xyclotec, Hartl Haus, Living Haus, HUF haus, Badenland are also a manufacture of prefabricated houses like Wolf. OCB-team, Polar Blockhausbau makes prefabricated houses from log wood. LHVH Architekten is a local company making "container type" prefabricated house: "ContainerLove". The home was assembled from three modules, each 3 meters in width and with lengths of 7, 9 and 14 meters.

Pic 21, 22, 23. Container Love examples from Germany





German architectural studio Slawik Architects has created a portable home that fits into the size of a standard shipping container even it is a wood framed construction, not metal. Dubbed HomeBox, being positioned upright and not on the longer side.



Pic 24. HomeBox example from Germany

Conclusion: Even there are already established players on the market, clearly the size of market is big by targetting towards passivehouse/ Zero energy house. Using BIM the houses can be differentiated from current offerings and create huge market potential. Government is supporting this approach with funding opportunities.

8. REGULATION / STANDARDS

BELOW ARE ILLUSTRATIONS OF LAWS SCHEEMES IN NORDIC COUNTRIES AND GERMANY:

DS/CEN/CR 1751 (M1, M2 AND M3)

MILJØVAREDEKLARATIONEN (MVD-DK ORDNINGEN)

LCA TOOLS

DGNB

FOLLOWS EU LEGISLATION

VOLUNTARY M1 (LOW ENERGY MATERIALS)

CEN / TC 350

BUILDING ACT (2010:900)+PLANNING AND BUILDING ORDINANCE (2011:338).

BASTA

REACH

NS OG TEK10

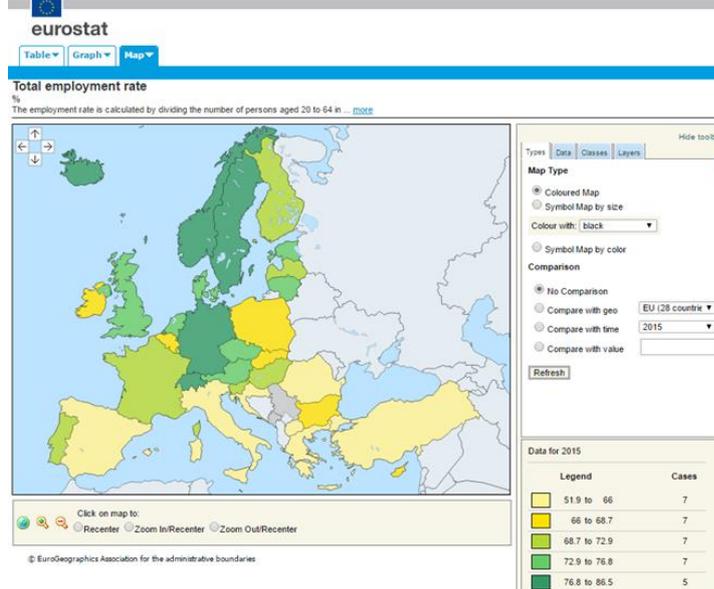
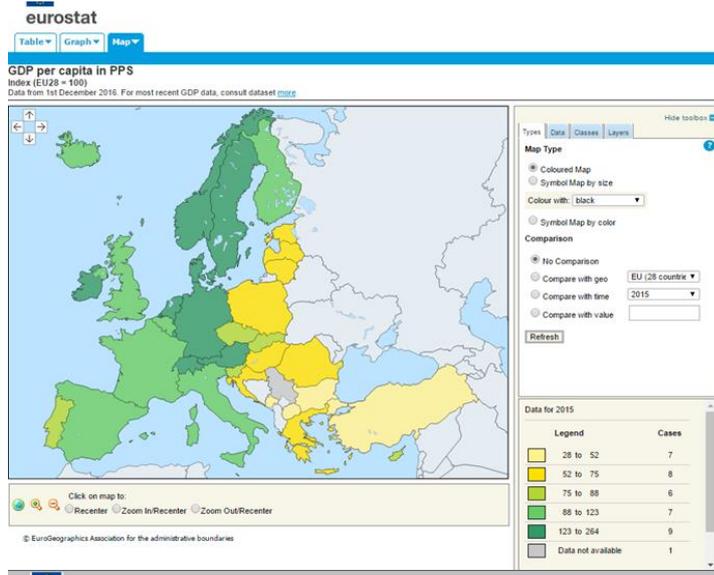
NATIONAL BUILDING CODE OF FINLAND AND SWEDEN

From the above list we see that we have huge amount of different regulatory laws, requirements partly from European Union, partly from local legislations. It is very important to find a common base for requirement which needs to be fulfilled for this Nordic Home platform to make it as widely compatible as possible. Special requirements from Germany and also China, if the concept shall be adopted to this market too. A separate ppt has been made on the China market for Nordic home also focusing on regulation.

9. EUROPEAN DATA GDP per capita in Europe (Dec 2016).

Key figures across European countries are illustrated in the figure below. We see that our main target markets Nordic + Germany are pretty strong. Finland slightly behind.

Employment rate also indicates that Nordic + Germany are strong, Finland slightly lagging behind them.

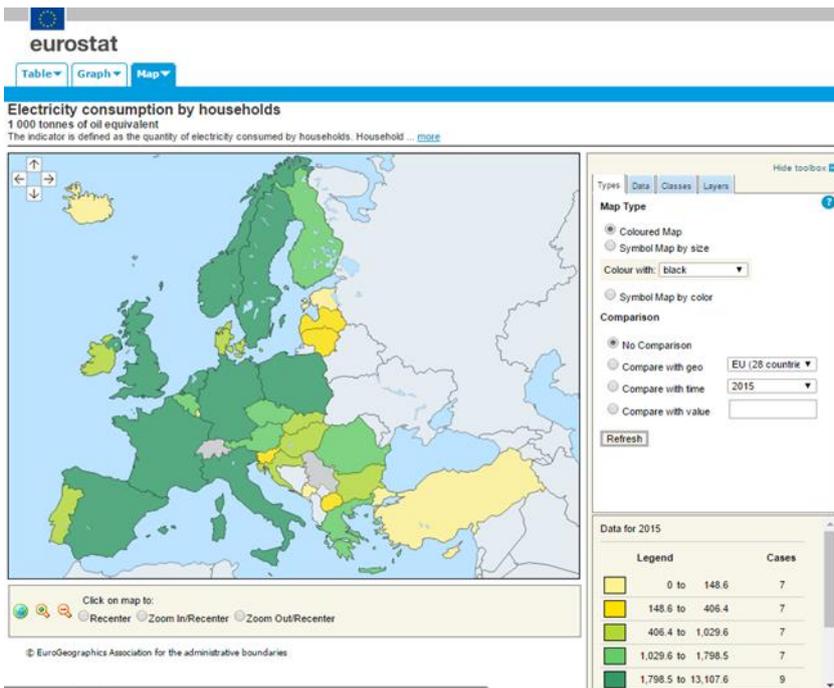
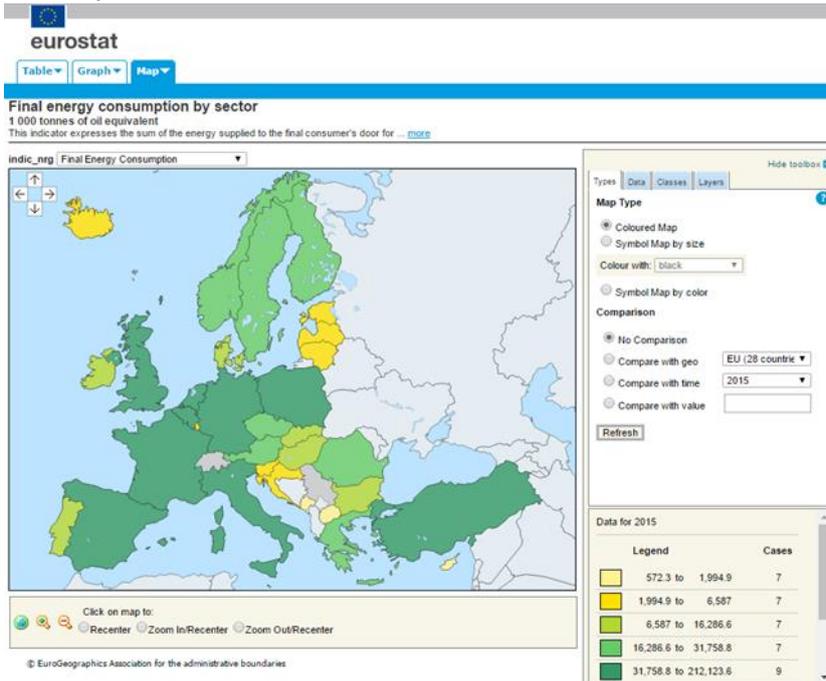


EUROPEAN DATA Total energy consumed.

Denmark is using least energy compared to the rest of Nordic countries and Germany.

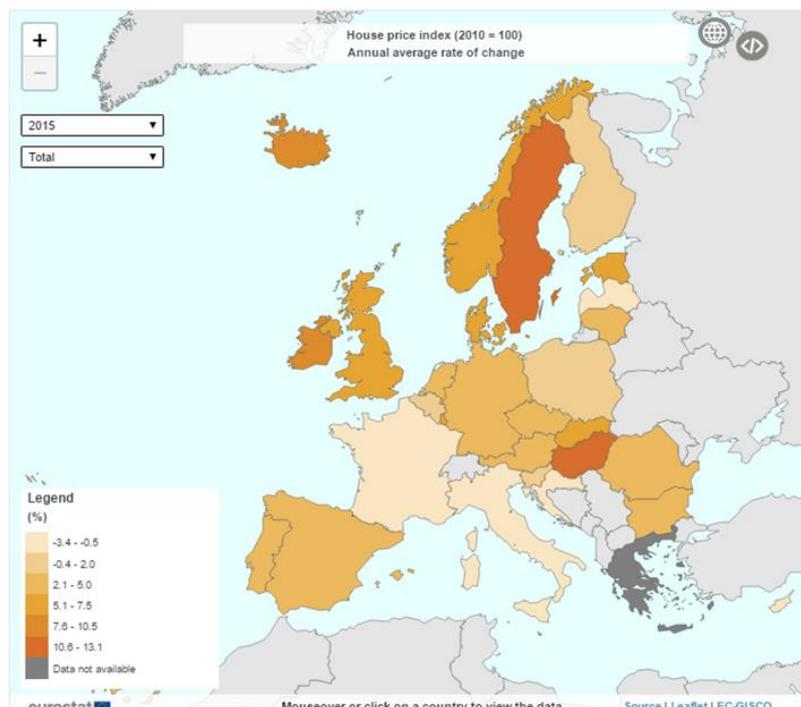
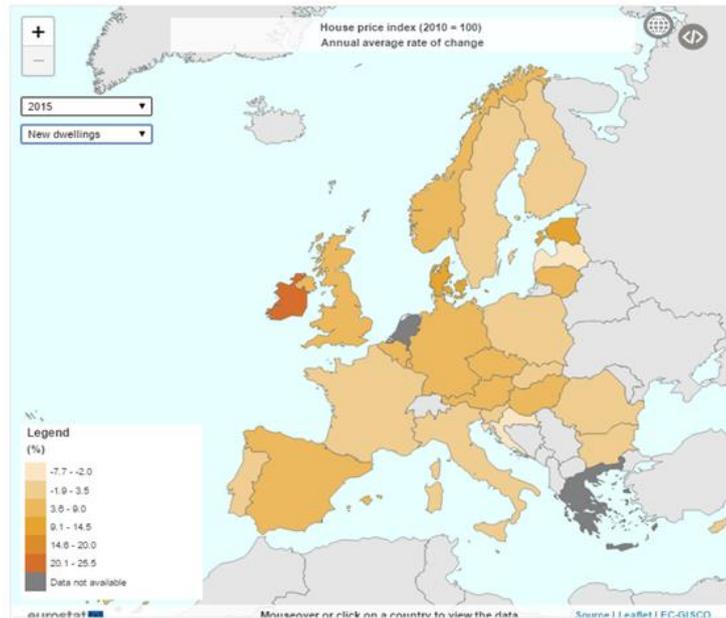
Electricity usage by households. Denmark using least electricity.

Creation of waste by countries. Recycling (waste management) more advanced in Germany, Denmark, Sweden and Norway compared to rest of Europe inclusive Finland.



EUROPEAN DATA House price index

As we can see from the index of new houses in Sweden and Finland the increase of prices has been more moderate compared to Norway, Denmark and Germany. But in overall price development in Finland is only with moderate increase. In Norway, Denmark and Germany the increase of prices have been bigger. Sweden is interesting as new house prices has increased a little, but overall big price increase, so old house prices increased much. In new houses in Finland and Sweden the price increase has been very moderate compared to Norway and Germany. In Denmark, the price increase has been strongest.



10. EUROPEAN DATA

FINLAND

Construction Output 1996-2017

Construction Output in Finland increased 8.10 percent in September of 2016 over the same month in the previous year. Construction Output in Finland averaged 4.69 percent from 1996 until 2016, reaching an all time high of 27.20 percent in June of 2010 and a record low of -18.40 percent in May of 2009.

Home Ownership Rate 2004-2017

Home Ownership Rate in Finland decreased to 72.70 percent in 2015 from 73.20 percent in 2014. Home Ownership Rate in Finland averaged 73.27 percent from 2004 until 2015, reaching an all time high of 74.30 percent in 2010 and a record low of 71.40 percent in 2004.

House Price Index 2005-2017

Housing Index in Finland increased to 107.67 Index points in the third quarter of 2016 from 107.64 Index points in the second quarter of 2016. Housing Index in Finland averaged 98.40 Index points from 2005 until 2016, reaching an all time high of 107.67 Index points in the third quarter of 2016 and a record low of 78.42 Index points in the first quarter of 2005.

Housing Starts 1995-2017

Housing Starts in Finland increased to 4094 in October from 4000 in September of 2016. Housing Starts in Finland averaged 2536.81 from 1995 until 2016, reaching an all time high of 5552 in May of 2000 and a record low of 525 in February of 1995.

Manufacturing Production 1991-2017

Manufacturing Production in Finland increased 1.50 percent in December of 2016 over the same month in the previous year. Manufacturing Production in Finland averaged 2.52 percent from 1991 until 2016, reaching an all time high of 24.20 percent in February of 1995 and a record low of -26.10 percent in January of 2009.

Households Debt To Income 2000-2017

Households Debt in Finland increased to 112.62 percent of gross income in 2015 from 109.80 percent in 2014. Households Debt To Income in Finland averaged 90.98 percent from 2000 until 2015, reaching an all time high of 112.62 percent in 2015 and a record low of 60.84 percent in 2000.

Consumer Price Index (CPI) 1951-2017

Consumer Price Index CPI in Finland decreased to 100.40 Index Points in January of 2017 from 101.80 Index Points in December of 2016. Consumer Price Index CPI in Finland averaged 47.07 Index Points from 1951 until 2016, reaching an all time high of 100.80 Index Points in October of 2016 and a record low of 5.10 Index Points in November of 1954.

Employment Rate 1988-2017

Employment Rate in Finland decreased to 67 percent in January from 68.30 percent in December of 2016. Employment Rate in Finland averaged 67.42 percent from 1988 until 2017, reaching an all time high of 79.60 percent in June of 1988 and a record low of 56.80 percent in January of 1994.

Labour Costs 1975-2017

Labour Costs in Finland increased to 112.74 Index Points in the third quarter of 2016 from 112.30 Index Points in the second quarter of 2016. Labour Costs in Finland averaged 77.81 Index Points from 1975 until 2016, reaching an all time high of 112.74 Index Points in the third quarter of 2016 and a record low of 28.40 Index Points in the first quarter of 1975.

GDP Annual Growth Rate 1976-2017

The Finnish GDP expanded 0.2 percent year-on-year in the fourth quarter of 2016, compared to a 1.6 percent growth in the September quarter, preliminary data showed. It was the lowest growth since the third quarter of 2015. On a quarterly basis, the economy contracted 0.5 percent, compared to a 0.4 percent growth in the third quarter. GDP Annual Growth Rate in Finland averaged 2.14 percent from 1976 until 2016, reaching an all time high of 7.60 percent in the third quarter of 1979 and a record low of -9.30 percent in the first quarter of 2009.

GDP From Construction 1990-2017

GDP From Construction in Finland increased to 2523 EUR Million in the third quarter of 2016 from 2501 EUR Million in the second quarter of 2016. GDP From Construction in Finland averaged 2399.30 EUR Million from 1990 until 2016, reaching an all time high of 3217 EUR Million in the first quarter of 1990 and a record low of 1778 EUR Million in the third quarter of 1995.

SWEDEN

Construction Output 1995-2017

Construction output in Sweden increased 10.10 percent in October of 2016 over the same month in the previous year. Construction Output in Sweden averaged 2.94 percent from 1995 until 2016, reaching an all time high of 21 percent in March of 2006 and a record low of -16.80 percent in August of 2009

Home Ownership Rate 2004-2017

Home Ownership Rate in Sweden increased to 70.60 percent in 2015 from 69.30 percent in 2014. Home Ownership Rate in Sweden averaged 69.30 percent from 2004 until 2015, reaching an all time high of 70.80 percent in 2010 and a record low of 66.60 percent in 2004.

House Price Index 2005-2017

Housing Index in Sweden increased to 233.90 Index points in January from 226.69 Index points in December of 2016. Housing Index in Sweden averaged 153.61 Index points from 2005 until 2017, reaching an all time high of 233.90 Index points in January of 2017 and a record low of 100 Index points in January of 2005

Housing Starts 1970-2017

Housing Starts in Sweden increased to 14.58 Thousand in the fourth quarter of 2016 from 12.51 Thousand in the third quarter of 2016. Housing Starts in Sweden averaged 10.10 Thousand from 1970 until 2016, reaching an all time high of 35 Thousand in the fourth quarter of 1971 and a record low of 1.53 Thousand in the first quarter of 1997

Manufacturing Production 1991-2017

Manufacturing Production in Sweden decreased 0.90 percent in December of 2016 over the same month in the previous year. Manufacturing Production in Sweden averaged 1.73 percent from 1991 until 2016, reaching an all time high of 19.20 percent in November of 1994 and a record low of -23.70 percent in January of 2009.

Net Disposable Personal Income 1980-2017

Disposable Personal Income in Sweden decreased to 494731 SEK million in the third quarter of 2016 from 604719 SEK million in the second quarter of 2016. Disposable Personal Income in Sweden averaged 260491.22 SEK million from 1980 until 2016, reaching an all time high of 604719 SEK million in the second quarter of 2016 and a record low of 71581 SEK million in the first quarter of 1980.

Households Debt To Income 2000-2017

Households Debt in Sweden increased to 151.43 percent of gross income in 2015 from 148.60 percent in 2014. Households Debt To Income in Sweden

averaged 127.08 percent from 2000 until 2015, reaching an all time high of 151.43 percent in 2015 and a record low of 96.19 percent in 2000.

Consumer Price Index (CPI) 1960-2017

Consumer Price Index CPI in Sweden decreased to 317.50 Index Points in January from 319.68 Index Points in December of 2016. Consumer Price Index CPI in Sweden averaged 172.81 Index Points from 1960 until 2017, reaching an all time high of 319.68 Index Points in December of 2016 and a record low of 27.70 Index Points in April of 1960.

Employment Rate 2005-2017

Employment Rate in Sweden decreased to 66.20 percent in January from 66.40 percent in December of 2016. Employment Rate in Sweden averaged 65.89 percent from 2005 until 2017, reaching an all time high of 69.90 percent in July of 2007 and a record low of 62.60 percent in January of 2010.

Labour Costs 2008-2017

Labour Costs in Sweden increased to 125.80 Index Points in November from 125.30 Index Points in October of 2016. Labour Costs in Sweden averaged 111.26 Index Points from 2008 until 2016, reaching an all time high of 125.80 Index Points in November of 2016 and a record low of 100 Index Points in January of 2008.

GDP Annual Growth Rate 1994-2017

The Swedish economy expanded 2.8 percent year-on-year in the third quarter of 2016, easing from an upwardly revised 3.6 percent growth in the previous period and below market expectations of 3 percent, according to preliminary estimates. GDP Annual Growth Rate in Sweden averaged 2.67 percent from 1994 until 2016, reaching an all time high of 7.70 percent in the fourth quarter of 2010 and a record low of -6.10 percent in the first quarter of 2009.

Gdp From Construction 1981-2017

Gdp From Construction in Sweden increased to 58449 SEK Million in the third quarter of 2016 from 57474 SEK Million in the second quarter of 2016. Gdp From Construction in Sweden averaged 48476.71 SEK Million from 1981 until 2016, reaching an all time high of 62448 SEK Million in the third quarter of 2007 and a record low of 40165 SEK Million in the fourth quarter of 1993.

NORWAY

Norway Registered Dwelling Permits 1960-2017

Building Permits in Norway decreased to 3062 in January from 3133 in December of 2016. Building Permits in Norway averaged 2470.81 from 1960 until 2017, reaching an all time high of 5266 in September of 1971 and a record low of 761 in July of 2009.

New Home Sales 2010-2017

New Home Sales in Norway increased to 35621 over the past 12 months to December 2016. New Home Sales in Norway averaged 28157.76 from 2010 until 2016, reaching an all time high of 35621 in December of 2016 and a record low of 23104 in December of 2010.

House Price Index 1992-2017

Housing Index in Norway remained unchanged at 199.30 Index Points in the fourth quarter of 2016 from 199.30 Index Points in the third quarter of 2016. Housing Index in Norway averaged 101.82 Index Points from 1992 until 2016, reaching an all time high of 199.30 Index Points in the third quarter of 2016 and a record low of 32.50 Index Points in the first quarter of 1993.

Housing Starts 2000-2017

Housing Starts in Norway decreased to 3099 in January from 3585 in December of 2016. Housing Starts in Norway averaged 2305 from 2000 until 2017, reaching an all time high of 4113 in March of 2006 and a record low of 1137 in July of 2009.

Manufacturing Production 1991-2017

Manufacturing Production in Norway decreased 2 percent in December of 2016 over the same month in the previous year. Manufacturing Production in Norway averaged 0.97 percent from 1991 until 2016, reaching an all time high of 8.90 percent in May of 2007 and a record low of -10.40 percent in April of 2009.

Households Debt To Income 2000-2017

Households Debt in Norway increased to 189.35 percent of gross income in 2015 from 187.47 percent in 2014. Households Debt To Income in Norway

averaged 158.73 percent from 2000 until 2015, reaching an all time high of 189.35 percent in 2015 and a record low of 118.51 percent in 2000.

Disposable Income of Households 2002-2017

Disposable Personal Income in Norway increased to 342808 NOK Million in the second quarter of 2016 from 329813 NOK Million in the first quarter of 2016. Disposable Personal Income in Norway averaged 246214.26 NOK Million from 2002 until 2016, reaching an all time high of 345748.00 NOK Million in the second quarter of 2015 and a record low of 162149.00 NOK Million in the first quarter of 2002.

Consumer Price Index (CPI) 1950-2017

Consumer Price Index CPI in Norway decreased to 104.30 Index Points in January from 146 Index Points in December of 2016. Consumer Price Index CPI in Norway averaged 61.77 Index Points from 1950 until 2017, reaching an all time high of 146.70 Index Points in November of 2016 and a record low of 7.10 Index Points in February of 1950.

Employment Rate 1988-2017

Employment Rate in Norway increased to 74.70 percent in the third quarter of 2016 from 67.40 percent in the second quarter of 2016. Employment Rate in Norway averaged 68.63 percent from 1988 until 2016, reaching an all time high of 74.70 percent in the third quarter of 2016 and a record low of 63 percent in the first quarter of 1993.

Labour Costs 1995-2017

Labour Costs in Norway decreased to 115.30 Index Points in the fourth quarter of 2016 from 123.20 Index Points in the third quarter of 2016. Labour Costs in Norway averaged 84.58 Index Points from 1995 until 2016, reaching an all time high of 123.20 Index Points in the third quarter of 2016 and a record low of 53.40 Index Points in the fourth quarter of 1995.

GDP Annual Growth Rate 1979-2017

The Gross Domestic Product in Norway expanded 1.80 percent year-on-year in the fourth quarter of 2016, recovering from a 0.9 percent contraction in the previous period. In 2016, the economy advanced 1 percent, slowing from a 1.6 percent expansion in 2015. It is the lowest growth rate in 3 years, due to a slowdown in household spending and a fall in exports. GDP Annual Growth Rate in Norway averaged 2.57 percent from 1979 until 2016, reaching an all

time high of 10.20 percent in the first quarter of 1980 and a record low of -4.30 percent in the second quarter of 2009.

GDP From Construction 1978-2017

GDP From Construction in Norway increased to 45532 NOK Million in the fourth quarter of 2016 from 44774 NOK Million in the third quarter of 2016. GDP From Construction in Norway averaged 29591.60 NOK Million from 1978 until 2016, reaching an all time high of 45532 NOK Million in the fourth quarter of 2016 and a record low of 20183 NOK Million in the third quarter of 1979.

DENMARK

Construction Output 2001-2017

Construction output in Denmark increased 4.60 percent in September of 2016 over the same month in the previous year. Construction Output in Denmark averaged 1.43 percent from 2001 until 2016, reaching an all time high of 26 percent in February of 2005 and a record low of -18.40 percent in February of 2010.

Home Ownership Rate 2003-2017

Home Ownership Rate in Denmark decreased to 62.70 percent in 2015 from 63.30 percent in 2014. Home Ownership Rate in Denmark averaged 65.70 percent from 2003 until 2015, reaching an all time high of 67.40 percent in 2006 and a record low of 62.70 percent in 2015.

House Price Index 2005-2017

Housing Index in Denmark increased to 116.97 Index points in the third quarter of 2016 from 115.91 Index points in the second quarter of 2016. Housing Index in Denmark averaged 104.05 Index points from 2005 until 2016, reaching an all time high of 117.56 Index points in the third quarter of 2007 and a record low of 83.27 Index points in the first quarter of 2005.

Housing Starts 1994-2017

Housing Starts in Denmark increased to 1913 in the fourth quarter of 2016 from 1468 in the third quarter of 2016. Housing Starts in Denmark averaged 2286.58 from 1994 until 2016, reaching an all time high of 5193 in the second quarter of 2005 and a record low of 1003 in the fourth quarter of 2009.

Manufacturing Production 1986-2017

Manufacturing Production in Denmark increased 11.20 percent in November of 2016 over the same month in the previous year. Manufacturing Production in Denmark averaged 1.76 percent from 1986 until 2016, reaching an all time high of 26.10 percent in October of 1988 and a record low of -22.50 percent in September of 2009.

Households Debt To Income 2000-2017

Households Debt in Denmark decreased to 242.79 percent of gross income in 2015 from 268.07 percent in 2014. Households Debt To Income in Denmark averaged 235.46 percent from 2000 until 2015, reaching an all time high of 268.87 percent in 2009 and a record low of 180.80 percent in 2001.

Consumer Price Index (CPI) 1980-2017

Consumer Price Index CPI in Denmark remained unchanged at 100.30 Index Points in January of 2017 from 100.30 Index Points in December of 2016. Consumer Price Index CPI in Denmark averaged 72.64 Index Points from 1980 until 2017, reaching an all time high of 100.60 Index Points in June of 2016 and a record low of 33 Index Points in January of 1980.

Employment Rate 2007-2017

Employment Rate in Denmark decreased to 65.60 percent in November from 65.80 percent in October of 2016. Employment Rate in Denmark averaged 65.73 percent from 2007 until 2016, reaching an all time high of 70.20 percent in September of 2008 and a record low of 63 percent in February of 2014.

Labour Costs 1990-2017

Labour Costs in Denmark decreased to 106.42 Index Points in the third quarter of 2016 from 111.11 Index Points in the second quarter of 2016. Labour Costs in Denmark averaged 86.52 Index Points from 1990 until 2016, reaching an all time high of 111.11 Index Points in the second quarter of 2016 and a record low of 68.27 Index Points in the first quarter of 1995.

GDP Annual Growth Rate 1991-2017

Denmark's gross domestic product expanded 1.2 percent in the third quarter of 2016 over the same quarter of the previous year. GDP Annual Growth Rate in Denmark averaged 1.59 percent from 1991 until 2016, reaching an all time high

of 6.50 percent in the fourth quarter of 1994 and a record low of -6.20 percent in the second quarter of 2009.

GDP From Construction 1990-2017

GDP From Construction in Denmark decreased to 21605 DKK Million in the third quarter of 2016 from 21800 DKK Million in the second quarter of 2016.

GDP From Construction in Denmark averaged 18802.85 DKK Million from 1990 until 2016, reaching an all time high of 23893 DKK Million in the third quarter of 2006 and a record low of 13812 DKK Million in the first quarter of 1993.

GERMANY

Building Permits for New Dwellings 2003-2017

Building Permits in Germany decreased to 27139 in November from 27777 in October of 2016. Building Permits in Germany averaged 18278.84 from 2003 until 2016, reaching an all time high of 29846 in June of 2016 and a record low of 9738 in January of 2009.

Construction Output 1992-2017

Construction output in Germany increased 0.40 percent in December of 2016 over the same month in the previous year. Construction Output in Germany averaged 0.07 percent from 1992 until 2016, reaching an all time high of 48.30 percent in February of 1992 and a record low of -38.90 percent in February of 1996.

Home Ownership Rate 2005-2017

Home Ownership Rate in Germany decreased to 51.90 percent in 2015 from 52.50 percent in 2014. Home Ownership Rate in Germany averaged 52.89 percent from 2005 until 2015, reaching an all time high of 53.40 percent in 2011 and a record low of 51.90 percent in 2015.

House Price Index 1991-2017

Housing Index in Germany decreased to 135.91 Index Points in January from 136.39 Index Points in December of 2016. Housing Index in Germany averaged 107.43 Index Points from 1991 until 2017, reaching an all time high of 154.90 Index Points in January of 1991 and a record low of 95.50 Index Points in May of 2009.

Manufacturing Production 1992-2017

Manufacturing Production in Germany decreased 0.90 percent in December of 2016 over the same month in the previous year. Manufacturing Production in Germany averaged 1.45 percent from 1992 until 2016, reaching an all time high of 15.50 percent in February of 2011 and a record low of -24 percent in April of 2009.

Households Debt To Income 2000-2017

Households Debt in Germany decreased to 82.22 percent of gross income in 2015 from 82.78 percent in 2014. Households Debt To Income in Germany averaged 92.99 percent from 2000 until 2015, reaching an all time high of 106.63 percent in 2000 and a record low of 82.22 percent in 2015.

Total Disposable Income 1960-2017

Disposable Personal Income in Germany increased to 470.58 EUR Billion in the fourth quarter of 2016 from 464.16 EUR Billion in the third quarter of 2016. Disposable Personal Income in Germany averaged 214.51 EUR Billion from 1960 until 2016, reaching an all time high of 470.58 EUR Billion in the fourth quarter of 2016 and a record low of 22.96 EUR Billion in the first quarter of 1960.

Consumer Price Index (CPI) 1950-2017

Consumer Price Index CPI in Germany decreased to 108.10 Index Points in January from 108.80 Index Points in December of 2016. Consumer Price Index CPI in Germany averaged 59.70 Index Points from 1950 until 2017, reaching an all time high of 108.80 Index Points in December of 2016 and a record low of 20.50 Index Points in July of 1950.

Employment Rate 1992-2017

Employment Rate in Germany increased to 75 percent in the third quarter of 2016 from 74.30 percent in the second quarter of 2016. Employment Rate in Germany averaged 68.43 percent from 1992 until 2016, reaching an all time high of 75 percent in the third quarter of 2016 and a record low of 63.60 percent in the second quarter of 1997.

Labour Costs 1991-2017

Labour Costs in Germany increased to 111.17 Index Points in the fourth quarter of 2016 from 110.47 Index Points in the third quarter of 2016. Labour Costs in

Germany averaged 96.71 Index Points from 1991 until 2016, reaching an all time high of 111.17 Index Points in the fourth quarter of 2016 and a record low of 78.63 Index Points in the first quarter of 1991

GDP Annual Growth Rate 1992-2017

Germany's gross domestic product advanced by 1.2 percent year-on-year in the fourth quarter of 2016, compared with a 1.5 percent expansion in the previous period and a 1.6 percent growth previously estimated. Domestic demand contributed positively, as household consumption increased by 1.5 percent (the same as in Q3) and government expenditure was up by 3.2 percent (from 3.7 percent in Q3). Also, gross fixed capital formation in construction grew by 1.3 percent (from 2.1 percent in Q3), in particular in dwellings. Meanwhile, foreign trade had a downward effect on growth as imports increased by 4.5 percent (from 2.4 percent in Q3) while exports rose at a slower 3.3 percent (from 1.3 percent in Q3). For the whole year of 2016, the GDP advanced by 1.9 percent, the highest growth rate in five years, mainly driven by consumption expenditure. GDP Annual Growth Rate in Germany averaged 1.37 percent from 1992 until 2016, reaching an all time high of 6 percent in the first quarter of 2011 and a record low of -7.90 percent in the second quarter of 2009.

GDP From Construction 1991-2017

GDP From Construction in Germany increased to 38.35 EUR Billion in the fourth quarter of 2016 from 36 EUR Billion in the third quarter of 2016. GDP From Construction in Germany averaged 25.39 EUR Billion from 1991 until 2016, reaching an all time high of 38.35 EUR Billion in the fourth quarter of 2016 and a record low of 14.47 EUR Billion in the first quarter of 2006.

<http://www.tradingeconomics.com> https://ec.europa.eu/commission/index_en

11. IKEA BOKLOK CONCEPT

Ikea/Boklok and Skanska/Boklok business model:

In the Boklok concept, the low price is achieved by combining Pre-fabrication in factory and very high standardization of materials. This means wood based construction of small block of flats in 3 different sizes 1 room of 44,5m²; 2 rooms of 58,5 and 3 rooms of 72 m² apartments

Modules are produced inside the factory. They are like "container-type" modules.

Also the interior design is completely fixed and identical to all. In addition the kitchen, equipment's, cupboards etc are identical and fixed.

In the coming project in Helsinki area it's 2 storey wooden block of flat buildings, with separate sauna building for joint usage as in most normal block of flats.

12 TRUCK TRANSPORTATION DIMENSIONS

Sweden Width (W) = 4,2 m

Height (H)= No limitation

Norway W= 4,2 m

H = 4,2 m

Denmark W= 5,0 m

H = No limitation

Here more details of Finnish Transport:

H = 4,4 m (can go higher, but makes things more difficult due to planning of alternative routes etc).

W= many choices as below:

3,5 m then needed 1 car in front.

4,2- 4,95 m then needed 2 warning cars; 1 in front and 1 rear and apply permission (cost about 10Euro only valid for 3-6 months. Can be used for multiple transports during that time).

Also these 2 warning cars can be used simultaneously with 2 truck transportation, so warning car, truck, truck, warning car combination when width 4,2-4,95 m.

Over 5 m width needs 3 warning cars, permissions from police and some time limitations not to transport during rush hours and so on.

Below is typical trailer max sizes for truck transportation.

ACTUAL TRAILER COMBINATION

4 - axle



Height 4,2 m Width 2,6 m
Length 22 m
Total mass 36 t

5 - axle



Height 4,2 m Width 2,6 m
Length 22 m
Total mass 44 t

6 - axle



Height 4,2 m Width 2,6 m
Length 22 m
Total mass 53 t

7- axle

Height 4,2 m Width 2,6 m
Length 22 m
Total mass 60 t