Annex Report III  Market Assessment on Russia, China, Japan and South Korea
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1. EXECUTIVE SUMMARY

Economy

• In spite of a downturn in 2012, China’s GDP growth will probably settle at around 7-8% in the next decade and the growth of investments at 20-22%. After 2030 China’s national economy will be two times larger than that of the USA.

• Population growth stands at 0.46% p.a. China will have a large elderly population in 2050 because of the enforced family-planning in the past. Per capita income adjusted with purchasing power will be ½ of the USA level.

• Japan’s urbanization is at almost maximal level and the population is decreasing by 0.1% p.a. GDP growth picked up by 2 % in 2011-2012 but is insufficient to spur timber economy growth.

• South Korea’s GDP growth is moving up by 2.7% (2013) and 3.8% (2014). Population growth is less than 0.2% p.a. and urbanization continues at 0.7% p.a.

• Russian economy has recovered from the 2009 dive (-7.9% of GDP), and will maintain a 2-3% p.a. growth. Economy is vulnerable to the gas and oil market fluctuations and lacks a domestic diversification strategy. Population turned into a decline in the mid-1990s and the long-term prospect is for a declining population. RFE is losing out productive workforce due to internal emigration.
EXECUTIVE SUMMARY

Demand for wood products

• Most world markets for wood products have not yet fully recovered from the financial and economic crises since 2008: consumption levels are gradually returning to 2007 pre-crisis levels, with another minor slowdown tilting the growth in 2012. USA is currently re-bouncing better than the EU.

• China and Russia are emerging fast to a normal growth path, and have maintained a solid consumption growth since 2009 in roundwood (logs), coniferous sawnwood, particleboard.

• 2012 was a year of a slower growth for China’s timber industry, but further urbanization and government support to the construction of affordable houses will sustain the steady growth in demand for wood products. China will continue to be the demand engine of the entire world’s timber industry and trade.

• Japan will be a highly sophisticated but declining market for most wood products in the next decade. Government launched a Wood Points program on April 1, 2013 with a purpose to increase the usage of domestic forest products to 28 million m3 by 2015.

• Korea’s domestic demand for wood products is forecast to keep growing at a slow pace, driven by the government promotion of wood use in construction.

• Glulam is highly dependent on the building and construction activity, and its global consumption was downsized by nearly 25% after 2007 peak, and a lower consumption level was established after 2010.
EXECUTIVE SUMMARY

Market forecasts – coniferous sawnwood and glulam

• Coniferous sawnwood (CSW) consumption and imports have performed strongly in China (reaching 14-15 mill. m3 p.a.). Import forecast is high at 22 mill. m3 in 2020.

• Japanese market offers less volume but requires higher quality and Japanese-standard products. Imports of CSW are forecasted to continue their long-term decline, and slide from 6.2 mill. m3 in 2012 to 5.8 mill. m3 in 2020. At the same time the government aims to increase Japan’s self-sufficiency (from present 30% to 50%) through encouraging processing logs from its maturing planted coniferous forests.

• South Korea’s CSW imports are expected to further increase to 2.2 mill.m3 in 2020. All three countries will continue to receive domestic and North American promotion of green building with wood.

• Glulam consumption and imports are expected to grow very fast in China (420,000 m2 by 2020), steadily in Japan (to 770,000 m3 in 2020), and very fast from a low level in South Korea (74,000 m3 in 2020).

• China and Korea are glulam start-up markets while Japan is a world benchmark in specialized glulam imports and consumption. Large-span straight and curved glulam beams for public and commercial building are coming up in specialized end-use projects.

• Building innovations, stricter quality standards on structural timber, high-rise wooden buildings, scarcity of large logs, off-site manufacturing of building components etc. are driving up wider use of glulam, Cross-Laminated Timber (CLT), Laminated Veneer Lumber (LVL), and other engineered wood products.
EXECUTIVE SUMMARY

Market forecasts – wood-based panels

• Particle board (PB) is mostly a home market product. Imports are forecasted to slightly increase in China (450,000 m³ in 2020) and to decrease in Japan (250,000 m³) and South Korea (600,000 m³). Korea is the largest PB importer in East Asia.

• In fibreboard (FB) import forecasts to China (150,000 m³) and Korea (170,000 m³) are pointing drastically downwards by 2020, following improvement of domestic production - especially in medium-density fibreboard (MDF). Japan’s imports in 2020 are expected to stay high at 480,000 m³.

• China is the world’s largest plywood (PW) producer, and its imports are forecasted to decline to 350,000 m³ in 2020. Laminated Veneer Lumber (LVL) is a new product in China and 2020 import forecast is 90,000 m³.

• Japan is traditionally the world’s largest PW importer, and its forecast in 2020 is still 3,500,000 m³, trending downwards. LVL import prospects are 150,000 m³ in 2020.

• Korea is expected to import 1,350,000 m³ of PW in 2020, together with 65,000 m³ of LVL.

• Oriented Strand Board (OSB) is gradually picking up in China, where imports are forecasted to reach 380,000 m³ in 2020, which is slightly more than in Japan (340,000 m³) and three times higher than in Korea (120,000 m³).
### Forecast of coniferous sawn timber imports in the East Asian markets

<table>
<thead>
<tr>
<th>P.R. China PRC</th>
<th>Imports of sawn conifer timber</th>
<th>RUS share</th>
<th>Japan JPN</th>
<th>Imports of sawn conifer timber</th>
<th>RUS share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2000-2004</td>
<td>8 140 000 m³</td>
<td>8 %</td>
</tr>
<tr>
<td>2000</td>
<td>469 000 m³</td>
<td>27,5%</td>
<td>2005-2007</td>
<td>7 640 000 m³</td>
<td>14 %</td>
</tr>
<tr>
<td>2005</td>
<td>1 700 000 m³</td>
<td>53,5 %</td>
<td>2012</td>
<td>6 185 000 m³</td>
<td>13,2 %</td>
</tr>
<tr>
<td>2012</td>
<td>13 890 000 m³</td>
<td>44,7 %</td>
<td>2020</td>
<td>5 800 000 m³</td>
<td>n.a.</td>
</tr>
<tr>
<td>2020</td>
<td>22 200 000 m³</td>
<td>n.a.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Demand drivers 2013-2020:**
- rising disposable income, fast urbanisation, growth of mobility and leisure
- rapid increase of weekend homes, holiday centres, public buildings
- growth of interior decoration with more floor space/capita
- Canadian-US promotion
- high disposable income, low birth rates, ageing population, saturation of wood-based traditional housing
- growth of 2 x 4 housing with North American efforts
- growth of wooden non-residential buildings; also multi-storey buildings

<table>
<thead>
<tr>
<th>Republic of Korea ROK</th>
<th>Imports of sawn conifer timber</th>
<th>RUS share</th>
<th>Demand factors 2013-2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000-2004</td>
<td>297 000 m³</td>
<td>6,5 %</td>
</tr>
<tr>
<td>2005-2007</td>
<td>389 000 m³</td>
<td>11 %</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>1 470 000 m³</td>
<td>20 %</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>2 200 000 m³</td>
<td>n.a.</td>
<td></td>
</tr>
</tbody>
</table>

**Demand drivers 2013-2020:**
- scope for further urbanisation, government incentives for wood construction, approval of new building codes
- hybrid construction: concrete with wooden structures, roof-top small housing units to enable potential for EWPs such as CLT, glulam
- 2 x 4 promotion by Canada
### Forecast of particleboard and fibreboard imports in the East Asian markets

<table>
<thead>
<tr>
<th>Country</th>
<th>P.R. China</th>
<th>Japan</th>
<th>Republic of Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRC</strong></td>
<td>Imports of particleboard</td>
<td>Imports of particleboard</td>
<td>Imports of particleboard</td>
</tr>
<tr>
<td>2000</td>
<td>344 000 m³</td>
<td>2000-2004</td>
<td>210 000 m³</td>
</tr>
<tr>
<td>2005</td>
<td>578 000 m³</td>
<td>2005-2007</td>
<td>222 000 m³</td>
</tr>
<tr>
<td>2012</td>
<td>410 000 m³</td>
<td>2012 E</td>
<td>276 000 m³</td>
</tr>
<tr>
<td>2020 F</td>
<td>450 000 m³</td>
<td>2020 F</td>
<td>250 000 m³</td>
</tr>
<tr>
<td>Imports of fibreboard</td>
<td>Imports of fibreboard</td>
<td>Imports of fibreboard</td>
<td>Imports of fibreboard</td>
</tr>
<tr>
<td>2000</td>
<td>440 000 m³</td>
<td>2000-2004</td>
<td>490 000 m³</td>
</tr>
<tr>
<td>2005</td>
<td>900 000 m³</td>
<td>2005-2007</td>
<td>517 000 m³</td>
</tr>
<tr>
<td>2012</td>
<td>140 000 m³</td>
<td>2012 E</td>
<td>450 000 m³</td>
</tr>
<tr>
<td>2020 F</td>
<td>150 000 m³</td>
<td>2020 F</td>
<td>480 000 m³</td>
</tr>
</tbody>
</table>

- The MDF capacity in PRC was excessive in 2012.
## Forecast of plywood and LVL imports in the East Asian markets

<table>
<thead>
<tr>
<th>Country</th>
<th>P.R. China (PRC)</th>
<th>Japan (JPN)</th>
<th>Republic of Korea (ROK)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Imports of plywood</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>1 000 000 m3</td>
<td>4 868 000 m3</td>
<td>1 212 000 m3</td>
</tr>
<tr>
<td>2005</td>
<td>700 000 m3</td>
<td>4 486 000 m3</td>
<td>1 281 000 m3</td>
</tr>
<tr>
<td>2012</td>
<td>200 000 m3</td>
<td>3 660 000 m3</td>
<td>1 118 000 m3</td>
</tr>
<tr>
<td>2020 F</td>
<td>350 000 m3</td>
<td>3 500 000 m3</td>
<td>1 350 000 m3</td>
</tr>
</tbody>
</table>

Conifer plywood to grow fast

Import potential of LVL

- LVL standard since 2005 but consumption of construction LVL averaged only 5,500 m3 p.a. in 2007-2012 but demand will increase very fast from 2014 onwards upon startup of the 1st domestic LVL mill

- demand forecast 210,000 m3 whereof imports 90,000 m3

Imports mainly deciduous plyw.

Import potential of LVL

- LVL is well-known in Japan, further growth possible due to hybrid construction with steel and concrete structures

- consumption of LVL in 2012 220,000 m3 whereof imports 45%; structural LVL 85%; import ca 150,000 m3 in 2020

- use of structural LVL negligible in 2005-2007, 3,500 m3 p.a., consumption 5,000 m3 in 2012, all imported

-LVL to grow in hybrid structures and in 2 x 4 construction although Canadian 2 x 4 promoters prefer SPF and OSB; demand forecast 65,000 m3 in 2020
<table>
<thead>
<tr>
<th>P.R. China</th>
<th>PRC</th>
<th>Japan</th>
<th>JPN</th>
<th>Republic of Korea</th>
<th>ROK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports of OSB</td>
<td></td>
<td>Imports of OSB</td>
<td></td>
<td>Imports of OSB</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>18 000 m3</td>
<td>2000-2004</td>
<td>200 000 m3</td>
<td>2000-2004</td>
<td>23 600 m3</td>
</tr>
<tr>
<td>2005</td>
<td>57 000 m3</td>
<td>2005-2007</td>
<td>213 000 m3</td>
<td>2005-2007</td>
<td>42 500 m3</td>
</tr>
<tr>
<td>2012 E</td>
<td>132 000 m3</td>
<td>2012 E</td>
<td>227 000 m3</td>
<td>2012 E</td>
<td>60 000 m3</td>
</tr>
<tr>
<td>2020 F</td>
<td>380 000 m3</td>
<td>2020 F</td>
<td>340 000 m3</td>
<td>2020 F</td>
<td>120 000 m3</td>
</tr>
<tr>
<td>Imports of glulam</td>
<td></td>
<td>Imports of glulam</td>
<td></td>
<td>Imports of glulam</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>8 000 m3</td>
<td>2000-2004</td>
<td>550 000 m3</td>
<td>2000-2004</td>
<td>2 000 m3</td>
</tr>
<tr>
<td>2005</td>
<td>17 000 m3</td>
<td>2005-2007</td>
<td>706 000 m3</td>
<td>2005-2007</td>
<td>4 800 m3</td>
</tr>
<tr>
<td>2012</td>
<td>83 000 m3</td>
<td>2012 E</td>
<td>693 000 m3</td>
<td>2012 E</td>
<td>13 900 m3</td>
</tr>
<tr>
<td>2020 F</td>
<td>420 000 m3</td>
<td>2020 F</td>
<td>770 000 m3</td>
<td>2020 F</td>
<td>74 000 m3</td>
</tr>
</tbody>
</table>

Larch of major interest for glulam. CLT will grow from zero to tens of thousands of cubic metres before 2015.

Market of short glulams saturated, demand for long glulam beams to grow fast, together with CLT.

Gluelam and CLT to grow very fast between 2014 and 2020. Both suitable also for hybrid structures with steel/concrete.
EXECUTIVE SUMMARY

Market development and promotion

• The RFE companies will need a multi-year programme for technical and commercial promotion of their export-product range, especially in the PRC and the Republic of Korea. Japanese wood industry companies are relatively well aware of the RFE potential.
• Canada Wood approach in China, Japan and the Republic of Korea is a working model.
• Especially the extensive larch resources of the Russian Far East deserve a significant input for applied research for outdoor and indoor uses and related promotion. LVL, glulam and veneer sheets of larch need to be launched in China.
• Awareness of the basic properties of RFE larch is very limited in China, much better in Japan but almost non-existing in the Republic of Korea.
• Larch residues can hardly be used for pulping but their use for solid and liquid bio-fuels should be of interest in the export markets. Some advanced bio-chemical opportunities like arabinogalactan (to animal nutrition and pharma) have not yet been fully captured.
EXECUTIVE SUMMARY

Markets for solid biofuels

• Renewables are not yet important in the energy portfolios of China, Japan and Korea, but wood pellet demand for co-firing with coal for heat and power is expected to increase fast, especially in Korea which imported 122,000 tons of wood pellets in 2012. Korea’s wood pellet demand forecast is very high at 5.0 Mt in 2020 (4.0 Mt from imports), driven up by the government’s ambitious green electricity plan.

• China will rely more on its abundant straw pellets, whereas imported wood pellets are not economically transportable to the majority of co-firing plants which are located further inland. China’s imports were around 100,000 tons of wood pellets in 2012.

• Japan imported 71,000 t wood pellets in 2012, and volumes will pass 100,000 tons in 2013 and will continue to scale up.
EXECUTIVE SUMMARY

Markets for liquid biofuels

• Current supply of ligno-cellulosic liquid biofuel from forestry platform is negligible in the world. Recently some projects have been shelved due to excessive costs and poor market prospects.

• China, Japan and South Korea are potentially growing importers of biofuels. For the time being, all biofuel markets are highly policy-dependent, and the future demand hinges on:

  1. Renewable energy targets (China: 15% by 2020; Japan: rice straw and wood-based biofuels production to 6 million m3 by 2030);
  2. greening of the transport (blending mandates, fuel taxation/tax concessions for biofuels);
  3. heat & power (sustainability criteria for bioenergy, feed-in tariffs);
  4. chemical sectors (safe and bio-based chemicals); and
  5. related policy implementation.

• Pyrolysis oil of wood could be potentially in high demand when it becomes commercially available. China is the third largest global producer of bioethanol. Japan’s supply of oil-based biofuels is set to 0,5 M m3 in 2017 and 1,0 M m3 by 2020.
EXECUTIVE SUMMARY

Liquid Biofuels in Russian Far East

• Both 1st / 2nd generation liquid biofuels are very poorly developed and regulatory support system is only under development in Russia.

The most potent drivers are:
1. Feedstock supply as a solution to excessive waste problems in forestry and agriculture;
2. Economic development and employment creation for keeping remote areas inhabited;
3. High cost of hydro-carbons, resulting in high operational costs in transports, high emissions and health and environmental concerns; and
4. Long tradition of biochemistry in Russian academia and research institutions.

• Programme on development of Biotechnology through 2020 set optimistic targets on biofuel and bioenergy supply reaching 1,500,000 toe oil and 7 billion USD by 2020.

• State will probably not give much financial support until the technology is considered commercially viable.

• Russian Far East will have to look for co-investors (JV) from Japan and/or ROK with a captive market off-take and for sharing financial risk. Technology partner would bring critical knowledge on EPC and O&M, and later on help mitigating IP risks.
Market assessment of solid biofuels in the East Asian markets

### P.R. China (PRC)

**Pellets, biocarbon**

*Coal-fired power plants* account for 79% of power generation in the PRC. Coal to stay as No. 1 energy source. China’s coal reserves for 30-100 years ahead (depending on source). Only few coal-fired power plants are located on the coast.

*Co-firing potential in China*

Straw pellets are of interest due to rich domestic supply despite their low calorific value. Its output of pellets was 1.2 Mm3 mainly for exports in 2012 and imports less than 0.2 Mm3. Wood pellets only 100,000 t.

### Japan (JPN)

**Pellets, biocarbon**

*Coal-fired power plants* account for 27% of power generation. Due to the Fukushima disaster Japan returns to coal and develops renewables. Japan depends on coal imports. Most coal-fired power plants are located on the coast.

*Co-firing potential in Japan*

Japan has interest for wood pellets. Japan imported 71,000 t wood pellets in 2012. Japan has 60 pellet plants. Two big power plants started pellet use in 2009. Pellet imports will grow further and exceed 100,000 t p.a. in 2013.

### Republic of Korea (ROK)

**Pellets, biocarbon**

*Coal-fired power plants* account for 65% of power generation in Korea. ROK to build several new coal-fired plants in 2014-2020. Korea depends on imported coal. Most coal-fired power plants are located on the coast.

*Co-firing potential in Korea*

ROK has very great interest for imported wood pellets. ROK has 11 wood-pellet plants, with output 18,000 t in 2012. Production cost: KRW 400,000 per t in 2013. Material cost is 35% of total cost. Korea imported 122,000 t wood pellets in 2012. Demand forecast is high: 5.0 Mt in 2020.
# Market assessment of liquid biofuels in the East Asian markets

<table>
<thead>
<tr>
<th>P.R. China PRC</th>
<th>Japan JPN</th>
<th>Republic of Korea ROK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liquid biofuels</strong></td>
<td><strong>Liquid biofuels</strong></td>
<td><strong>Liquid biofuels</strong></td>
</tr>
<tr>
<td>China’s share of renewable energy will increase to 15% by 2020. PRC counts in the future more on processing of domestic agricultural residues (straw and corn residues) than imported biofuel of wood fibre. China is the third largest global producer of bioethanol (based on wheat and corn).</td>
<td>Japan is trying to reduce its dependency on imported oil to 80% by 2030. Pyrolysis oil is potentially of high demand but not commercially available yet. Japan’s supply of oil-based biofuels is set to 0.5 M m3 in 2017 and 1.0 M m3 by 2020. Rice straw, crops residues and wood-based biofuels production is targeted at 6 million m3 by 2030.</td>
<td>Demand potential of liquid-biofuel from the Russian Far East is promising in Korea. There are no concrete projects by Korean firms on liquid biofuels.</td>
</tr>
<tr>
<td><strong>Russian Federation RF</strong></td>
<td>Both 1st / 2nd generation liquid biofuels are very poorly developed and regulatory support system is only under development in Russia. Government target for a 3% share of biofuels in consumption by 2015 and 10% in 2020 seems far-stretched.</td>
<td></td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

RFE total forest products exports

• All wood products exports from RFE amounted to 976 mill. USD in 2012 (7.9 mill. m³), which was 12% of the entire wood product export value of the Russian Federation.

• In 2005 the export value was 952 mill. USD from 14.8 mill. m³ volume, dominated by unprocessed logs.

• Wood products are among the important exported goods in the Russian Far East with an 8.5% share of total export value from the region.

• Industrial roundwood exports fell from 13.9 mill. m³ in 2005 to 5.7 mill. m³ in 2012 as guided by the Russian Federation log export tax system.

• Sawnwood exports grew from 713,000 m³ in 2005 to 1.7 million m³ in 2012, what was the most positive development in RFE trade.
RFE industrial roundwood exports

- Industrial roundwood: peaked in 2007 (17.8 mill m³) and declined to 5.7 mill m³ in 2012 (-67%)
- 82% to China, 15% to South Korea
- Khabarovsky krai delivered 59% of exports, Primorsky krai 30%, Amurskaya oblast 9%
- 87% of logs exported were larch, 11% birch and aspen, 2% oak
EXECUTIVE SUMMARY

RFE sawnwood exports

• Increased from 0.7 mill m3 to 1.7 mill. m3 (+142%) in 2005 – 2011

• 87% of the exports headed to China, 10% to South Korea and 3% to Japan

• 51% of the exports were from Khabarovsky krai, 39% in Primorsky krai and 6% Jewish AO

• 67% of exports were larch, 12% birch and aspen, 12% oak, 7% ash and 2% from pine
EXECUTIVE SUMMARY

RFE veneer sheet exports

- 263,000 m³ exports in 2012
- 73% to Japan, 27% to China
- Primorsky krai produced 94%
- 84% coniferous and 16% non-coniferous
- Larch veneer is a growth product put on sale to Japan’s plywood manufacturers and furniture makers
EXECUTIVE SUMMARY

RFE other wood products exports

• In 2012, 10,600 tons of waste and scrap of paper and paperboard were exported from RFE

• In 2012, 35,000 m³ of particleboard were exported from Khabarovsky krai as well as 29,000 tons of chips, and 48,000 tons of pellets

• In 2012, Khabarovsky krai exported 10,000 tons of gluelam to Japan

• In 2012, Primorsky krai exported 132,000 m² of MDF and 131,000 tons of chips

• In 2012 less than 3,000 m³ of coniferous sawnwood was exported from Sakhalinskaya oblast’ to South Korea and Japan

• Magadanskaya oblast’, Khamchatka and Chukotka did not export wood products in 2010 - 2012
EXECUTIVE SUMMARY

Summary of RFE export prices

• Average price of exported industrial roundwood from RFE has been trending upwards to $111/m3 in 2012 ($76/m3 in 2005)

• Export price of all sawnwood has been flat at around $212/m3 in 2005-2012

• Larch has become more common in SW exports, and China as the dominant low-price export destination

• Larch SW export trend price was $158/m3 in 2012
2. Global trends in wood products markets from 2007 to 2012

Main Source: FAOSTAT
USA and EU lead IRW production and both declined from ~335 mill. m3 in 2007 to ~280 mill. m3 in 2012.

Russian output appears to grow steadily after 2009.

China's IRW production is increasing slowly above 100 mill. m3.

Russia’ exports diminished by 63% since 2007 as a result of log export taxes and economic recession.

EU IRW exports have returned to 2007 level and US export are slowly growing.
Industrial roundwood (IRW)

• In 2012 US consumption bounced to 325 mill. m³, but it was still 12% below 2007.
• Russia, China and Brazil consumed 159, 142 and 139 mill. m³, respectively.
• EU imports plummeted after 2007 and leveled at 49 mill. m³ in 2012.
• In 2012 China’s imports were 39 mill. m³.
• Production and consumption grew since 2009, while exports continuously decreased.

• Japan’s production was stable since 2007, but imports and consumption declined.
China, mill m3

- China’s production and consumption increased again since 2010.

EU, mill m3

- EU net trade deficit narrowed from -25 mill. m3 in 2007 to -14 mill. m3 in 2012.
Since 2007 Russia’s CSW production grew by 3 mill. m3, but is only 55% of EU’s in 2012.

In 2012 EU produced 4 times more than China, which is ramping up its capacity.

In 2011 and 2012 Russia’s exports had grown to reach 19 mill. m3.

Exports from EU decreased by 6 mill. m3 since 2007, but are in their own scale.
• China’s CSW consumption keeps growing fast: 37 mill. m³ in 2012, in contrast to a downward adjustment in USA and EU.

• In 2012 USA consumed 27 mill. m³ less than in 2007.

• China alone sustained growth in imports and came on par with US imports at 16 mill. m³ in 2011.

• EU was 2 times larger importer than and USA and China in 2012.
In 2012, 63% of Russia’s production was exported.

In 2012, 37% of the Japan’s consumption was satisfied with imports.
• In 2012, imports covered 40% of China’s consumption (25% in 2007).
• Higher imports have sustained fast consumption growth.

• EU net trade was +13 mill. m3 in 2012.
• Consumption and production are still below 2007 level.

• Consumption and production fell sharply after 2007 peak.
• Imports covered 27% of USA consumption in 2012.
Particle board (PB)

- EU PB production was equal to USA, China and Russian combined.
- Russia’s production increased by 1.2 mill. m³ since 2007.
- US production decreased by 29% since 2007.

- EU exports decreased by 2.5 mill. m³ since 2007.
- Exports from Russia and USA have been below 1 mill. m³ since 2007.
Particle board (PB)

- Falling consumption both in EU (by 1/5) and USA (by 1/3).
- Both China’s and Russia’s consumption increased by more than 50% since 2007.
- Japan’s consumption have not exceeded 1.6 mill. m3 since 2007.
- China’s and Russia’s imports were trending to 0.8-0.9 mill. m3 in 2012.
- EU imports decreased by 2.4 mill. m3 since 2007, and US by 3.5 m. m3.
Particle board (PB)

Russia, 1,000 m³

- Russia is fairly self-sufficient in PB, but net trade is negative (more imports).
- Output growth since 2009 has been 2.2 m. m³.

Japan, 1,000 m³

- Imports cover 36% of Japan’s PB consumption.
- Domestic production is on a constant decline.
China, 1,000 m³

• China is 95% self-sufficient in PB, with a steady import share.

EU, 1,000 m³

• EU PB consumption has come down by 10 m.m³.
• EU net trade was +3 m. m³ in 2012.

USA, 1,000 m³

• Falling consumption and production trend has been reversed after 2010.
• In 2012, 19% of the US consumption was supplied by imports.
Global consumption trend of glulam

- Glulam is still mostly a European-consumed product (2.8 mill. m³)

- Asia’s share of global consumption is around 1.8 mill. m³

- North American share has greatly diminished after 2006, following the housing sector crisis in the USA

Source: UNECE/FAO FPAMR 2012-2013
3. Russian domestic markets

Coniferous sawnwood, gluelam, wood-based panels, particleboard
Russian Federation house construction by type 2002-2012

- Stable growth in 2002-2012; floor area up 7% p.a.
- Bricks & wood account more than 70% of low-rise house construction in Russia
- Low-rise housing doubled in floor area, grew 8% p.a.
- Wooden house floor area tripled

Source: Russian Association of Wood Housing in UNECE/FAO FPAMR 2012-2013
Coniferous sawnwood consumption in the Russian Federation increased 3.6% since 2008, to 11 million m3 in 2012. Increase in exports continues race with production growth. Hardwood sawnwood consumption (1.3 mill. m3) is about 10% of coniferous sawnwood and of lesser importance.

Source: UNECE/FAO FPAMR 2012-2013

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</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>25,124</td>
<td>25,388</td>
<td>26,412</td>
<td>29,055</td>
<td>30,040</td>
<td>32,383</td>
</tr>
<tr>
<td>Imports</td>
<td>546</td>
<td>451</td>
<td>432</td>
<td>549</td>
<td>554</td>
<td>556</td>
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<tr>
<td>Exports</td>
<td>14,876</td>
<td>15,825</td>
<td>17,118</td>
<td>18,846</td>
<td>19,414</td>
<td>21,860</td>
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<tr>
<td>Apparent consumption</td>
<td>10,794</td>
<td>10,014</td>
<td>9,726</td>
<td>10,758</td>
<td>11,180</td>
<td>11,079</td>
</tr>
</tbody>
</table>
Domestic market: coniferous sawnwood prices in Russia

- Dec 2012: avg. $107/m³
- Prices returned from in Q4/2012 to the same level as Q1

Source: Rosstat 2013 data in UNECE/FAO FPAMR 2012-2013
Glulam in Russia

- Glulam production in Russia is low and fluctuated between 65,000 – 195,000 m³ in 2005 – 2009 (2% of European production level).
- Industry is operating on low capacity utilization levels and is highly sensitive to building and construction trends.
- Production is mostly concentrated in the Western part of Russia, but the largest single glulam facility by capacity is in Primorsky krai (STS Teknowood).
- Primorsky krai exports glulam to Japan (around 15,400 m³ per year).
- A large number of small glulam producers serve their local construction markets, especially in Moscow and St. Petersburg areas.
Particleboard consumption and production in Russia

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>5,751</td>
<td>4,562</td>
<td>5,429</td>
<td>6,634</td>
<td>6,751</td>
<td>6,724</td>
</tr>
<tr>
<td>Imports</td>
<td>472</td>
<td>248</td>
<td>231</td>
<td>229</td>
<td>275</td>
<td>293</td>
</tr>
<tr>
<td>Exports</td>
<td>411</td>
<td>575</td>
<td>470</td>
<td>280</td>
<td>761</td>
<td>761</td>
</tr>
<tr>
<td>Apparent consumption</td>
<td>5,812</td>
<td>4,235</td>
<td>5,190</td>
<td>6,583</td>
<td>6,266</td>
<td>6,256</td>
</tr>
</tbody>
</table>

- Consumption of particleboard has returned to a growth path after 2009 slump, at 6.26 mill. m3 in 2012 and 2013
- Production has grown by 1 mill. m3 since 2008, following the large new mills coming on stream
- Moscow region is dominant, followed by Vologda and Kostroma
- Large foreign producers lead by Kronospan and IKEA have moved in

Source: Rosstat 2013 data in UNECE/FAO FPAMR 2012-2013
Plywood consumption and production in Russia

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</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>2,592</td>
<td>2,107</td>
<td>2,689</td>
<td>3,040</td>
<td>3,146</td>
<td>3,247</td>
</tr>
<tr>
<td>Imports</td>
<td>115</td>
<td>53</td>
<td>35</td>
<td>43</td>
<td>189</td>
<td>196</td>
</tr>
<tr>
<td>Exports</td>
<td>1,326</td>
<td>1,334</td>
<td>1,512</td>
<td>1,378</td>
<td>1,574</td>
<td>1,589</td>
</tr>
<tr>
<td>Apparent consumption</td>
<td>1,381</td>
<td>826</td>
<td>1,212</td>
<td>1,705</td>
<td>1,761</td>
<td>1,854</td>
</tr>
</tbody>
</table>

- Plywood consumption and production have returned to a long-term growth path since a setback in 2008-2009
- Domestic consumption is approaching 2 mill m³
- Kostroma, the Komi Republic and Vologda lead in production
- Restructuring: Sveza acquired Fankom plywood mill in 2012
- Imports from China increased sharply in 2012

Source: Rosstat 2013 data in UNECE/FAO FPAMR 2012-2013
Other wood-based panels in Russia

OSB production is coming on stream in Russia:

- Novovyatskiy in Kirov region (slow run-up into production)
- Vladimir region mill into full capacity 2013-2014

Fibreboard additions:

- Sukhonskiy PPM (Sokol, Vologda region)
- MDF imports shooting up
Domestic market: particleboard and plywood prices in Russia

- Plywood Dec. 2012: 520 $/m³
- Particle board Dec. 2012: 276 $/m³
- Small rises from Q1 to Q4/2012 on both panels
- Substantial price increases since 2010

Source: Rosstat 2013 data in UNECE/FAO FPAMR 2012-2013
Domestic market: WBP imports in Russia

**Plywood**

- Source: UNECE/FAO Timber database 2013, Rosstat 2013

**Particleboard**

**Fibreboard**

**OSB**

Source: UNECE/FAO Timber database 2013, Rosstat 2013
Russia: conclusions

Russia is emerging fast from the latest economic down to a normalized growth path, and has maintained a steady consumption growth in industrial roundwood, coniferous sawnwood and particleboard since 2009.

Exports have driven production up fast in sawmilling, particleboard and plywood since 2009, and foreign investments in advanced wood-based panels industries (MDF, OSB) are increasing.

Imports of fibreboard (mostly MDF), OSB and also plywood moved up in the last years. All wood-based panels are recovering from the 2009 slump in demand and production.

Demand is sustained by stable growth in Russia’s housing sector: in 2002-2012 floor area grew by 7% p.a on average in all houses, while in wooden houses it tripled in a decade.

Moscow and St. Petersburg are the prime economic centers around which the demand growth for wood products is heavily concentrating.
Russian larch: new product opportunities

Some advanced bio-chemical opportunities like arabinogalactan (AG, to animal nutrition and pharma) have not yet been fully captured.

The large-scale sawmills of larch lumber across Russia, and especially in RFE, and Siberia, produce sufficient volumes of residues for establishing an industrial-scale production (scale in the range of 3,000 – 5,000 tons of AG).

Development projects can apply for grants from Russian BIOTECH-2030 platform, and subsidies from the Ministry of Industry and Trade for the R&D stage.
4. Detailed assessment on forest product markets in East Asia: China, Japan and Republic of Korea
Key driver in East Asia: China’s timber economy
SUMMARY STATEMENT ON CHINA’S ECONOMY IN 2012

IN 2012 THE CHINESE ECONOMY EXPERIENCED A DOWNTURN, WHEREIN REAL ESTATE INDUSTRY REMAINED WEAK, DOMESTIC BUILDING AND DECORATION MARKET KEPT DEPRESSED. THE US HOUSING CRISIS AND THE EUROPEAN DEBT CRISIS BOGGED DOWN EXPORTS FURTHER, AND JAPANESE ECONOMY SHOWED NO IMPROVEMENT. EXTERNAL AND DOMESTIC FACTORS LEAD INTO POOR SALES OF TIMBER INDUSTRY PRODUCTS.

2012 WAS THE MOST DIFFICULT YEAR, BUT IT IS ESTIMATED THAT THE GROWTH PACE OF CHINESE ECONOMY WILL BOTTOM OUT AND BECOME STABLE INTO 2014, WHILE THE RECENT PAST EXPORT LEVELS WILL NOT BE FULLY RECOVERED YET.
Economic structure adjustment

- In 2012 non-manufacturing industry was developing faster than manufacturing
- China’s economic structure is gradually transforming into service industry-based economy
- Domestic consumption plays an increasing role in supporting stable growth
- Production Index of Manufacturing Industry (PMI) of western and central China is the highest in the country
- Economic development of eastern part has begun a transition from scale expansion to quality improvement
- Western and central parts receive industrial transfer from the east of China, accelerating their development
China’s economic prospects

- Long-term economic growth rate maintained at 7-8%
- Growth of investment stabilized between 20-22% p.a.
- Macro-economic control will pay attention to the effective transition from external driving force (exports) to internal driving force (consumption) to stimulate economic growth, and focus on releasing of effective and latent demand in new areas of China.
**SUMMARY STATEMENT ON CHINA’S ECONOMY THE FUTURE**

**ANOTHER GIANT LEAP IS POSSIBLE IN THE NEXT 20 YEARS:**

**KEEPING THE 7-8% GROWTH:**

- **PER CAPITA INCOME ON PURCHASING POWER PARITY IN CHINA WILL REACH ½ OF THE USA**
- **NATIONAL ECONOMY WILL BE 2 TIMES LARGER THAN THAT OF USA**

**CURRENTLY, THE ECONOMIC DEVELOPMENT LEVEL ON MAINLAND CHINA IS SIMILAR TO JAPAN IN 1951, KOREA IN 1977 AND TAIWAN (POC) IN 1975 – WHICH THEN GREW ON AVG. 9.2%, 7.6% AND 8.3% P.A. RESPECTIVELY.**

**WITH LATE-DEVELOPING ADVANTAGE, CHINA IS ON TRACK TO RUN A PARALLEL TRACK, BUT THE RISK OF POLITICAL AND SOCIAL FRACTION POINTS IS REAL.**

**CHINA’S POPULATION AGE STRUCTURE PREDICTS THAT CHINA WILL HAVE A LARGE ELDERLY POPULATION IN 2050 BECAUSE OF THE ENFORCED FAMILY-PLANNING IN THE PAST.**
Prospects for timber trade depend on building & construction, furniture and home decoration

Year 2012 was a weak point of China’s timber economy: all imports went down except hardwood logs & chips. 2013 is a consolidating year where weaker enterprises exit.

China’s urbanization rate will mature to 70% by 2030, indicating China’s cities will be under rapid development in the next 10 - 20 years

Besides disposable income, *per capita* floor space is an important measure for market assessment as to furniture and other home decoration (see next two slides)

Wood-structure building has experienced rapid development recently, as evidenced by the following:

- In 2000, China had only 5 major enterprises for wood-structure building. But in 2010, the number had increased to more than 130.

- Building & construction company in Suzhou realized annual output value RMB 100 mill. yuan in 2010 and reached RMB 500 mill. yuan 2012.
China’s next group of major cities of growth 2012-2020
(living space exceeding 35 m² per capita)

Cities becoming “well off” in the next decade
(exceeding 35 sq metres per head in living space per head)

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<td>Xiangtan</td>
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<td>Hangzhou</td>
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<td>Hengyang</td>
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<td>Wuhan</td>
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<td>Luoyang</td>
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<td></td>
<td></td>
<td></td>
<td>Chengdu</td>
<td></td>
<td></td>
<td></td>
<td>Wenzhou</td>
</tr>
</tbody>
</table>

Note, only prefectures with a forecast urban population of over 2m by 2020 are shown.

Note 2: floor space may be overestimated
Residential floor space per head in China and timber consumption centers for Russian wood

Note: Floor space may be overestimated
5. Market assessment of wood products in China

China in the world’s forest products consumption

Sources: Worldmapper with FAOSTAT
Residential housing including home decoration in the PRC

China’s urban residential inventory: 21 billion m². Newly built residential floor space was 2.97 billion m² in 2009, inc. 0.79 billion urban, 1.02 billion rural and 1.16 billion other.

Home ownership: all China 85 %, rural 98 %; urban 75 %:
  Beijing 56 %; Shanghai 58 %; Tianjin 64 %; Chongqing 78 %; Jiangsu 80 %

Average floor space per capita: 22.5 m² in 2011 vs. 15 m² in 2005 and 12 m² in 1997.
Rural floor space completed 960 M m², urban floor space circa 1 000 M m² in 2011.

Affordable homes: 36 million new units in 2011-2015, i.e. 7.2 million new units p.a.

Large number of peasants move to cities, many new villages need to be re-planned and reconstructed, which will create a very large building material market in the following 20 years.

Rapid urbanisation will contribute to double-digit growth of residential construction, especially in inland cities and new satellite cities in the neighbourhood of existing big East-China cities.

Land-use policy of the government affects availability of suburban areas for low-rise villa construction on the outskirts of cities such as Beijing and Shanghai. A villa boom started at the same time as wood-frame residential construction legalized in 2004.

Code for Design of Timber Structures GB 50005-2003 is the most important code for wood buildings controlling the design of load-bearing wood structures for low-rise housing.
### Forecast of urban residential building area increase in China’s major cities

<table>
<thead>
<tr>
<th>City</th>
<th>Forecast net increase in urban residential building stock, 2011-2020 (m sq metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chongqing</td>
<td>1,109</td>
</tr>
<tr>
<td>Chengdu</td>
<td>447</td>
</tr>
<tr>
<td>Zhengzhou</td>
<td>396</td>
</tr>
<tr>
<td>Tianjin</td>
<td>389</td>
</tr>
<tr>
<td>Beijing</td>
<td>350</td>
</tr>
<tr>
<td>Xi’an</td>
<td>279</td>
</tr>
<tr>
<td>Changsha</td>
<td>272</td>
</tr>
<tr>
<td>Shanghai</td>
<td>271</td>
</tr>
<tr>
<td>Shenzhen</td>
<td>265</td>
</tr>
<tr>
<td>Dongguan</td>
<td>234</td>
</tr>
</tbody>
</table>

- Figures are for urban areas within referenced prefecture.

Chongqing is a very large municipality.

Capital of the Sichuan Province.

Capital of the Henan Province.

A coastal municipality near Beijing.

Capital of the Shaanxi Province.

Capital of the Hunan Province.

Next-door-neighbour to Hong Kong.

Major furniture centre, Pearl River Delta.

Inland cities enjoy above-average growth, partly due to improved road network & high-speed trains.
Demand for building materials for new residential housing in cities and towns in PRC 2012 - 2020

36 million affordable apartments to be built under “12th Five-year Plan” will drive up large demand for building products, decoration and furniture.

Large number of peasants move to cities, many new villages need to be re-planned and reconstructed, which will create a very large building material market in the following 20 years.

Main building materials demand:
- cement consumption 420 M t in 2012, annual growth 15 M tpa or 3,5 %
- consumption of steel 90 M t in 2012, annual growth 3,15 M tpa or 3,5 %
- consumption of sawn timber 55 M m3, annual growth 2,2 M m3 p.a. or + 4 %
Demand for wood-based low-rise buildings in rural and remote sub-urban areas in PRC 2012 - 2020

Wood-frame houses and log houses: initial building rate only 15,000 units (13,000 wood-frame homes and 2,000 log houses) in 2012, but strong growth of 350-1,450 units p.a. in 2013-2016 and 2,000-2,900 units p.a. in 2017 and 2020. Differences between wood-frame houses and log houses fading as most log houses made from squared laminated logs against higher quality mark. Rural and sub-urban wooden buildings function as second-homes for weekend as construction of suburban close-to-city villas is stagnating due to strict land-use policy of the government.

Holiday houses and club houses in resorts, restaurants and coffee & tea shops in recreation areas near cities, weekend houses in the neighborhood of golf courses and log houses in ski resorts (North of Beijing, Heilongjiang, Inner Mongolia) are of great interest.

Direct consumption of sawnwood, logs and wood-based panels in wood-frame & log houses: initial level only 140,000 m³ in 2012, but demand for high-quality wooden houses accelerating despite land-use restrictions. Increased car ownership, better roads and longer holidays contribute to second homes popularity and holiday houses also within middle-class; annual growth of demand 50-125,000 m³ p.a. in 2013-2016 and 180-250,000 m³ p.a. in 2017-2020.

Demand for wood in other buildings: restaurants, motels, holiday-resort hotels, bus stations, club houses, kindergartens, homes for elderly people etc. Consumption of sawn timber and wood-based panels 80-200 m³/building, demand growth for wood products 25-40,000 m³ p.a. in 2013-2016, 50-90,000 m³ p.a. in 2017-2020.
Two main segments and raw materials for house-building with wood

Log cabin structure in North China is mainly made from timbers imported from Russia, while modern, light wood structures and multi-storey buildings in South China are mainly made from timbers imported from North America.
A loghouse village 50 km from Beijing

Note modern squared log material and large treated-wood decking of Russian pine between the houses.
### Production of sawn timber in PRC 2000-2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Coniferous</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>6 344 000</td>
<td>4 000 000</td>
</tr>
<tr>
<td>2001</td>
<td>7 638 000</td>
<td>5 000 000</td>
</tr>
<tr>
<td>2002</td>
<td>8 516 000</td>
<td>6 000 000</td>
</tr>
<tr>
<td>2003</td>
<td>11 269 000</td>
<td>7 000 000</td>
</tr>
<tr>
<td>2004</td>
<td>15 325 000</td>
<td>8 000 000</td>
</tr>
<tr>
<td>2005</td>
<td>17 903 000</td>
<td>10 000 000</td>
</tr>
<tr>
<td>2006</td>
<td>24 865 000</td>
<td>12 000 000</td>
</tr>
<tr>
<td>2007</td>
<td>28 291 000</td>
<td>12 500 000</td>
</tr>
<tr>
<td>2008</td>
<td>28 410 000</td>
<td>12 000 000</td>
</tr>
<tr>
<td>2009</td>
<td>32 998 000</td>
<td>14 000 000</td>
</tr>
<tr>
<td>2010</td>
<td>37 230 000</td>
<td>15 000 000</td>
</tr>
<tr>
<td>2011</td>
<td>44 602 000</td>
<td>19 000 000</td>
</tr>
<tr>
<td>2012</td>
<td>55 682 000</td>
<td>20 000 000</td>
</tr>
</tbody>
</table>

Sources: FAOSTAT adjusted with Chinese data
### Production of sawn timber by provinces in 2011 in PRC

<table>
<thead>
<tr>
<th>Province</th>
<th>Total output</th>
<th>of which Railway sleepers &amp; other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner Mongolia</td>
<td>5 704 400 m³</td>
<td>m³</td>
</tr>
<tr>
<td>Shandong</td>
<td>5 542 000</td>
<td>8 800</td>
</tr>
<tr>
<td>Guangxi</td>
<td>3 644 200</td>
<td>25 000</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>3 004 600</td>
<td>33 200</td>
</tr>
<tr>
<td>Anhui</td>
<td>2 778 500</td>
<td>26 500</td>
</tr>
<tr>
<td>Hunan</td>
<td>2 714 600</td>
<td>157 500</td>
</tr>
<tr>
<td>Liaoning</td>
<td>2 364 100</td>
<td>45 200</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>2 008 600</td>
<td>30 100</td>
</tr>
<tr>
<td>Sichuan</td>
<td>1 749 900</td>
<td>23 600</td>
</tr>
<tr>
<td>Fujian</td>
<td>1 691 100</td>
<td>-</td>
</tr>
<tr>
<td>Guangdong</td>
<td>1 526 400</td>
<td>6 800</td>
</tr>
<tr>
<td>Other provinces</td>
<td>11 874 100</td>
<td>79 700</td>
</tr>
<tr>
<td>PRC, total</td>
<td>44 602 500 m³</td>
<td>436 400 m³</td>
</tr>
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</table>

Main source: China State Forest Administration (SFA)
## Imports of coniferous sawn timber in PRC 2000-2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Total imports</th>
<th>from Russia</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>2000</td>
<td>469 000</td>
<td>129 000</td>
<td>27.5%</td>
</tr>
<tr>
<td>2002</td>
<td>1 189 000</td>
<td>457 000</td>
<td>38.4%</td>
</tr>
<tr>
<td>2004</td>
<td>649 000</td>
<td>1 700 000</td>
<td>38.2%</td>
</tr>
<tr>
<td>2006</td>
<td>1 016 000</td>
<td>2 108 000</td>
<td>48.2%</td>
</tr>
<tr>
<td>2007</td>
<td>2 804 000</td>
<td>1 426 000</td>
<td>50.8%</td>
</tr>
<tr>
<td>2008</td>
<td>3 645 000</td>
<td>1 802 000</td>
<td>49.4%</td>
</tr>
<tr>
<td>2009</td>
<td>6 344 000</td>
<td>3 150 000</td>
<td>49.7%</td>
</tr>
<tr>
<td>2010</td>
<td>9 371 000</td>
<td>4 367 000</td>
<td>46.6%</td>
</tr>
<tr>
<td>2011</td>
<td>14 920 000</td>
<td>6 073 000</td>
<td>40.7%</td>
</tr>
<tr>
<td>2012</td>
<td>13 890 000</td>
<td>6 210 000</td>
<td>44.7%</td>
</tr>
</tbody>
</table>

Main source: China’s import statistics

Russia No. 1, Canada No. 2
Canada to overtook Russia as No. 1
Canada maintained its leadership
Production of WBP in China 2000-2012 (m3)

<table>
<thead>
<tr>
<th>Year</th>
<th>Plywood</th>
<th>Particleboard</th>
<th>Fibreboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>10 764 000</td>
<td>2 870 000</td>
<td>5 140 000</td>
</tr>
<tr>
<td>2005</td>
<td>25 842 000</td>
<td>5 760 000</td>
<td>20 610 000</td>
</tr>
<tr>
<td>2006</td>
<td>28 024 000</td>
<td>8 430 000</td>
<td>24 660 000</td>
</tr>
<tr>
<td>2007</td>
<td>35 835 000</td>
<td>8 290 000</td>
<td>27 290 000</td>
</tr>
<tr>
<td>2008</td>
<td>35 578 000</td>
<td>11 420 000</td>
<td>29 060 000</td>
</tr>
<tr>
<td>2009</td>
<td>44 681 000</td>
<td>14 310 000</td>
<td>34 300 000</td>
</tr>
<tr>
<td>2010</td>
<td>46 000 000</td>
<td>12 640 000</td>
<td>43 540 000</td>
</tr>
<tr>
<td>2011</td>
<td>39 200 000</td>
<td>12 400 000</td>
<td>49 330 000</td>
</tr>
<tr>
<td>2012</td>
<td>43 900 000</td>
<td>12 890 000</td>
<td>54 960 000</td>
</tr>
</tbody>
</table>

Sources: FAOSTAT adjusted with Chinese data
China’s WBP production is under a debate

• FAO, in collaboration with key reporters on China’s WBP production, namely State Forestry Administration (SFA), Chinese Academy of Forestry (CFA), and China National Forest Products Industry Association (CNFPIA) is seeking to clarify the discrepancy between plywood output and the industrial roundwood balance in the country.

• Four major potential areas that may cause the problem were identified:

1. over-estimate plywood production when field statistician mixes up m2 with m3 due to lack of knowledge;
2. double counting of production when some mills put face veneers on plywood purchased from other plywood mills;
3. double counting/miscounting when veneer sheets are counted as plywood;
4. harvest quota is not a true representation of total roundwood used (over-the-quota harvest, unreported harvest).

• Although these problems may exist in all plywood-producing provinces, further investigation will be conducted in three major ones (Shandong, Jiangsu, Guangxi).

• It is expected that the official numbers on China’s plywood industry will be retroactively downscaled in the official and international statistics as a result of this research and capacity-building project.
## Imports of WBP in China 2000-2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Total imports</th>
<th>Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>6 626 000</td>
<td>Indonesia No.1, Malaysia No.2, Thailand No.3</td>
</tr>
<tr>
<td>2002</td>
<td>5 943 000</td>
<td>Indonesia No.1, Malaysia No.2, Thailand No.3</td>
</tr>
<tr>
<td>2004</td>
<td>5 638 000</td>
<td>Indonesia No.1, Malaysia No.2, Thailand No.3</td>
</tr>
<tr>
<td>2006</td>
<td>4 309 000</td>
<td>Indonesia No.1, Malaysia No.2, Thailand No.3</td>
</tr>
<tr>
<td>2007</td>
<td>3 356 000</td>
<td>Malaysia No.1, Thailand No. 2, Indonesia No.3</td>
</tr>
<tr>
<td>2008</td>
<td>2 747 000</td>
<td>Malaysia No.1, Thailand No. 2, Indonesia No.3</td>
</tr>
<tr>
<td>2009</td>
<td>2 744 000</td>
<td>Thailand No.1, Malaysia No.2, Indonesia No.3</td>
</tr>
<tr>
<td>2010</td>
<td>3 875 000</td>
<td>Malaysia No.1, Thailand No. 2, Indonesia No.3</td>
</tr>
<tr>
<td>2011</td>
<td>3 184 000</td>
<td>Malaysia No.1, Thailand No.2, New Zealand No.3</td>
</tr>
<tr>
<td>2012</td>
<td>3 189 000</td>
<td>Malaysia No.1, Thailand No.2, New Zealand No.3</td>
</tr>
</tbody>
</table>

Main source: FAOSTAT and GTA
Sawn timber end use segments in PRC

Total sawn timber demand (55 M m3 p.a.) with growth prospects:

- **Coniferous SW** annual growth in demand 1,5 M m3, more than 4 % p.a.
  - overall domestic supply of coniferous sawn timber to stagnate
  - log imports to grow, domestic log supply to decrease
  - imports of rough sawn timber to increase; most coniferous SW for construction site, roof and structural use, but higher quality SW also further processed into home decoration, builder’s joinery and carpentry (BJC, see detailed slides per segment)

- **Deciduous sawn timber** annual growth in demand 0,7 M m3 max. and constrained by poor quality & sizes of domestic plantation logs & falling supply of tropical timber
  - overall domestic supply of deciduous sawn timber to stagnate due to shortage of high-quality logs (temperate hardwood log & SW imports continue in high demand)
  - most deciduous SW goes to furniture, BJC, flooring and home-decoration items
Treated sawn timber and durable wood in fast expansion

Treated sawn timber market size in 2012: 850 000 m³ whereof domestic output 720 000 m³ or 85% mainly CCA-treated* wood, based on Russian pine sawn timber; imports 130 000 m³ mainly non-CCA treated timber from New Zealand and USA.

End-uses:
- Gardening & landscaping: 75% of the treated-wood consumption.
- Posts, construction timber, fencing and outdoor furniture: about 20%
- Bridges, children playgrounds and indoor applications: residual 5%

Market outlook: further growth thanks to rapid urbanisation; demand approaching 1 500 000 m³ with imports accounting for close to 200 000 m³ in 2015. Demand forecast 2 300 000 m³ for 2020.

Distribution outlook for 2015: - BIY/DIY stores 9%
- Wholesalers with 41%
- Project applications such as landscaping 50%

Consumption of railroad ties: (not included in treated wood above) 1 M m³ in 2000, today 150 000 m³, further decline in sight caused by concrete ties.

(* CCA chromated copper arsenate, slightly toxic; alternative ACQ alcaline copper quaternary)
Furniture end-use for sawnwood and wood-based panels

Structure: around 38,000 furniture makers with production value of USD 85,000 million, exports account for more than 70% of output. There are registered 4,086 major firms with min. turnover RMB 20 million:

- 2,523 furniture factories making mainly wooden furniture
- 1,563 furniture factories making furniture from materials other than wood

Production of wooden furniture amounts to ~240 million pieces p.a. Wooden furniture accounts still for 60% of production value of all furniture. Wood-based panels are the primary material for 80% of all wooden furniture, while solid wood (sawn timber based) is used for 20%. Majority (70%) of Chinese furniture buyers prefer WBP furniture for lower price.

Consumption of rough coniferous sawnwood (i.e. SW without further processing) for furniture applications is max. 400,000 m³ p.a. – of which processing waste of solid wood material up to 35%. Russian and North European pine, NZ Radiata pine and spruce from northern Europe are the most popular materials in Chinese wood-furniture industry.

Dalian-based Markor and Dalian Huafeng are good examples of coniferous SW users in China. IKEA’s increasing popularity in China supports Chinese makers of pine furniture because IKEA buys most of its pine furniture from Chinese factories.
Wood-frame windows, doors and stairs & staircases

Wood-Frame Windows and Doors: 2012 market size 500 M m² whereof aluminium-framed accounted for 55 %, PVC for 35 %, steel for 6 % and wood for 4 %. China counted 158 firms making wood-frame windows in 2013 (just two in 2001). The biggest is Alavus Beijing with three factories and the 2nd biggest is Shunda-Moser. Velux China is the biggest manufacturer of roof windows in China. Most window manufacturers buy three-ply pine laminates in lengths 600 cm from laminating factories. The wood-frame window market grows at a rate of 15 % p.a.

Wood door production at ex-factory prices amounted to RMB 79 billion in 2010. Double-digit annual growth continues despite the PVC competition according to Fuhuang Wood Door Co. Solid wood consumption for wood-frame windows and doors is several million m³ p.a. The door industry is a heavy user of solid wood but also plenty of HDF, veneers and MDF.

Stairs & staircases: output value of the whole branch RMB 20 billion whereof wooden stairs and staircases account for 80-85 %. There are around 2,000 manufacturers. Wood consumption as rough sawn timber is estimated at 460 000 m³ p.a. Rubberwood accounts for 35 %, beech for 32 %, oak for 25 % and other species for 8 % (mahogany, birch, larch and pine). Demand for wooden stairs and staircases grows at double-digit annual rate.
Market opportunities for RFE products by segment in PRC

**Treated sawn timber:**
- sales of pine sawn timber to Chinese wood treatment plants;
- development of alternative naturally durable larch-based plain and laminated products for landscaping use.

**Wooden furniture:**
- sales of top-quality pine sawn timber and sliced pine veneers to Chinese coniferous furniture manufacturers (veneers also to manufacturers of interior doors);
- sales of low-quality sawn timber of birch for non-visible parts of furniture;
- sales of larch sawn timber to manufacturers of garden and park furniture.

**Wooden windows, doors, stairs:**
- sales of top-quality 3-ply laminated pine components to window makers;
- sliced pine and birch veneers to Chinese door manufacturers;
- oak components to staircase companies;
- larch laminates of interest to manufacturers wood-frame windows and stairs & staircases.
New product opportunities in PRC 1

China’s plywood and flooring industries are in transformation:

• Development of softwood plywood is expected to gain momentum since there are abundant Russian larch available, together with New Zealand Radiata pine.
• Quality improvement is of key importance: China’s domestic concrete form plywood can be re-used only 3-5 times, in comparison to 30-50 rounds of use achieved with plywood made in Finland or the USA.
• Solid wood laminated flooring to fill a large market demand below higher-priced solid wood parquet and plank flooring, which are becoming constrained from the falling availability of valuable deciduous timbers.
• Solid wood laminated flooring is becoming a market mainstream product with its moderate price and engineered wood quality. Plywood manufacturers can easily convert into solid wood laminated flooring manufacturers (e.g. Jiashan of Zhejiang, which is renowned as China’s prime centre of solid wood laminated flooring).
• Adopt poplar hardening techniques for solid wood flooring quality.
China has not yet discovered properly Engineered Wood Products EWP:

- The raw materials of EWPs are mostly boreal or southern hemisphere softwoods, lower quality deciduous woods like poplar and aspen for OSB, but also possible with small-diameter hardwood timbers from plantations, as well as relatively little used larch, which all suit China’s raw material supply well.

- EWPs are characterized by uniform structure, high strength, large specification and dimensional stability, and meet the highest requirements of modern wood structures in buildings, bridges, furniture and outdoor landscape construction.

- Great interest for straight and curved glulam posts and beams in Shanghai. Limited Chinese supply: only Haring company (Tianjin) which is an Austrian invested manufacturer but mainly supplies to the Japanese market. A single temple renovation project absorbed 8 000 m³ of gluelam (from Tianjin). A continuous demand for glulam structures from architects and builders but difficult to obtain in Shanghai. A Chinese glulam standard exists since late-2011.

- Cross Laminated Timber (CLT), which allows building multi-storey buildings fast and cost-effectively, and sequestrating more carbon in high-rise buildings. High-quality spruce is normally used.

- OSB (oriented strand board), LVL (laminated veneer lumber), PSL (parallel strand lumber), LSL (laminated strand lumber), L-Beams, etc. also have growth prospects (see next slides).
Laminated Veneer Lumber (LVL)

Multiple layers of veneers are glued parallel to grain into 1,220 mm wide, 90 mm thick and 24 m long lumber in high temperature, and pressure.

LVL is of straight line and outstanding strength, so it can be used as main beam and lintel.
Parallel Strand Lumber (PSL)

For structural uses, suitable for house and commercial buildings, and visual applications alike.

610-2440mm pine veneer block is made by gluing, micro-wave hardening pressing.
I-shaped Wood Joist (I-Beam)

LVL and OSB (oriented strand board) glued together into a structural beam which can support large load without bending especially in floors.
China: Conclusions

China is the world’s leading wood products market and producer, and will remain the main market for RFE wood industry.

It is a market where new opportunities can be actively pursued because all end-use segments for wood have not yet been fully developed.

China will tread in a deficit of wood supply also in the foreseeable future.

Wood product markets in China took a giant leap in the 2000s as a result of privatization of dwellings which unleashed a huge growth in urban construction.

Wood demand was strengthened in the furniture industry, which spread its clout from domestic to export markets (first in the USA, second the EU, and then diversifying to all continents).

Third wave is the expansion of China’s dominance in wood-based panels markets and in other value-added wood products (builder’s joinery and carpentry, BJC).
6. Market assessment of wood products in Japan

Japan in the world’s forest products consumption

Sources: Worldmapper with FAOSTAT
Residential housing indicators in Japan

**Homes and home ownership:** all Japan: 49,6 M homes whereof privately owned 30,31 M homes or 61,2 %; provinces, high-end: Akita 78,4 %, Toyama, Fukui, Yamagata, Niigata and Gifu in range 78,5-73%; low-end: Tokyo 44,6 %, Osaka 53 %, Hokkaido 57,2 %, Kyoto 60,8 %

**Average floor space/capita:** 35,7 m² in 2005 (new population census to be conducted in 2015); Akita 46,9 m², Hokkaido 37,2 m², Tokyo 29,8 m², Toyoma 49,8 m², Kyoto 34,5 m², Osaka 27,8m²

**Affordable homes:** not an issue in Japan due to high income level.

**Urbanisation:** with 91,3 % practically completed.
Government introduced its **Wood Points Program** on April 1, 2013 to increase the usage of domestic forest products up to 28 million m³ by 2015. Total budget of ¥41 billion will subsidize more than 135,000 new homes.

Construction of dwellings has declined in the last 24 years: falling trend is set to continue after a temporary hike (920,000 units) in 2013. Below are housing starts in the past two decades:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All types, total</td>
<td>1 684 788</td>
<td>1 215 913</td>
<td>898 352</td>
<td>834 117</td>
<td>882 797</td>
</tr>
<tr>
<td>- wooden</td>
<td>722 502</td>
<td>555 497</td>
<td>469 043</td>
<td>464 837</td>
<td>486 756</td>
</tr>
<tr>
<td>Share of wooden</td>
<td>42,9 %</td>
<td>45,7 %</td>
<td>52,2 %</td>
<td>55,7 %</td>
<td>55,1 %</td>
</tr>
</tbody>
</table>
2 x 4 new housing starts by type

Trends in 2X4 Housing Starts

Source: Japan 2x4 Home Builders’ Association
Wooden housing types in Japan

Jikugumi is a **traditional Japanese post and beam house** which uses more and more glulam. This type accounts for the largest share of wooden housing. The jikugumi business employs thousands very small construction companies since a team of 3-4 skilled men is required for a single jikugumi house (see jikugumi frame presented on next slide).

**Prefabricated:** incl. steel-prefab, no separate statistics for wood-prefab but a declining trend for steel.

North American **2 x 4 construction** promotion has resulted in an increasing market share.

<table>
<thead>
<tr>
<th>Wooden housing divided into three categories:</th>
<th>1992</th>
<th>2002</th>
<th>2007</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>- traditional jikugumi houses</td>
<td>365 799</td>
<td>263 902</td>
<td>260 631</td>
<td>247 045</td>
</tr>
<tr>
<td></td>
<td>54,5 % 52,4 % 51,7 % 50,7 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- prefabricated houses</td>
<td>252 398</td>
<td>160 871</td>
<td>145 360</td>
<td>132 224</td>
</tr>
<tr>
<td></td>
<td>37,6 % 31,9 % 28,8 % 27,2 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2 x 4 houses</td>
<td>52 933</td>
<td>78 988</td>
<td>98 555</td>
<td>107 487</td>
</tr>
<tr>
<td></td>
<td>7,9 % 15,7 % 19,5 % 22,1 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Total wooden houses</td>
<td>671 130</td>
<td>503 761</td>
<td>504 546</td>
<td>486 756</td>
</tr>
</tbody>
</table>
Application of glulam in a traditional Japanese house (jikugumi)

Three Major Application of Glue Laminated Wood for Japanese Traditional Housing

Wood use for an average-size house of 35 “tsubo” or 115,5 m² floor space:
- Sawn timber & glulam: 0,2 m³ for one m² (115,5 x 0,2 m³ = 23,1 m³)
- Wood-based panels: 0,0503 m³/m² for a jikugumi house (115,5 x 0,0503 m³ = 5,81 m³) or 0,058 m³/m² for a US-type 2x4 house (115,5 x 0,058 m³ = 6,70 m³);

>> i.e. one average house consumes 28,9 - 29,8 m³ sawn timber, glulam and wood-based panels;
>> wooden roof rafters ~ 1 m³ for each jikugumi house of size of 115,5 m².

Source: R. Takahashi, May 2012
Residential housing in Japan - 2 x 4 Features

Adoption of 2 x 4 construction in Japan: prefectures with above-average 2 x 4 construction: Aichi, Chiba, Fukuoka, Hokkaido, Hyogo, Kanagawa, Saitama and Tokyo

Differences between Japanese and North American 2 x 4 technology:
Panel sizes: Japan: 3 ft x 6 ft (914 mm x 1829 mm) // USA & Canada: 4 ft x 8 ft panel size

Japanese builders dislike North American sizing which is not fitting with tatami (traditional flooring mat sizes, usually with a fixed aspect ratio of 2:1)

Spacing of studs and joists: Japan: 455 mm (17.9 inches) USA & Canada: 16 inches (405 mm)

Solid wood vs. WBP: Japan: more solid wood/glulam USA & Canada: more wood-based panels

<table>
<thead>
<tr>
<th>Residential wooden houses</th>
<th>2012</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of 2 x 4 houses</td>
<td>107 500</td>
<td>115 000</td>
<td>120 000</td>
</tr>
<tr>
<td>Number of other wooden houses</td>
<td>379 000</td>
<td>383 000</td>
<td>385 000</td>
</tr>
<tr>
<td>Total, wooden residential houses</td>
<td>486 500</td>
<td>498 000</td>
<td>505 000</td>
</tr>
</tbody>
</table>
Japan’s tsunami damage in March 2011

The earthquake & tsunami fully destroyed 104,000 houses, 96,000 homes to half, and damaged 378,000 homes partially in Miyagi, Iwate, Fukushima, Chiba, Ibaraki, Tochigi and Gunma.

Survival rate of wooden houses was above average (jikugumi houses were equal to 2x4 houses).

The 2 x 4 Association inspected 20,895 homes in March-July and found out that no 2 x 4 homes were completely destroyed and only four houses were half-destroyed.

The image of wood-frame homes was enhanced.

Replacement and repair construction estimate: 3,2 M m3 sawn timber and 785 000 m3 wood-based panels between March 2011 and late 2015.

Source: Japan Prefab Homes Builders Association
Wood promotion for public buildings in Japan

Around 40 % of Japan’s wood consumption is used for construction. Stagnation of residential construction will be felt more within steel-frame and concrete construction.

New legislation to promote use of wood in public buildings was imposed in late 2010. The Government is promoting wooden structures and wooden interior decoration in public buildings whenever it is possible under the building codes.

Building codes and material standards will be revised accordingly as soon as results from extensive experimental work e.g. as to fire resistance of wood structures are available. Special attention is paid to low-rise wooden buildings up to three storey.

Targets in non-residential buildings:
- non-wood 92 % in 2010 >> down to 65 % in 2020
- wood 8 % (~870 000 m3) in 2010 >> up to 35 % (~3 900 000 m3) in 2020

Source: Forestry Agency at Ministry of Agriculture, Forestry and Fisheries, Japan, 2010-2013
Production of sawn timber and wood-based panels (m3) in Japan

<table>
<thead>
<tr>
<th>Year</th>
<th>Sawn timber</th>
<th>Conifer ST</th>
<th>Plywood (*)</th>
<th>Particleboard</th>
<th>Fibreboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>17 231 000</td>
<td>16 100 000</td>
<td>3 218 000</td>
<td>1 261 000</td>
<td>447 000</td>
</tr>
<tr>
<td>2005</td>
<td>12 825 000</td>
<td>12 200 000</td>
<td>3 212 000</td>
<td>1 234 000</td>
<td>420 000</td>
</tr>
<tr>
<td>2006</td>
<td>12 800 000</td>
<td>12 200 000</td>
<td>3 262 000</td>
<td>1 245 000</td>
<td>437 000</td>
</tr>
<tr>
<td>2007</td>
<td>11 632 000</td>
<td>11 900 000</td>
<td>3 073 000</td>
<td>1 245 000</td>
<td>475 000</td>
</tr>
<tr>
<td>2008</td>
<td>10 884 000</td>
<td>10 600 000</td>
<td>2 586 000</td>
<td>1 243 000</td>
<td>397 000</td>
</tr>
<tr>
<td>2009</td>
<td>9 291 000</td>
<td>9 076 000</td>
<td>2 287 000</td>
<td>972 000</td>
<td>320 000</td>
</tr>
<tr>
<td>2010</td>
<td>9 415 000</td>
<td>9 190 000</td>
<td>2 645 000</td>
<td>960 000</td>
<td>340 000</td>
</tr>
<tr>
<td>2011</td>
<td>9 434 000</td>
<td>9 183 000</td>
<td>2 486 000</td>
<td>959 400</td>
<td>374 000</td>
</tr>
<tr>
<td>2012 ca.</td>
<td>9 150 000</td>
<td>8 910 000</td>
<td>2 550 000</td>
<td>960 000</td>
<td>370 000</td>
</tr>
</tbody>
</table>

Note: Some sources give output data by calendar years and some other sources by fiscal years
(*) share of conifer plywood including larch plywood was 92% in 2012; LVL included
# Imports of coniferous sawn timber (m3) in Japan

<table>
<thead>
<tr>
<th>Year</th>
<th>Coniferous Sawn Timber</th>
<th>Main Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2004</td>
<td>8 140 000</td>
<td>Canada 50 %</td>
</tr>
<tr>
<td>2005-2007</td>
<td>7 640 000</td>
<td>Canada 43 %</td>
</tr>
<tr>
<td>2008</td>
<td>6 210 000</td>
<td>Canada 45 %, Russia 11 %, Finland 11 %</td>
</tr>
<tr>
<td>2009</td>
<td>5 600 000</td>
<td>Canada 34 %, 12 % Russia</td>
</tr>
<tr>
<td>2010</td>
<td>6 150 000</td>
<td>Canada 39 %, Russia 13 %</td>
</tr>
<tr>
<td>2011</td>
<td>6 572 000</td>
<td>Canada *) 41,5 % according to Canadian sources but only 35,4 % according to Japanese sources (MOF); from Russia 865 239 m3, 13 %</td>
</tr>
<tr>
<td>2012 E</td>
<td>6 185 000</td>
<td>Canada 41 % according to MOF, Russia 13 %</td>
</tr>
</tbody>
</table>

Note: Some sources give output data by calendar years and some other sources by fiscal years.

Canada 2011: imports of conifer sawn timber from Canada to Japan 2 328 341 m3
## Imports of Wood-based panels and glulam (m3) in Japan

<table>
<thead>
<tr>
<th>Year</th>
<th>Plywood</th>
<th>Particleboard</th>
<th>Fibreboard</th>
<th>OSB</th>
<th>Glulam (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2004</td>
<td>4 868 000</td>
<td>210 000</td>
<td>490 000</td>
<td>200 000</td>
<td>550 000</td>
</tr>
<tr>
<td>2005-2007</td>
<td>4 486 000</td>
<td>222 000</td>
<td>517 000</td>
<td>213 000</td>
<td>706 000</td>
</tr>
<tr>
<td>2008</td>
<td>3 560 000</td>
<td>185 000</td>
<td>490 000</td>
<td>218 000</td>
<td>404 000</td>
</tr>
<tr>
<td>2009</td>
<td>2 844 000</td>
<td>182 000</td>
<td>415 000</td>
<td>177 000</td>
<td>457 000</td>
</tr>
<tr>
<td>2010</td>
<td>3 130 000</td>
<td>206 000</td>
<td>476 000</td>
<td>212 000</td>
<td>564 000</td>
</tr>
<tr>
<td>2011</td>
<td>3 666 000</td>
<td>272 000</td>
<td>449 000</td>
<td>298 000</td>
<td>671 000</td>
</tr>
<tr>
<td>2012</td>
<td>3 660 000</td>
<td>276 000</td>
<td>450 000</td>
<td>227 000</td>
<td>693 000</td>
</tr>
</tbody>
</table>

Note: Some sources give output data by calendar years and some other sources by fiscal years
*) domestic production of glulam averaged 1 291 000 m3 in 2010-2012
Japan: Conclusions

Japan has had a post World War II shortage of domestic wood resources to meet its requirements in residential and industrial use.

It is a traditional importer of high-quality wood products with tight product requirements due to the high specialization of end-users.

Since 2010 policies have been instigated to promote the use of wood in public buildings. At the same time the government aims to increase Japan’s self-sufficiency (from present 30% to 50%) through encouraging processing logs from its maturing planted coniferous forests.

Government launched a Wood Points program on April 1, 2013 with a purpose to increase the usage of domestic forest products to 28 million m3 by 2015.
7. Market assessment of wood products in South Korea

Korea in the world’s forest products consumption

Sources: Worldmapper with FAOSTAT
Residential housing indicators in South Korea

**Home ownership:** all Korea: 56 % (IMF 60,7 %), Seoul 45 %, chonsei/jeonse rental system based on lump-sum deposit to the owner for use of the property with no additional requirement for periodic rent payments. Deposit is fully refunded at the end of contract period with no interest.

**Average floor space/capita:** 10,1 m² in 1990, 33 m² in 2012, e.g. in Gwangju in the South 40 m²

**Affordable homes:** real problem especially in Seoul; new government incentives in August 2013

**Urbanisation:** with 83,2 % still scope for further urbanisation which will go into new satellite cities around Seoul and a few other major cities. Sejong City, 120 km South of Seoul, will become new administrative capital next year.

**Total housing starts** in 2013 decreased by 6 % from 2012; building permits for wooden houses in 2013 went down by 8 % from 2012.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Permits</td>
<td>10 184</td>
<td>11 022</td>
<td>10 922</td>
<td>11 382</td>
<td>7 365</td>
<td>6 782</td>
</tr>
<tr>
<td>Number of Starts</td>
<td>8 191</td>
<td>9 503</td>
<td>9 558</td>
<td>10 159</td>
<td>6 440</td>
<td>6 073</td>
</tr>
</tbody>
</table>
Residential construction by type in South Korea 2000-2020

The consumers’ preferences are favorable for wood-based housing.

Rising income level and greater interest for wellness will contribute to lower-rise housing including wooden and hybrid houses.

Wooden construction types in South Korea

◦ Architectural: renovation of original/old buildings or new bld. with traditional design. E.g. hundreds of low-cost roof-top housing cells (Ok-Tab-Bang) are installed every month, and they are becoming very common in the eight largest cities of Korea. Cross Laminated Timber (CLT) can substitute brick and concrete structures and initial experiments are under way.

◦ Light Frame Wood House (2 x 4 system) : most of new wooden residential buildings.

◦ Non-residential (Mixed-use and Commercial, etc.): post-and-beam structure and hybrid system with engineered wood for school buildings, golf club houses, education centres, churches, etc.

◦ Outdoor: wooden decking, gazebos, small bridges, etc.

Regulatory framework for wooden building in South Korea

□ The fire resistance performance standard of light wood frame building as contained in the (Korea Standard) KS F 1611-1 and KS F 1611-3

□ Building height made of wood construction shall be limited to 18 m and building height excl. roof shall be limited to 15 m

□ The gross floor are of wood construction shall be limited to 3 000 m², and fire-partitions shall be provided for every 1 000 m². Only if sprinklers are installed for fire-protection, the gross floor area shall be allowed to 6 000 m². The light-frame construction shall be limited to three storey but with sprinkler it is allowed for a 4-storey building

Source: Mr. KANG Byung-Ok, Director, Architecture Planning, Min. of Construction & Transportation, 2010
Examples of recent wood building projects in Korea

Mirinae Village in Yangpyung 65 km from Seoul (1.5 storey houses)

Main materials are coniferous sawn timber from B.C. Canada and Canadian OSB

Lake Hills Golf Club, Suncheon: 450 m³ straight & curved glulam beams

First 4-Storey Wood Frame Building in Korea

Shin-Lim: Roof-top Housing Cells from Bricks/Concrete – in future these can be of Cross Laminated Timber (CLT)

Source: Mr. TAI Jeong, Canada Wood, Seoul, May 2013
Production of sawn timber and wood-based panels (m3) in South Korea

<table>
<thead>
<tr>
<th>Year</th>
<th>Sawn timber</th>
<th>Conifer ST</th>
<th>Plywood*)</th>
<th>Particleboard</th>
<th>Fibreboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4 370 000</td>
<td>3 800 000</td>
<td>619 000</td>
<td>722 000</td>
<td>943 000</td>
</tr>
<tr>
<td>2005</td>
<td>4 360 000</td>
<td>3 608 000</td>
<td>627 000</td>
<td>847 000</td>
<td>1 653 000</td>
</tr>
<tr>
<td>2006</td>
<td>4 360 000</td>
<td>2 744 000</td>
<td>674 000</td>
<td>777 000</td>
<td>1 642 000</td>
</tr>
<tr>
<td>2007</td>
<td>3 800 000</td>
<td>3 300 000</td>
<td>699 000</td>
<td>955 000</td>
<td>1 717 000</td>
</tr>
<tr>
<td>2008</td>
<td>3 350 000</td>
<td>3 100 000</td>
<td>650 000</td>
<td>955 000</td>
<td>1 600 000</td>
</tr>
<tr>
<td>2009</td>
<td>3 140 000</td>
<td>3 000 000</td>
<td>494 000</td>
<td>934 000</td>
<td>1 660 000</td>
</tr>
<tr>
<td>2010</td>
<td>3 620 000</td>
<td>3 500 000</td>
<td>450 000</td>
<td>920 000</td>
<td>1 830 000</td>
</tr>
<tr>
<td>2011</td>
<td>3 700 000</td>
<td>3 000 000</td>
<td>422 200</td>
<td>1 077 300</td>
<td>2 021 700</td>
</tr>
<tr>
<td>2012</td>
<td>3 700 000</td>
<td>3 000 000</td>
<td>455 000</td>
<td>815 000</td>
<td>1 900 000</td>
</tr>
<tr>
<td>2020 F</td>
<td>2 500 000</td>
<td>400 000</td>
<td>1 100 000</td>
<td>2 100 000</td>
<td></td>
</tr>
</tbody>
</table>

The Government of ROK will promote wider use of SW from domestic pine plantations, and support with soft loans the development of fast-growing planted forests up to 1 mill. ha by abroad by 2050. Target for self-sufficiency is 22% in 2020.

Sources: Korean statistics adjusted with FAOSTAT
**Imports of coniferous sawn timber (m3) in South Korea**

<table>
<thead>
<tr>
<th>Year</th>
<th>Conifer Sawn Timber</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2004</td>
<td>297 000 Canada No.1 followed by Chile, New Zealand and Russia</td>
</tr>
<tr>
<td>2005-2007</td>
<td>389 000 Canada No. 1, followed by Russia, Chile, PRC and NZ</td>
</tr>
<tr>
<td>2008</td>
<td>350 000 53.1% from Canada</td>
</tr>
<tr>
<td>2009</td>
<td>715 000 24.5% from Canada, 22.4% from Chile, 19.9% Russia</td>
</tr>
<tr>
<td>2010</td>
<td>1 200 000 27.0% from Russia, 22.6% from Chile, 19.5% from Canada</td>
</tr>
<tr>
<td>2011</td>
<td>1 789 000 Chile No. 1, Russia No. 2, Canada with 18% No. 3</td>
</tr>
<tr>
<td>2012</td>
<td>1 470 000 Canada No 1, Chile No.2, Russia No.3</td>
</tr>
<tr>
<td>2020 F</td>
<td>2 200 000</td>
</tr>
</tbody>
</table>

Russian pine enjoys good quality reputation, especially Siberian pine (Irkutsk, Krasnoyarsk) for more demanding applications than rough formwork.

RFE larch has a good future potential if promotion is carried out carefully.

Sources: Korean import statistics
## Imports of Wood-based Panels and Gluelam (m3) in South Korea

<table>
<thead>
<tr>
<th>Year</th>
<th>Plywood *)</th>
<th>Particleboard</th>
<th>Fibreboard</th>
<th>OSB</th>
<th>Gluelam</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-04</td>
<td>1,212,000</td>
<td>726,000</td>
<td>523,000</td>
<td>23,600</td>
<td>2,000</td>
</tr>
<tr>
<td>2005-07</td>
<td>1,281,000</td>
<td>827,000</td>
<td>435,000</td>
<td>42,500</td>
<td>4,800</td>
</tr>
<tr>
<td>2008</td>
<td>1,050,000</td>
<td>623,000</td>
<td>400,000</td>
<td>62,000</td>
<td>6,900</td>
</tr>
<tr>
<td>2009</td>
<td>750,000</td>
<td>615,000</td>
<td>190,000</td>
<td>58,000</td>
<td>8,100</td>
</tr>
<tr>
<td>2010</td>
<td>845,000</td>
<td>766,000</td>
<td>226,000</td>
<td>66,000</td>
<td>9,700</td>
</tr>
<tr>
<td>2011</td>
<td>1,300,000</td>
<td>715,800</td>
<td>116,000</td>
<td>56,700</td>
<td>11,800</td>
</tr>
<tr>
<td>2012</td>
<td>1,050,000</td>
<td>630,000</td>
<td>105,000</td>
<td>65,000</td>
<td>13,900</td>
</tr>
<tr>
<td>2020 F</td>
<td>1,700,000</td>
<td>750,000</td>
<td>170,000</td>
<td>120,000</td>
<td>74,000</td>
</tr>
</tbody>
</table>

EWPs, construction plywood, LVL, OSB, gluelam and CLT will enjoy strong growth at the expense of standard sawn timber in 2014-2020; CLT to grow very fast after 2014.

*) Plywood including LVL (laminated veneer lumber); gluelam: also square laminated logs incl.

Sources: Korean statistics adjusted with FAOSTAT
Republic of Korea (ROK) is a slowly growing market for mainly construction wood products, including engineered wood products (EWP) for modern and quality-consistent building components.

Further urbanization and promotion of wooden construction as a part of the Governments’ green economy policy are the main drivers of wood imports.

Due to limited forest resources the country is highly dependent on imported logs and wood products.

There is further scope for expansion at a moderate pace, supported by government incentives for hybrid wood construction and the approval of new building codes.
8. Forecast of wood products imports in China, Japan and the Republic of Korea up to 2020
## Comparison of key housing indicators in the PRC, Japan and Korea

<table>
<thead>
<tr>
<th>P.R. China</th>
<th>PRC</th>
<th>Japan</th>
<th>JPN</th>
<th>Republic of Korea</th>
<th>ROK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditure of income to housing 10 % (China Statistics Bureau: underestimated)</td>
<td></td>
<td>Expenditure of income to housing 21,6 %</td>
<td>Aver. home: 1,8 rooms/person</td>
<td>Expenditure of income to housing 16 %</td>
<td></td>
</tr>
<tr>
<td>- HK 44 %, Shanghai 37 %, - Beijing 31 %</td>
<td></td>
<td>Home ownership: JPN 61,2 %</td>
<td>- Tokyo 44,6 %, Osaka 52,9 %</td>
<td>Average home: 1,4 rooms/person</td>
<td></td>
</tr>
<tr>
<td>Home ownership: PRC 85 %</td>
<td></td>
<td>- Hokkaido 57,2 %</td>
<td>- Akita 78,4 %, Shiga 70,4 %</td>
<td>Home ownership: ROK 56 %</td>
<td></td>
</tr>
<tr>
<td>rural 98 % urban 75 %</td>
<td></td>
<td></td>
<td></td>
<td>Seoul: home ownership 45%</td>
<td></td>
</tr>
</tbody>
</table>

### Summary statements:

Residential housing incl. home decoration constitutes the main driver of demand for wood products in PRC, Japan and ROK.

PRC: use of wood for construction in urban areas was banned for circa 40 years until 2004. Concrete formwork was the only exception. Use of wood for furniture was unrestricted. High-rise concrete houses dominate residential construction.

Japan: wood-based housing is popular still in urban residential areas. Gov’t tries to raise the share of public buildings with wooden structure from 8% in 2010 to 35% in 2020. The image of wood-framed houses was enhanced after the tsunami.

ROK: the time of traditional (Haksa-Jea) partly wood-based houses with tile roof and large wooden floor is over. High-rise concrete houses dominate residential construction.
Comparison of key market drivers in the PRC, Japan and Korea

<table>
<thead>
<tr>
<th>P.R. China</th>
<th>PRC</th>
<th>Japan</th>
<th>JPN</th>
<th>Republic of Korea</th>
<th>ROK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>1 349,6 mill.</td>
<td>Population</td>
<td>127,3 mill.</td>
<td>Population 49,0</td>
<td>Population 49,0</td>
</tr>
<tr>
<td>change</td>
<td>change + 0,46 % p.a.</td>
<td>change - 0,1%</td>
<td>change + 0,57 % p.a.</td>
<td>change + 0,18 %</td>
<td>change + 0,18 %</td>
</tr>
<tr>
<td>65 + years</td>
<td>9,4 %</td>
<td>65 + years</td>
<td>24,8 %</td>
<td>65 + years 12,3 %</td>
<td>65 + years 12,3 %</td>
</tr>
<tr>
<td>Urbanisation</td>
<td>50,6 %</td>
<td>Urbanisation</td>
<td>91,3 %</td>
<td>Urbanisation 83,2</td>
<td>Urbanisation 83,2</td>
</tr>
<tr>
<td>change</td>
<td>change + 2,85 % p.a.</td>
<td>change + 0,57 % p.a.</td>
<td>change + 0,71 % p.a.</td>
<td>change + 0,71 %</td>
<td>change + 0,71 %</td>
</tr>
<tr>
<td>GDP/capita</td>
<td>USD 8 700</td>
<td>GDP/capita</td>
<td>USD 36 900</td>
<td>GDP/capita USD 32</td>
<td>GDP/capita USD 32</td>
</tr>
<tr>
<td>Disp. income</td>
<td>USD 3 292</td>
<td>Disp. income</td>
<td>USD 24 147</td>
<td>Disp. income USD 17</td>
<td>Disp. income USD 17</td>
</tr>
</tbody>
</table>
| GDP Growth rates
<table>
<thead>
<tr>
<th>Year</th>
<th>PRC</th>
<th>JPN</th>
<th>ROK</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>11.3</td>
<td>1.3</td>
<td>4.0</td>
</tr>
<tr>
<td>2006</td>
<td>12.7</td>
<td>1.7</td>
<td>5.2</td>
</tr>
<tr>
<td>2007</td>
<td>14.2</td>
<td>2.2</td>
<td>5.1</td>
</tr>
<tr>
<td>2008</td>
<td>9.6</td>
<td>-1.0</td>
<td>2.3</td>
</tr>
<tr>
<td>2009</td>
<td>9.2</td>
<td>-5.5</td>
<td>0.3</td>
</tr>
<tr>
<td>2010</td>
<td>10.4</td>
<td>4.7</td>
<td>6.3</td>
</tr>
<tr>
<td>2011</td>
<td>9.3</td>
<td>-0.6</td>
<td>3.7</td>
</tr>
<tr>
<td>2012</td>
<td>8</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2013 f</td>
<td>7.6</td>
<td>2.0</td>
<td>2.8</td>
</tr>
<tr>
<td>2014 f</td>
<td>7.3</td>
<td>1.2</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Summary statements:

P.R. China will continue to offer the best market opportunities to RFE exporters of forest products btw. today and 2020.

Japan will be stagnating market in volume terms in 2014-2020. Japan is a most sophisticated, quality-minded market which means more attractive prices for advanced wood products.

ROK grows slowly, lags behind Japan in quality requirements, but will develop in the same direction as Japan did during the last 20 years. Short-term opportunities for wood-based products can be found but long-term prospect is bleak.

PRC is a new market for most advanced wood products, such as glulam and other engineered wood products (EWP). This can be also a positive factor since a market can be “created” in the PRC, whereas especially Japan but also ROK constitute “established” markets for most wood products.
## Forecast of coniferous sawn timber imports in the East Asian markets

<table>
<thead>
<tr>
<th>P.R. China (PRC)</th>
<th>Imports of sawn conifer timber</th>
<th>RUS share</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>469 000 m³</td>
<td>27,5%</td>
</tr>
<tr>
<td>2005</td>
<td>1 700 000 m³</td>
<td>53,5 %</td>
</tr>
<tr>
<td>2012</td>
<td>13 890 000 m³</td>
<td>44,7 %</td>
</tr>
<tr>
<td>2020</td>
<td>22 200 000 m³</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

**Demand drivers 2013-2020:**
- rising disposable income, fast urbanisation, growth of mobility and leisure
- rapid increase of weekend homes, holiday centres, public buildings
- growth of interior decoration with more floor space/capita
- Canadian-US promotion

<table>
<thead>
<tr>
<th>Japan (JPN)</th>
<th>Imports of sawn conifer timber</th>
<th>RUS share</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2004</td>
<td>8 140 000 m³</td>
<td>8 %</td>
</tr>
<tr>
<td>2005-2007</td>
<td>7 640 000 m³</td>
<td>14 %</td>
</tr>
<tr>
<td>2012</td>
<td>6 185 000 m³</td>
<td>13,2 %</td>
</tr>
<tr>
<td>2020</td>
<td>5 800 000 m³</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

**Demand factors 2013-2020**
- high disposable income, low birth rates, ageing population, saturation of wood-based traditional jigukumi housing
- growth of 2 x 4 housing with North American efforts
- growth of wooden non-residential buildings; also multi-storey buildings

<table>
<thead>
<tr>
<th>Republic of Korea (ROK)</th>
<th>Imports of sawn conifer timber</th>
<th>RUS share</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2004</td>
<td>297 000 m³</td>
<td>6,5 %</td>
</tr>
<tr>
<td>2005-2007</td>
<td>389 000 m³</td>
<td>11 %</td>
</tr>
<tr>
<td>2012</td>
<td>1 470 000 m³</td>
<td>20 %</td>
</tr>
<tr>
<td>2020</td>
<td>2 200 000 m³</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

**Demand drivers 2013-2020**
- scope for further urbanisation, government incentives for wood construction, approval of new building codes
- hybrid construction: concrete with wooden structures, roof-top small housing units to enable potential for EWPs such as CLT, glulam
- 2 x 4 promotion by Canada
## Forecast of plywood and LVL imports in the East Asian markets

<table>
<thead>
<tr>
<th>P.R. China</th>
<th>Imports of plywood</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1 000 000 m³</td>
</tr>
<tr>
<td>2005</td>
<td>700 000 m³</td>
</tr>
<tr>
<td>2012</td>
<td>200 000 m³</td>
</tr>
<tr>
<td>2020 F</td>
<td>350 000 m³</td>
</tr>
</tbody>
</table>

Conifer plywood to grow fast

**Import potential of LVL**
- LVL standard since 2005 but consumption of construction LVL averaged only 5 500 m³ p.a. in 2007-2012 but demand will increase very fast from 2014 onwards upon startup of the 1st domestic LVL mill
- demand forecast 210 000 m³ whereof imports 90 000 m³

<table>
<thead>
<tr>
<th>Japan</th>
<th>Imports of plywood</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2004</td>
<td>4 868 000 m³</td>
</tr>
<tr>
<td>2005-2007</td>
<td>4 486 000 m³</td>
</tr>
<tr>
<td>2012 E</td>
<td>3 660 000 m³</td>
</tr>
<tr>
<td>2020 F</td>
<td>3 500 000 m³</td>
</tr>
</tbody>
</table>

Imports mainly deciduous plyw.

**Import potential of LVL**
- LVL is well-known in Japan, further growth possible due to hybrid construction with steel and concrete structures
- consumption of LVL in 2012 220 000 m³ whereof imports 45%; structural LVL 85%; import ca 150 000 m³ in 2020

<table>
<thead>
<tr>
<th>Republic of Korea</th>
<th>Imports of plywood</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2004</td>
<td>1 212 000 m³</td>
</tr>
<tr>
<td>2005-2007</td>
<td>1 281 000 m³</td>
</tr>
<tr>
<td>2012 E</td>
<td>1 118 000 m³</td>
</tr>
<tr>
<td>2020 F</td>
<td>1 350 000 m³</td>
</tr>
</tbody>
</table>

**Import potential of LVL**
- use of structural LVL negligible in 2005-2007, 3 500 m³ p.a., consumption 5 000 m³ in 2012, all imported
- LVL to grow in hybrid structures and in 2 x 4 construction although Canadian 2 x 4 promoters prefer SPF and OSB; demand forecast 65 000 m³ in 2020
### Forecast of particleboard and fibreboard imports in the East Asian markets

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>P.R. China Imports of particleboard (m3)</th>
<th>Japan Imports of particleboard (m3)</th>
<th>Republic of Korea Imports of particleboard (m3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
<td>344 000</td>
<td>210 000</td>
<td>726 000</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>578 000</td>
<td>222 000</td>
<td>827 000</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>410 000</td>
<td>276 000</td>
<td>630 000</td>
</tr>
<tr>
<td></td>
<td>2020 F</td>
<td>450 000</td>
<td>250 000</td>
<td>600 000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>440 000</td>
<td>490 000</td>
<td>523 000</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>900 000</td>
<td>517 000</td>
<td>435 000</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>140 000</td>
<td>450 000</td>
<td>105 000</td>
</tr>
<tr>
<td></td>
<td>2020 F</td>
<td>150 000</td>
<td>480 000</td>
<td>170 000</td>
</tr>
</tbody>
</table>

The MDF capacity in PRC was excessive in 2012.
### Forecast of OSB and glulam imports in the East Asian markets

<table>
<thead>
<tr>
<th>P.R. China</th>
<th>Imports of OSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>18 000 m³</td>
</tr>
<tr>
<td>2005</td>
<td>57 000 m³</td>
</tr>
<tr>
<td>2012 E</td>
<td>132 000 m³</td>
</tr>
<tr>
<td>2020 F</td>
<td>380 000 m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Imports of glulam</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
</tr>
<tr>
<td>2005</td>
</tr>
<tr>
<td>2012</td>
</tr>
<tr>
<td>2020 F</td>
</tr>
</tbody>
</table>

Larch of major interest for glulam. CLT will grow from zero to tens of thousands of cubic metres before 2015.

<table>
<thead>
<tr>
<th>Japan</th>
<th>Imports of OSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2004</td>
<td>200 000 m³</td>
</tr>
<tr>
<td>2005-2007</td>
<td>213 000 m³</td>
</tr>
<tr>
<td>2012 E</td>
<td>227 000 m³</td>
</tr>
<tr>
<td>2020 F</td>
<td>340 000 m³</td>
</tr>
</tbody>
</table>

Imports of glulam

| 2000-2004 | 550 000 m³ |
| 2005-2007 | 706 000 m³ |
| 2012 E    | 693 000 m³ |
| 2020 F    | 770 000 m³ |

Market of short glulams saturated, demand for long glulam beams to grow fast, together with CLT.

<table>
<thead>
<tr>
<th>Republic of Korea</th>
<th>Imports of OSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2004</td>
<td>23 600 m³</td>
</tr>
<tr>
<td>2005-2007</td>
<td>42 500 m³</td>
</tr>
<tr>
<td>2012 E</td>
<td>60 000 m³</td>
</tr>
<tr>
<td>2020 F</td>
<td>120 000 m³</td>
</tr>
</tbody>
</table>

Imports of glulam

| 2000-2004 | 2 000 m³ |
| 2005-2007 | 4 800 m³ |
| 2012 E    | 13 900 m³ |
| 2020 F    | 74 000 m³ |

Gluelam and CLT to grow very fast between 2014 and 2020. Both suitable also for hybrid structures with steel/concrete.
9. Market assessment of biofuels in Russia, China, Japan and South Korea
Policy framework for liquid biofuels in Europe

Europe leads the way in setting up regulatory frameworks for creating market pull for sustainable liquid biofuels. Some of measures will impact also non-European countries through trade, transports and services.

Lowering of emissions from aviation has recently suffered from a delay in Europe (EU-ETS), and the first low-sulphur shipping fuel directives are being put into place in 2015 in Northern European seabed.

Renewable Energy Directive (RED, 2009), which mandates transportation sector to use at least 10 % renewables in final energy consumption by 2020 is undergoing a proposal for amendments:

- forest-based biofuels to lose their double and four times counting against targets;
- a 2,5 % target for advanced biofuels, wherein forest-based ligno-cellulosic feedstock is included (specifically bark, branches, leaves, sawdust and cutter shavings, and other ligno-cellulosic material except saw logs and veneer logs); and
- a 6 % cap for food and energy crop derived biofuels.
Existing and future value chains in forest industries

**Biomass**
- Forest (Logs, Thinnings/Harvest residuals, Bark)
- Short rotation forestry
- Energy crops
- Agricultural waste
- Municipal solid waste
- Ecosystem services (Carbon, Watercourses, Biodiversity, Leisure)

**Trading**
- Waste (Discarded wood, Processing waste, Recycled paper)

**Primary manufacture**
- Sawmill
- Panel plant
- Pulp mill
- Biorefinery
- Paper/board mill (Reels, Sheets)
- Conversion
- Independent power plants (Co-fired, Power/CHP)
- Biorefinery (2G biofuels, Basic chemicals)

**Downstream manufacture**
- Intermediate and final solid wood products
- Engineered wood components
- Builder’s joinery, carpentry, floors, furniture

**Distribution/end products**
- Panel plant
- Conversion
- Biochemicals, plastics, Biomaterials
- Transportation fuels
- Commercial/domestic boilers
- Investable assets/offsets

**End of life**
- Waste wood (recycled, incinerated)
- Waste paper (recycled, incinerated)
- Waste (recycled, incinerated, landfill)
- “New”

**“Old”**
- Engineered wood components
- Builder’s joinery, carpentry, floors, furniture
- Grid power Heat networks Co-located heavy energy user
- Waste paper (recycled, incinerated, landfill)
- “Old”
Technological pathways to produce bioenergy

Thermo-Chemical
- Combustion
  - Excess air
    - Heat & Power
  - Partial air
    - Fuel Gases (CO + H₂)
      - SNG, Hydrogen
      - Liquid transport fuels
  - No air
    - Heat & Power

Bio-Chemical
- Gasification
  - Heat & Power

- Pyrolysis
  - Char & Liquids
    - Heat & Power

- Hydrolysis & Fermentation
  - Liquid transport fuels

Physical
- Pellets
- Briquettes
- Torrefied pellets
- Bio Carbon
- Heat & Power
Bio-carbon and pyrolysis products

- Biomass pyrolysis products include torrefied biomass, bio-carbon, bio-oil and producer gas.
- Torrefied wood chips are mainly composed of cellulose and lignin.
- Torrefaction reaction rates are highest in straw, followed by deciduous woods and coniferous woods.
- Slow pyrolysis yields bio-carbon pellets, fast pyrolysis yields bio-oil with bio-carbon as by-product.
- Biocarbon pellets have an energy density 65-70% higher than that of conventional wood pellets. The product is water-resistant and can be stored outdoors; it does not reabsorb moisture after drying.
## Production, trade and consumption of wood pellets (tons) in 2012

<table>
<thead>
<tr>
<th>Country</th>
<th>Production</th>
<th>Exports</th>
<th>Imports</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>791,000</td>
<td>729,000</td>
<td>1,000</td>
<td>63,000</td>
</tr>
<tr>
<td>China</td>
<td>100,000</td>
<td>3,000</td>
<td>0</td>
<td>97,000</td>
</tr>
<tr>
<td>Japan</td>
<td>78,000</td>
<td>0</td>
<td>71,000</td>
<td>149,000</td>
</tr>
<tr>
<td>South Korea</td>
<td>18,000</td>
<td>0</td>
<td>122,000</td>
<td>140,000</td>
</tr>
</tbody>
</table>
Co-firing potential of wood pellets/chips with coal

Coal-fired power plants account for 79% of power generation the PRC, for 27% in Japan and for 65% in Korea.

China will maintain its present coal dependence; Japan (after Fukushima) and ROK will use more coal in 2014-2020.

The PRC has rich coal resources for the next 35-100 years; Japan and South Korea will rely on imports of coal.

All three countries import oil and natural gas (LNG), but price per generated power unit is not competitive with coal.

Co-firing increases burning inconsistency in comparison to coal, and generates marginal chlorine traces which are harmful to boilers due to corrosion. Normal wood pellets cannot be ground as fine as coal before burning.

Co-firing with wood chips is possible only up to 5% with coal. Coarse wood chips are not recommended for co-firing.

Wood pellets can account for max. 20% in co-firing with coal.

Next degree of processing is biocarbon/biochar pellets; both are technically suitable for co-firing with coal, but not yet feasible for commercial production.

<table>
<thead>
<tr>
<th>Technical criteria</th>
<th>Wood Pellets</th>
<th>Biocarbon Pellets</th>
<th>Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Content</td>
<td>7 - 10 %</td>
<td>1 - 5 %</td>
<td>10 - 15 %</td>
</tr>
<tr>
<td>Calorific Value (GJ/t)</td>
<td>16 – 20</td>
<td>20 - 24</td>
<td>17 - 28</td>
</tr>
<tr>
<td>Bulk density (kg/m3)</td>
<td>550 - 750</td>
<td>700 - 850</td>
<td>800 - 850</td>
</tr>
<tr>
<td>Off-gassing*</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

(* “Off-gases” are spontaneously produced during storage or transportation, and may pose a health and fire hazard)
Pyrolysis oil

Fast pyrolysis of biomass is one of the most promising technologies for converting biomass to liquid fuels (BTL).

Pyrolysis bio-oil is produced by thermal treatment of biomass in absence of oxygen.

Pyrolysis oil has a lower heating value (~50%), higher acidity and higher solids content in comparison to fossil fuel oils. Wood-based pyrolysis oils tend to be acid and corrosive (ASTM D7544-12 applies). Oils are biodegradable.

Compared to conventional wood pellets and biocarbon pellets, pyrolysis oil has a higher energy density and a better transport economy. Can serve as an alternative product to pellets in utilizing sawmill residues.

Processing of pyrolysis oil into car or truck fuels is too expensive at the moment. Pyrolysis oil cannot compete with coal as power-plant fuel if bioenergy incentives are missing.

VTT of Finland estimates that liquid biofuel from logging residues can be processed at a cost of EUR 0,50 - 0,70 per litre. VTT’s calculation basis is a 300 MW processing plant. If by-product heat energy can be utilised for district heating or as industry steam (e.g. for drying of sawn timber), the overall utilisation degree of biomass can achieve 74-80 %.
RTP™ (Rapid Thermal Process) pyrolysis

Technical concept by Envergent Technologies (UOP/ENSYN JV):

- Uses fluidised-bed technology in which heat exchange is based on sand.
- Pre-treated and dried biomass is fed into reactor for oxygen-free gasification.
- Gas from the reactor goes to a cyclone which separates sand and other solids.
- Gas is fed into a condenser for cooling and liquefying.

Investment and viability:

- A pyrolysis unit for a biomass capacity of 400 bone-dry tonnes per day (BDMTPD) costs around EUR 28 million, and a complete pyrolysis plant EUR 37 million.
- This plant size would produce 85 000 t pyrolysis oil p.a. and would need 270 000 m$^3$ chips (cubic metres solid measure).
- The cost of pyrolysis oil would be circa EUR 42/MWh at a non-integrated plant and EUR 29-30/MWh at an integrated plant (big pulp or wood-industry mill or a big CHP).
- Even the lower cost is prohibitive in the market place in comparison to coal if no supporting tax or polluter pays -system exists.
Liquid biofuels and green chemicals: an emerging global market

- Market pull for liquid BF hinges on political decisions on the dominant strategy for decarbonizing the transport sector: electricity vs. natural/biogas vs. bioethanol/ biodiesel. Localized demand can be found in energy-intensive industries, district heating and power generation.
- Natural gas has been a short term alternative for “green fuel”, while fracking of shale gas and oil sands in North America have put off demand for bio-oil despite large government supply-side stimulation and investment subsidies in both biomass production and installations of new biofuel plants.
- Green chemicals refining business could be much more profitable than liquid biofuels; the global market for chemicals is worth $3 trillion.
- Base chemicals are produced from some 10 different raw materials (fossil fuels, minerals, salt, water and biomass).
- Around 85% of all chemicals are produced from 20 base chemicals (ethane, propane, butane, ammonia, benzene, methanol, etc.).
- Base chemicals are converted to around 300 intermediate chemicals (acetic acid, formaldehyde, urea, ethane oxide, acetaldehyde, etc.).
- Further used into at least 35,000 consumer products (plastics, electronics, solvents, detergents, pharmaceuticals, bio-composite materials, etc.).
- Indicative value-added potential:
  - in intermediate chemicals: 10 times higher than in fuel
  - In final consumer products: 50 times higher than in fuel
Policy framework on renewable energy is only emerging in Russia

There is neither a comprehensive regulatory framework nor financial supporting mechanism for promoting 2nd generation liquid biofuels in transportation or energy production in Russia. Same regulations, requirements and standards are applied to 2nd gen. biofuels as to conventional fossil fuels (i.e. no blending mandates or tax reliefs are yet applicable).

Consequently, the production of both 1st and 2nd generation biofuels is very poorly developed in Russia. Government target for a 3% share of biofuels in consumption by 2015 and 10 % in 2020 seems far-stretched.

At a Federal level, the founding policy documents are:

3. *Comprehensive Program on Development of Biotechnology in the Russian Federation until 2020*;

Key bioenergy and biofuel targets are:

- 10% share in motor oil;
- 10% share in generation of thermal power;
- 20% share in solid biofuels in the European market (mainly pellets);
- 5% share in the world market for motor biofuels and additives.
Russia’s BioTech 2030 Programme

Industrial Biotech is fully legalized in Russia and its recent embodiment is the BioTech 2030 Programme.

Representative of the Russian BioTech 2030 Programme indicate that the current oversupply of Russia’s grain harvest (20 Mt but will grow up to 70 Mt/yr.) could be used for 1st generation biofuels without distortion to the food chains.

Move towards 2nd generation biofuels based on straw and wood biomass in Russia can be supported with regulatory measures, but less by negative image of 1st generation biofuels than elsewhere.

Logical development clusters can be identified in wood and agri-business platforms across the country. Russian Biofuels Association experts are available to support and identify partners.

Russia would also benefit from the introduction of international best-practices and standards on sustainability of biofuels, and appropriate risk management on producing, handling and using chemicals (e.g. EU REACH).
Drivers for biofuels in Russia

Biofuel demand is currently very limited but signals from remote areas indicate local costs of fossil fuels getting prohibitively high and transports restricted (at extreme cases diesel is delivered with airplanes). In regions like Altay there is a huge pile-up problem with wood and agricultural waste. Locally produced crude bio oil would serve as alternative to heating oil and low-sulphur substitute to heavy bunker oil for shipping (North Europe first).

Decentralized and mobile small-scale units can serve the local crude bio-oil production and immediate consumption better than large centralized plants. Scaling up from multiple smaller units is also necessary for supplying to oil refineries.

Aviation and transport biofuels and biochemical production would require hydro-treatment, cracking and distillation at large scale in oil refineries, but initial volumes may be too small to attract refineries buy into bio-based blending stocks.

The most potent drivers are:
- Feedstock supply is becoming a pressuring force towards biofuel production (waste handling). Access and costs need to be understood through a proper policy, regulatory and sector reviews in agricultural and forest sectors (per region).

- Economic development and employment creation in remote regions and rural communities can be activated around biofuels and energy self-sufficiency (keeping areas inhabited).

- High cost of hydro-carbons, resulting in high operational costs in transports, high emissions from poor energy efficiency in production and use, and health and environmental concerns over fossil fuels.

- Long tradition of biochemistry in Russian academia and research institutions. This needs to be followed up with applied science, technology partnerships and commercialization of new technologies.
Policy framework on renewable energy in China

The world’s biggest carbon emitter, China, launched emission trading schemes (ETS) in six regions in 2013 and plans expanding to a national scheme in 2015.

China is the most successful host country under CDM with over half of the 600 million UN carbon credits totally issued.

China has committed to invest heavily in clean energy resources and improving energy efficiency in the 12th Five Year Plan (2011-2015) and aims to cut the carbon intensity of its economy 40%–45% below 2005 levels by 2020.

Target on renewable energy share is 15% in 2020.
Policy versus practice in China

The readiness of Chinese coal-fired power plants to biomass co-firing is far from that of Japan or Korea.

Many big coal-fired plants are located in inland, making transport cost of imported pellets prohibitive to any reduction of CO2 emissions of power plants.

China aims at 1,3 % bio-energy share in its energy mix in 2015. It means some 500,000 Mtce. Biomass power should reach 13 GW at the end of the 12th five-year plan (2011-2015), and 18 GW by 2020.

Generation of biogas is supposed to amount to 22 billion m3. Bio-ethanol target is 3,5 - 4 M tonnes (1,9 M tonnes in 2011) and bio-diesel target one M tonnes (50 000 tonnes in 2011, mainly of jathropa and other plants but not wood).

China’s solid fuel (all biomass) target is 10 million tonnes during the same period. There are 250 manufacturers of solid fuels mainly from straw in China, with output of 3,2 million tonnes in 2011. The share of wood-based solid fuels is estimated at just 30 000 tonnes p.a.

The Government pays subsidies in the range of RMB 100 - 150 per tonne for gasification of straw or wood pellets.

China will import wood pellets but likely much less than the Republic of Korea and Japan.

Pyrolysis oil from the Russian Far East could have a market as a substitute of heavy fuel oil in city-area district heating plants in the North of China.

It is early days to assess competitiveness of RFE pyrolysis oil in China because cost structure of manufacturing in the RFE and also cost of transports to Chinese destinations are umknown until fully-fledged liquid biofuel feasibility studies are made.
National Energy Strategy of 2006 outlined high ambitions on reducing dependency on fossil fuels and producing more biofuels. 2008 Law to Promote the Usage of Biomass Resources to Produce Biofuels lent support to feedstocks and processors, right before economic recession kicked in.

Following Fukushima, the closure of country’s most nuclear power plants has forced energy companies to restart coal-fired and also idled oil-fired plants although oil is the most expensive fuel source.

Returning to coal, the cheapest source of energy, was considered a realistic policy move despite the nation’s plans to cut carbon emissions. Several new coal-fired power plants will be installed within the next three years.

In October 2013 Japan relaxed its previous UNFCCC 2020 targets to lower CO₂ emissions by -25% (against 1990 levels), to -3.8% in comparison to 2005 levels and +3% in comparison to 1990 levels!

Japan has postponed the creation of a national cap-and-trade emission trading scheme until 2014 after industry concerns, but plans for a bilateral offset mechanism that would serve as an alternative to the Kyoto Protocol's CDM. Bilaterally, it would be possible to get credits from nuclear projects and carbon capture and storage (CCS) as well.
Policy _versus_ practice in Japan

Majority of Japan’s nuclear power plants were closed indefinitely after the Fukushima disaster and since then Japan increased imports of natural gas and coal. Government is advocating that some of the nuclear plants be re-opened, what would allow more ambitious CO2 emission targets.

Japan will aim to cut emissions by 2.8% through planting of trees, while the remainder will be done by reducing emissions from energy utilities and industry, or by offsetting emissions through purchasing of carbon credits from other countries.

Government introduced a feed-in-tariff (FIT) scheme in July 2012. FIT applies to electricity generated of wood biomass, and the scheme obliges electricity utilities to purchase it at fixed prices up to 20 years.

Lobbied by the industries, gov’t set out a guideline that requires biomass power producers to purchase wood biomass unused by traditional industries and to ensure the traceability of purchased biomass.

With the enforcement of FIT scheme, a number of biomass power stations are scheduled to start operation in the next few years in Japan, which may launch competition for wood biomass between power producers and traditional industries.

The renaissance of coal-fired power plants in Japan offers good market opportunities for RFE suppliers of conventional wood pellets for co-firing in existing and new coal-fired power plants. Biocarbon pellets (with 70% higher energy density than wood pellets) would be accepted technically but there is not yet a market price for biocarbon pellets.

Pyrolysis oil is potentially of high demand but not yet commercially available.
Production of Wood Pellets in Japan in 2003-2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Wood Pellets</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>3 800</td>
</tr>
<tr>
<td>2005</td>
<td>22 000</td>
</tr>
<tr>
<td>2006</td>
<td>25 000</td>
</tr>
<tr>
<td>2007</td>
<td>30 000</td>
</tr>
<tr>
<td>2008</td>
<td>36 000</td>
</tr>
<tr>
<td>2009</td>
<td>51 000</td>
</tr>
<tr>
<td>2010</td>
<td>58 000</td>
</tr>
<tr>
<td>2011</td>
<td>78 000</td>
</tr>
<tr>
<td>2012</td>
<td>n.a.</td>
</tr>
</tbody>
</table>
Policy framework on renewable energy in Korea

In Korea renewable energy accounted for 2-3% of total power generation in 2010-2011. Target for renewable energy in 2020 is 11%.

Within renewable energy hydropower had 25.5%, waste (garbage) 59%, solar energy 5%, wind 5%, biomass gas 3%, fuel cells 2%, wave power from the ocean 0.3% and biomass pellets merely 0.22%.

Korea has committed on high international level (Rio+20, MDGs, UNFCCC, etc.) to implement its national version of a green economic growth plan.

Government aims to launch a carbon emission trading scheme (ETS) in 2015 - two years later than originally planned.

A 2% biodiesel blending rate was introduced in 2012.

Source: Eco-Frontier, Korea, May 2013
Policy *versus* practice in South Korea 1

Government is facing opposition from business groups because the ETS may increase production costs for domestic companies.

Korea launched a domestic offset mechanism in May 2011, which allows large firms to receive carbon credits by investing in clean technology in smaller companies.

Korea has committed to cut emissions by 30% below business as usual-level by 2020 (4% reduction against 2005 levels).

Government has approved construction of eight new coal-fired plants.

The long-term energy program of the Government concludes that biomass co-firing is the most economical solution for a significant increase of renewable energy.

Korea is ready for large-scale use of wood pellets for co-firing in power plants.
Policy *versus* practice in South Korea 2

The Korean RPS (Renewable Portfolio Standard) calls for gradually increasing obligatory rates of renewable energy.

RFS (Renewable Fuel Standard) policy is under discussion and public hearing, and may be implemented in 2014.

A management system of energy & GHG came into force April 2010; obliges 13 power companies (min. 500 MW) to comply with RPS.

1 MWh output is equivalent to 1 REC (Renewable Energy Certificate); the compliance companies have to generate power from renewable energy or buy REC from the market to meet their renewable portfolio imposed. The price of REC was USD 87 in May 2013.

Examples of large-scale users:

- Yeo-Su Coal Power Plant uses 150,000 tpa of wood pellets for co-firing.
- Tae-An, Ha-Dong and Dong-Hae were committed to start using wood pellets in 2013.
- Dong-Hae and Dangjin are constructing new bio-power plants based exclusively on the use of wood pellets (and some wood chips at Dong-Hae).

Korean experts forecast that consumption of wood pellets will achieve 4.7 – 5.0 million tons in 2020.

Source: Eco-Frontier, Korea, May 2013
Imports of Wood Pellets to the Republic of Korea in 2009-2012

- 2009: 12,042 t
- 2010: 20,000 t (full year)
  - Jan-March 2010: 4,139 t
  - Jan-June 2010: 13,447 t
  - Jan-Oct 2010: 7,473 t
- 2011: 25,000 t
- 2012: 122,000 t

Diagram showing imports from China, Vietnam, Chile, and Etc. for the specified periods.
South Korea: start of a major wooden pellet market

The Korean wood pellets market is expected to grow substantially due to the newly introduced government plan, according to which power companies will have to increase the proportion of renewable electricity production.

60% of this renewable energy is expected to be produced with wood pellets. Korean Forest Service assesses that the maximum domestic production of wood pellets is 1 million tons per year and forecasts an annual demand of 5 million tons by 2020 (thus, 4 million tons will have to be imported).

Forecast Korean wood pellets demand by sector in 2020:

- Power plants: 2,880 M tons
- Greenhouses: 1,250 M tons
- Households: 840 M tons

According to the IEA bioenergy report, the Korean power sector would have a demand of 15 million tons of wood pellets by 2020 if 2% of the national coal consumption will be substituted every year. This is considering the higher renewable energy requirements and the projected growth in Korea’s energy consumption.
Demand potential for wood pellets in Korea in 2008-2030

Forecast wood pellets consumption in 2020: 5 M t
## Market assessment of solid biofuels in the East Asian markets

<table>
<thead>
<tr>
<th>Country</th>
<th>Energy Source</th>
<th>Biofuels Used</th>
<th>Power Generation</th>
<th>Energy Source</th>
<th>Biofuels Used</th>
<th>Power Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.R. China</td>
<td>Coal</td>
<td>Pellets, biocarbon</td>
<td>79%</td>
<td>Coal</td>
<td>Pellets, biocarbon</td>
<td>79%</td>
</tr>
<tr>
<td>Japan</td>
<td>Coal</td>
<td>Pellets, biocarbon</td>
<td>27%</td>
<td>Coal</td>
<td>Pellets, biocarbon</td>
<td>27%</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>Coal</td>
<td>Pellets, biocarbon</td>
<td>65%</td>
<td>Coal</td>
<td>Pellets, biocarbon</td>
<td>65%</td>
</tr>
</tbody>
</table>

### Co-firing potential in China

**Coal-fired power plants** account for 79% of power generation in the PRC. Coal to stay as No. 1 energy source. China’s coal reserves for 30-100 years ahead. Only few coal-fired power plants are located on the coast.

**Co-firing potential in China**

Straw pellets are of interest due to rich domestic supply despite the low calorific value. Its output of pellets was 1,2 M m³ mainly for exports in 2012 and imports less than 0.2 Mm³. Wood pellets only 100,000 t.

### Co-firing potential in Japan

**Coal-fired power plants** account for 27% of power generation. Due to the Fukushima disaster Japan returns to coal and develops renewables. Japan depends on coal imports. Most coal-fired power plants are located on the coast.

**Co-firing potential in Japan**

Japan has interest for wood pellets. Japan imported 71,000 t wood pellets in 2012. Japan has 60 pellet plants. Two big power plants started pellet use in 2009. Pellet imports will grow further and exceed 100,000 t p.a. in 2013.

### Co-firing potential in Korea

**Coal-fired power plants** account for 65% of power generation in Korea. ROK to build several new coal-fired plants in 2014-2020. Korea depends on imported coal. Most coal-fired power plants are located on the coast.

**Co-firing potential in Korea**

ROK has very great interest for imported wood pellets. ROK has 11 wood-pellet plants, with output 18,000 t in 2012. Production cost: KRW 400,000 per t in 2013. Material cost is 35% of total cost. Korea imported 122,000 t wood pellets in 2012. Demand forecast is high: 5.0 Mt in 2020.
Market assessment of liquid biofuels in the East Asian markets

**P.R. China**  **PRC**

**Liquid biofuels**

China’s share of renewable energy will increase to 15% by 2020.

PRC counts in the future more on processing of domestic agricultural residues (straw and corn residues) than imported biofuel of wood fibre.

China is the third largest global producer of bioethanol (based on wheat and corn).

**Japan**  **JPN**

**Liquid biofuels**

Japan is trying to reduce its dependency on imported oil to 80% by 2030.

Pyrolysis oil is potentially of high demand but not commercially available yet.

Japan’s supply of oil-based biofuels is set to 0.5 M m3 in 2017 and 1.0 M m3 by 2020.

Rice straw, crops residues and wood-based biofuels production is targeted at 6 million m3 by 2030.

**Republic of Korea**  **ROK**

**Liquid biofuels**

Demand potential of liquid-biofuel from the Russian Far East is promising in Korea.

There are no concrete projects by Korean firms on liquid biofuels.

**Russian Federation**  **RF**

Both 1st / 2nd gen. liquid biofuels are very poorly developed and regulations only under development in Russia.

Government target for a 3% share of biofuels in consumption by 2015 and 10% in 2020 seems far-stretched.
Liquid biofuel market summary

• The biofuel markets are highly policy dependant, and will remain so in the foreseeable future.
• In Russia, the Programme on development of Biotechnology through 2020 set optimistic targets of biofuel and bioenergy supply to reach by 2020: 1,500,000 toe oil and about 7 billion USD.
• State financial support will probably not be high due to the fact that the technology is not commercial yet: 10% share in motor oil; 10% share in generation of thermal power; 20% share of solid biofuel in the European market.
• Because the process for production of liquid biofuels is not yet commercially viable despite promises of Honeywell, Metso and other developers, the Russian Far East shall look for co-investors from Japan and/or ROK.

Source: Russian Customs Office: Far East branch
Russia’s WTO membership

• Russia joined WTO in August 2012, what has implications to its ability to use trade measures, such as log export taxes, to stimulate domestic wood industry. At the same time import protection of wood products will have to be lowered, correspondingly.

• The experiences of log export taxes have been mixed in different regions of the Federation. Alone these measures have been inadequate to induce foreign investments in expected large scale.

• RFE market may be affected above-average on relaxation of import tariffs due to its shipping infrastructure and proximity to China’s powerful wood industry.

• According to the experts of the Russian Economic School and Ernst & Young, reduction of import duties for forest products as a result of Russia's accession to the WTO will lead to an increase in volume of imported timber products and, consequently, the decrease in domestic timber production 25.9% in the RFE.

• The WTO-related reductions in duties will most probably increase demand for roundwood beyond tax-free quotas, and lead to localized raw material deficits on the domestic market. The shortages of raw material may undermine wood supply base for existing and planned value-added investment projects of larger scale.
Wood products export from the Russian Far East

- RFE exports decreased by 1 mill. m³ since 2010.
- Exports to China decreased by 18% since 2010, while exports to Korea increased by 113%.
- In 2012, Khabarovsky krai’s exports of wood products accounted for the 55% of the value of all RFE wood products exports.

RFE exports by wood product

- Industrial roundwood: 73%
- Sawnwood: 22%
- Veneer sheets: 3%
- Wood pellets/wood chips/MDF/Particle board: 2%

Regions’ share in wood products exports from RFE, 2012

- Primorsky krai: 36%
- Khabarovsky krai: 55%
- Amurskaya obl.: 1%
- Jewish AO: 8%

Total export values: 975 mill. USD.
Industrial roundwood export from the Russian Far East

- Exports of industrial roundwood from RFE reached the peak in 2007 (17.8 mill m3) and since then they kept decreasing till 5.7 mill m3 in 2012 (-67%).

- In 2012 China was the destination of 82% of the exports, while South Korea 15%.

- Khabarovsky krai accounted for 59% of the exports, Primorsky krai 30%, Amurskaya oblast 9%, and Jewish AO 2%.

- In 2012, 87% of the logs exported from RFE were from larch trees, 11% from birch and aspen and 2% from oak.

[Graph showing export volumes from 2005 to 2012]

[Bar chart showing tree species in industrial roundwood exports from RFE, 2012]
Sawnwood export from the Russian Far East

- Exports of sawnwood have continuously increased from 2005 till 2011, passing from 0.7 mill m3 to 1.7 mill. m3 (+142%), while in 2012 export decrease by 3%.

- In 2012, 87% of the exported sawnwood headed to China, 10% to South Korea and 3% to Japan.

- 51% of the exports were produced in Khabarovsky krai, 39% in Primorsky krai and 6% in Jewish AO.

- 67% of the exported sawnwood was produced with wood from larch, 2% from birch and aspen, 12% from oak, 7% from ash and 2% from pine.
Veneer sheets export from the Russian Far East

• Veneer sheets is the only RFE wood product in which imports of Japan greatly exceed those from China.

• In 2012 Japan’s imports dropped by 22% to 191,000 m³, while China’s imports doubled reaching 70 thousand m³.

• In 2012 Japan accounted for 73% of the export share, while China was the destination the remaining 27%.

• In 2012 Primorsky krai produced 94% of RFE exported veneer sheets, Amurskya oblast 5% and Khabarovskiy krai 1%.

• The type of wood used for the production was for 84% coniferous and for 16% non coniferous.
Russian Far East pulp and paper exports

Pulp and paper export

• In 2012 pulp and paper exports were still very small, reaching only 10,600 tons.

• In the period 2010-2012, the exports increased by 156%, but almost only recovered paper was exported.

• 64% of the exports comes from Primorsky krai and 34% from Khabarovsky krai.
Primorsky krai wood and wood products exports

Industrial Roundwood

- 95% of Primorsky krai exports of industrial roundwood went to China and 4% to Japan.
- The exports diminished from 2007 to 2012, from 6.5 to 1.7 mill. m3.
- 69% of the exported logs were from larch, 27% from birch and aspen and 4% from oak.
Sawnwood export from Primorsky Krai

• While Japan was the biggest importer from 2005 to 2008, since 2009 China began to rise its share reaching 584,000 m³ in 2012.

• 86% of exported sawnwood headed to China in 2012, 10% to South Korea and 4% to Japan.

• 32% of the exported sawnwood was produced with wood of larch, 28% with wood of oak, 25% with wood of birch and aspen and 15% with wood of Ash.
Veneer sheets and glulam export from Primorsky krai

- In 2012 exports of veneer sheets from Primorsky krai amounted to 235,000 m³, dropping by 16% from 2011.
- Japan’s imports of RFE veneer sheets declined by 36% last year, while China imported 26% more than in 2011.
- Japan is the destination of 82% of the exports, while China receives the remaining 12%.
- 94% of the exported veneer sheets were produced from coniferous trees.
- Exports of gluelam to Japan were quite stable in the 2010-2012 period, and stayed slightly above 10,000 tons in 2012.
Other wood products export from Primorsky krai

**Wood chips**

- Exports of wood chips doubled from 2010 to 2012, reaching 131,000 tons.
- In 2012, 44% of the exports headed to South Korea, 40% to China and 16% to Japan

**Medium Density Fiberboard**

- In 2010 and 2011 MDF have not been exported from Primorsky krai.
- In 2012, 132,000 m² of MDF were exported.
- 79% of the exports went to South Korea, 18% to Japan and 3% to China

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**Exports of wood chips from Primorsky krai, 1,000 tons**

- 2010: 20,000 tons
- 2011: 60,000 tons
- 2012: 140,000 tons

**Primorsky krai exports of MDF by country of destination (2012)**

- Total volume: 135,000 m³
- 79% to South Korea
- 18% to Japan
- 3% to China
Khabarovsky krai wood and wood products exports

Industrial roundwood

- Khabarovsky krai’s exports of industrial roundwood diminished from 2007 (9.7 mill m3) to 2012 (3.3 mill. m3) by 65%.

- South Korea had great hike of RFE industrial roundwood imports reaching 838 thou m3 in 2012, which is an increase of 246% from 2010.

- In 2012, 95% of the exported logs were from fir, larch and spruce trees, while 4% from birch and aspen trees.

**Industrial roundwood exports from Khabarovsky krai, m3**

**Industrial roundwood exports from Khabarovsky krai by tree species, 2012**

- Total volume: 3.4 mill. m3

- 95% from fir, larch and spruce trees
- 4% from birch and aspen trees
Sawnwood export from Khabarovsky krai

• Japan’s imports have decreased by 89% since 2005, while China’s one almost tripled from 2009 to 2011.

• China is the biggest buyer, accounting for the 84% of exports, but South Korea (12%) and Japan (3%) have a relevant market share.

• 89% of the sawnwood was produced using larch, 3% using oak wood, 3% ash and 5% birch, aspen and cedar wood.

Sawnwood exports from Khabarovsky krai, m3

Exports of sawnwood from Kahabarovsky krai by tree species, 2012

- Pine
- Larch
- Oak
- Ash
- Birch/Aspen

Total volume: 885,000 m3
Veneer sheets export from Khabarovsky krai

- In 2012 China was the only country which imported veneer sheets from Khabarovsky krai.
- Veneer sheets export decreased by 30% in 2012, amounting only to 3,100 m³.
- 92% of the exported products were produced with non coniferous wood.
Other wood products export from Khabarovsky krai

Wood Chips and wood pellets

- China imported wood chips in 2010 (29 thou tons) and 2011 (11,000 tons).
- In 2012 South Korea started importing wood pellets (48,000 tons).

Particle board

- Khabarovsky krai exported 35,000 m3 in 2012, improving by 70% 2010 results.
- In 2012, 50% of the exports headed to South Korea, 42% to China and 8% to Japan.
Amurskaya oblast’ wood and wood products exports

Industrial roundwood

• Amurskaya oblast diminished its exports of industrial roundwood by 64% from 2008 (1.5 mill. m³) to 2012, when exports reached 0.5 mill. m³.

• China dominates the market, importing almost all the logs which pass the Russian border.

• 94% of the exported logs come from larch, 5% from pine and 1% from birch and aspen.
Sawnwood and veneer sheets export from Amurskaya oblast’

Sawnwood

• In 2012 sawnwood exports decreased by 5%, amounting to 109,000 m³.
• China was destination of 94% of the exports, while Germany’s share was 5%.
• 85% of the sawnwood was produced with larch wood, 7% with birch and aspen wood, 4% with pine wood and 4% with spruce and fir wood.

Veneer sheets

• In 2012 veneer sheets’ exports increased by 12%, amounting to 12,000 m³.
• In the last three years, only China imported veneer sheets from Amurskaya oblast’.
• Exported veneer sheets were produced only with non coniferous wood.
Industrial roundwood and veneer sheets exports from Jewish AO

**Industrial roundwood**

- Exports of industrial roundwood decreased by 70% from 2007 to 2012 (105,000 m3).
- 89% of the logs were from larch trees, 11% from birch.

**Veneer sheets**

- Export of veneer sheets dropped in 2011 (-91%) and started growing again 2012 (4,400 m3).
- Exported veneer sheets were produced only of non coniferous wood.
Jewish AO wood and wood products exports

Sawnwood

- Exports of sawnwood from Jewish AO have greatly increased since 2008 (+326%), reaching 111,000 m³.
- 65% of the exported sawnwood was produced with larch trees, 31% with birch and aspen and 4% with pine.

Exports of sawnwood from Jewish AO by tree species, m³

- Total volume: 112,000 m³
- 65% Larch/Spruce/Fir
- 31% Birch/Aspen
- 4% Pine
RFE exports summary

- All wood products exports from RFE amounted to 976 mill. USD in 2012 (7.9 mill. m3), which was 12% of the entire wood product export value of the Russian Federation.
- In 2005 the export value was 952 mill. USD from 14.8 mill.m3 volume, dominated by unprocessed logs.
- Wood products are among the important exported goods in the Russian Far East with an 8.5% share of total export value from the region.
- Industrial roundwood exports fell from 13.9 mill. m3 in 2005 to 5.7 mill. m3 in 2012 as guided by the Russian Federation log export tax system.
- Sawnwood exports grew from 713,000 m3 in 2005 to 1.7 million m3 in 2012, what was the most positive development in RFE trade.
RFE exports structure and origins

• In 2012, as much as 73% of the exports were of industrial roundwood, 22% sawnwood, and 3% veneer sheets
• Remaining 2% were comprised of wood chips, wood pellets, particleboard and MDF
• Around 55% of the exports came from Khabarovsky, 34% from Primorsky, 8% from Amur and 3% from JAO
Industrial roundwood exports from RFE

- Industrial roundwood: peaked in 2007 (17.8 mill m3) and declined to 5.7 mill m3 in 2012 (-67%)
- 82% to China, 15% to South Korea
- Khabarovsky krai delivered 59% of exports, Primorsky krai 30%, Amurskaya oblast 9%, JAO 2%
- 87% of logs exported were larch, 11% birch and aspen, 2% oak
Sawnwood exports from RFE

- Increased from 0.7 mill m3 to 1.7 mill. m3 (+142%) in 2005 – 2011

- 87% of the exports headed to China, 10% to South Korea and 3% to Japan

- 51% of the exports were from Khabarovsky krai, 39% in Primorsky krai and 6% Jewish AO, 4% Amurskaya

- 67% of exports were larch, 12% birch and aspen, 12% oak, 7% ash and 2% from pine
Other wood products exports from RFE

- In 2012, 10,600 tons of waste and scrap of paper and paperboard were exported from RFE.
- In 2012, 35,000 m³ of particleboard were exported from Khabarovsky krai as well as 29,000 tons of chips, and 48,000 tons of pellets.
- In 2012, Khabarovsky krai exported 10,000 tons of glulam to Japan.
- In 2012, Primorsky krai exported 132,000 m² of MDF and 131,000 tons of chips.
- In 2012, less than 3,000 m³ of coniferous sawnwood was exported from Sakhalinskaya oblast’ to South Korea and Japan.
- Magadanskaya oblast’, Khamchatka and Chukotka did not export wood products in 2010 - 2012.
11. Export prices of wood products from RFE
• The RFE trend price for IRW exports is moving up and reached 112 USD/m3 in 2012.
• China and Japan paid 84% more for IRW in 2012 than in 2005.
• The RFE SW export trend price was flat at 212 USD/m3 in 2012.

• In 2012 Japan paid on average 376 USD/m3 of sawnwood, which was 141% more than China’s (156 USD/m3), and 109% more than Korea’s (180 USD/m3).
• Export prices of IRW from Primorsky to China went to 129 USD/m3
• Primorsky’s average IRW export trend price settled at 127 USD/m3 in 2012.
• Export price to Japan reached 473 USD/m³ in 2012, which was 50% more than in 2010. Export mix changed to include more high-value hardwoods.

• Exports to China had a value of 192 USD/m³ in 2012, 9% less than in 2009.

• Primorsky’s average SW export trend price was 235 USD/m³ in 2012.
• Export prices of Primorsky veneer sheets are determined mostly by Japan, i.e. moving up from 250 USD/m³ in 2010 to 344 USD/m³ in 2012.

• Long-term price trend was not available from the Far East branch of the Russian Customs.
Average prices of Primorsky wood chips ranged between 19-36 USD/m3 (China and Japan, respectively) in 2012.
The price of exported glulam from Primorsky krai was higher in comparison to the average price of exported glulam from the rest of Russia. This refers to the final composition of glulam as building components.

The price lowered in 2012 after a peak of over 1,110 USD/ton in 2011.
The price of exported Khabarovsky IRW to China increased from 68 USD/m3 in 2005 to 84 USD/m3 in 2012.

The average export trend price of Khabarovsky IRW was 98 USD/m3 in 2012.
• Exported Khabarovsky sawnwood to Japan (274 USD/m3) was 97% more expensive than sawnwood exported to China (139 USD/m3) in 2012. Species mix and quality explain

• Trend price of sawnwood exports from Khabarovsk was 180 USD/m3 in 2012.
Amursk IRW export price to China increased by 42% from 2005, reaching 104 USD/m³ in 2012.
• Prices of JAO exported IRW increased by 81% from 2005, reaching 96 USD/m³ in 2012.

• The export trend price for JAO IRW in 2012 was 100 USD/m³.
Summary of RFE export prices

- Average price of exported industrial roundwood from RFE has been trending upwards to $111/m3 in 2012 ($76/m3 in 2005)
- Export price of all sawnwood has been flat at around $212/m3 in 2005-2012
- Larch has become more common in SW exports, and China as the dominant low-price export destination
- Larch SW export trend price was $158/m3 in 2012