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Market for forest machinery producers in the Leningrad region

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Abstract
Need for timber and energy wood harvesting machinery in the Leningrad region has been assessed in this report as the region is one of the key customers for wood harvesting machinery in Russia. Actual cut has been about 8 million m^3 in the recent years and may not increase in the future due to challenges in implementation of the new Forest Code and increasing custom duties for round wood export. Recent and coming development of forestry practices in the region includes fast implementation of cut-to-length harvesting, transfer of technology, introduction of commercial thinnings and energy wood harvesting. The forest machine fleet in the Leningrad region is about 750 machines for traditional technology and about 120-150 machines for cut-to-length technology. Domestic machinery fleet is very old, and approximately 80% of the machines are utilised over normative assigned lifetime. Domestic forest machinery manufacturing has dropped both in quantity and models, and thus imported cut-to-length machinery is replacing domestic tree-length machinery.

Results indicate that the need for cut-to-length machinery is 20-30 harvesters, forwarders and short-wood trucks per year and could increase to 30-40 machines each in the near future. Maximum need for the machinery in the Leningrad region could be 50-60 harvesters, forwarders and short-wood trucks per year if allowable cut and thinnings would be realised in full scale. Need for energy wood harvesting machinery is about 4 biomass forwarders, 10 mobile chippers and wood chip trucks per year and could be 6 and 15-20 machines per year in the near future, respectively. Maximum need could be 30-40 biomass forwarders, mobile chippers and wood chip trucks per year if energy wood would be collected after fully realised allowable cut and thinnings.

Currently only one third of the forest leasers in the Leningrad region have enough forest resources and could be users of Nordic cut-to-length technology based on actual cut. These 41 enterprises would need 270 machines, of which 90 harvesters, 100 forwarders and 80 short-wood trucks. Thirty seven companies in energy wood harvesting would need about 50 biomass forwarders and chippers and about 60 wood chip trucks. Ten biggest enterprises would need half of the total fleet. Sixty percents of the forest leasers in the Leningrad region have enough forest resources and could be users of Nordic cut-to-length technology if allowable cut would be utilised completely and if also thinnings would be done in full scale. These about 70 enterprises would need 500-770 machines, of which 160-260 harvesters, 190-280 forwarders and 150-230 short-wood trucks. In energy wood harvesting 56-70 companies would need 100-150 biomass forwarders and chippers and 110-180 wood chip trucks. Also in this case top ten enterprises would need half of the total fleet.

Keywords
Russia, Leningrad region, forest resources, forest operations, logging enterprices, machinery

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Preface

The Leningrad region is one of the key forest industry producers in Russia and thus it is one of the key customers for wood harvesting machinery. The actual cut during the last years has been 8 million m^3 and may not increase in the near future due to challenges in the implementation of the new Forest Code and increasing customs duties for round wood export.

Recent development of forestry practices in Leningrad region includes fast implementation of cut-to-length harvesting, transfer of technology, introduction of commercial thinnings and energy wood harvesting. Traditional Russian wood harvesting systems have been used side-by-side with Nordic technology.

Logging enterprises in the Leningrad region play an important role in the wood procurement for comparatively developed forest industry in Northwest Russia. They have been among the most important suppliers of the Russian regions for the Finnish forest industry, exporting more than 3 million m^3 of industrial round wood annually. Companies are deeply rooted in the local communities and involved in the socio-economic development of rural districts.

This report has been prepared as part of the project "Possibilities for Energy Wood Procurement and Use in Northwest Russia" at the Finnish Forest Research Institute. The aim of the project has been to estimate the availability of different energy wood sources, their technical and economic availability in the Leningrad region, to design cost effective energy wood procurement systems and to assess needs for technology development. This project is part of a larger research consortium "Reduction of Greenhouse Gas Emissions in Russia – Finnish Business Opportunities" coordinated by the Lappeenranta Technical University, belonging to the CLIMBUS technology program of the Finnish Funding Agency for Technology and Innovation TEKES. Project at the Finnish Forest Research Institute has received funding from TEKES, Komatsu Forest, Stora Enso and UPM-Kymmene.

Joensuu, December 2007

Authors

1 Introduction

The total Russian market for wood harvesting machinery is approximately $150 million per year; and import accounts half of the total market (Belikov 2007). Domestic machinery production has collapsed after the collapse of Soviet Union both in quantity and models. Therefore import of machinery has been increasing substantially and is estimated to reach 500 machines or 200 million euros in the near future (Grishkovets 2006). Finnish manufacturers of wood harvesting and supportive machinery are market leaders in Russia, with nearly 50% market share (Hietikko 2006). Their products are generally known for quality and sturdiness. Relief of customs duties on the imported high-tech equipment (Government of Russian Federation 2006) further improves opportunities to sell Finnish machinery to Russia.

The Leningrad region is one of the key customers for wood harvesting machinery in Russia as this region is one of the major producers of forest products industry. The region produces 4% of the industrial round wood, 10% of the pulp and paper, and 3% of the sawn timber in Russia (Karvinen et al. 2006).

In this report we have analysed need for timber and energy wood harvesting machinery in Leningrad region.

1.1 Overview of forestry in the Leningrad region

The total growing stock of the Leningrad region is approximately 970 million m^3, of which at least 735 million m^3 was available for wood supply in 2006. Approximately 35% of the growing stock is pine, 29% spruce, 25% birch, 9% aspen and 2% other tree species.

About 63% of the Leningrad region's forests are considered to be commercial forests, where harvestable crop can be grown within a reasonable time. Much of this land is managed for timber purposes, while one million hectares are protected from harvesting based on legislation and policy.

The annual allowable cut is 9.4 mill m^3 under bark (u. b.) of which 3.9 mill m^3 coniferous and 5.5 mill m^3 deciduous tree species. The actual cut in 2006 was 8.2 million m^3, including 5.3 million m^3 from final felling, 1.4 million m^3 from thinnings (in Russian – *rubki promezhutochnogo pol'zovania*), and 1.5 million m^3 from other fellings.

The Leningrad region had 27 state forest units (*leskhoz*) in 2006. Figure 1 shows forest units and provides also information about the unit size of stocked forest area. Agricultural forests and other forests are taken into account as an aggregated unit in the map.

Recent development of forestry practices in Leningrad region includes:

- move towards cut-to-length harvesting (tree processed into assortments at the stump);
- transfer of technology;
- smaller harvesting sites;
- introduction of commercial thinnings;
- introduction of energy wood harvesting.

In January 2007, Russia dramatically changed the Forest legislation (Forest Code 2006). Regional government got new responsibility to manage 95% of the Leningrad region forested land. The federal government is responsible for the rest. As forest management now falls under regional and federal regulations, each region has its own set of statutes, policies, and regulations to govern how commercial forests can be utilized. Forests are leased in auction up to 49 years, and forest leasers have to take responsibility of forest management.

Russia aims to increase use of forest resources and aims to intensify forest management (increasing use of thinnings). Aim is also to increase wood processing in Russia. This requires substantial investments in the forest sector. Export of round wood will be made unprofitable when the program for increasing export duties for round wood will be implemented. Russia increased export customs duties of round wood to 20% of the export value or minimum of 10 Euro/m^3 1.7.2007. In the next phase it will be at least 25% or 15 Euro/m^3 by 1.4.2008 and 50% or 50 Euro/m^3 by 1.1.2009 (Government of Russian Federation 2007), which would eventually stop export of round wood. As 30% of the Leningrad region's round wood is exported mostly to Finland and Sweden, these changes would have dramatic impact on the region's forestry economy unless domestic demand would increase rapidly.

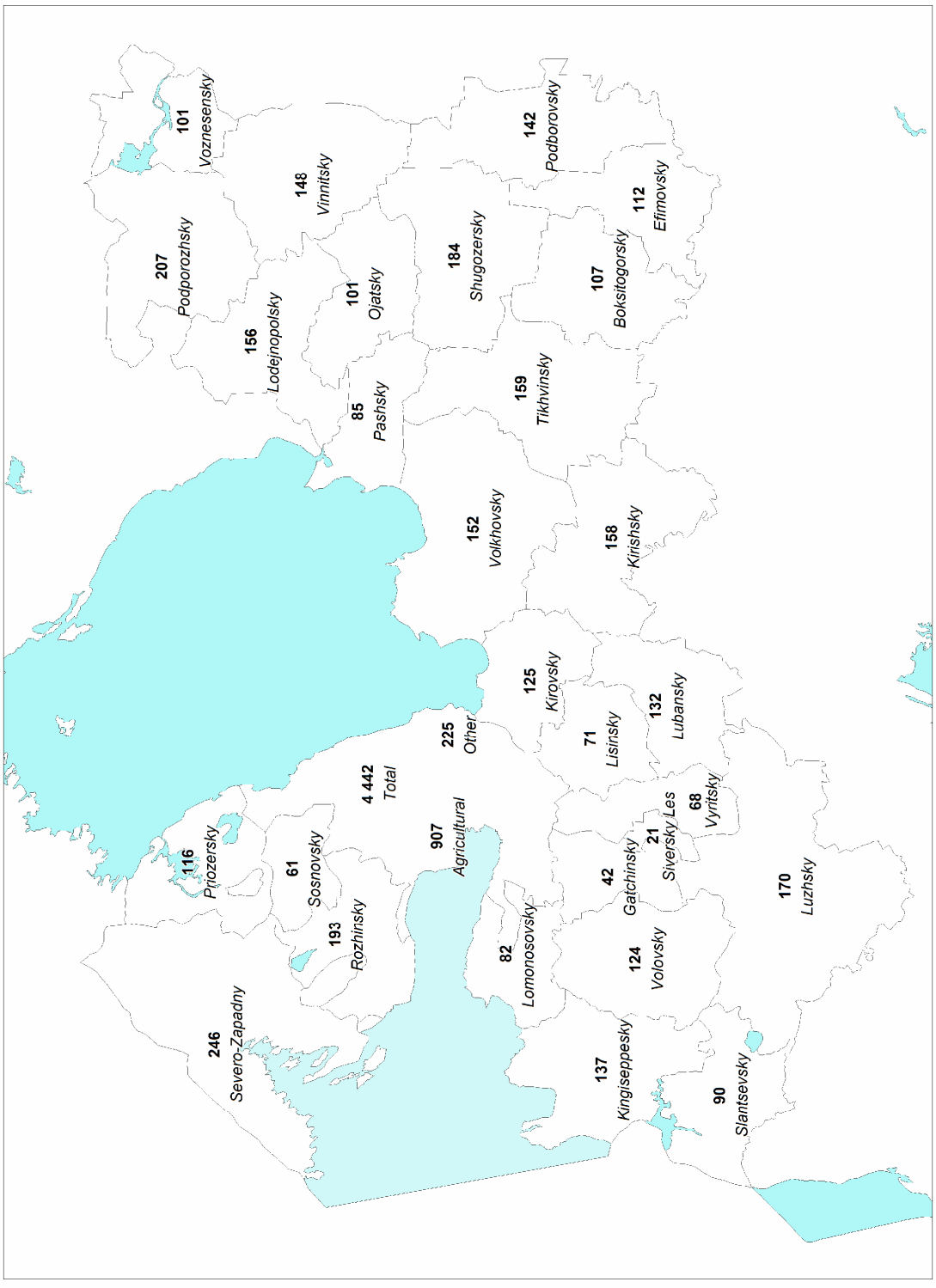

Figure 1. Stocked forest area (1000 ha) in forest units of the Leningrad region.

1.2 Overview of forest industry in the Leningrad region

The forest industry contributes significantly to the Leningrad region economy. Forest industry makes up over 16% of the Leningrad region's total industrial production and employs 16% of the industrial workforce (Gelvanovsky et al. 2006).

The structure of forest industries for this region is quite diverse. There are vertically integrated holdings, including different combinations of pulp and paper mills, sawmills, and logging enterprises. There are also independent companies, including small and medium sized enterprises (SME), supporting companies and organizations.

The forest industry experienced crisis and transition period after 1990. Table 1 shows development between 1990 and 2006 in sawmilling, pulp and paper production. Forest industry collapsed in 1990 after dissolving of the USSR, and stabilized between 1995 and 1998. There was growing period 1998-2000 due to the local currency default but stagnation since 2004 in other products than lumber and fiberboards.

Table 1. Forest industry production in Leningrad region 1990-2006.

Product	1990	1995	2000	2004	2005	2006
Lumber, 1 000 m^3	1201	394	392	379	429	622
Particle boards, 1 000 m^3	57	8	24	113	96	111
Fiberboards, 1 000 m^2	6 300	1 300	0,03	411	5 075	7 077
Paper, 1 000 tons	427	244	305	457	431	484
Pulp, 1 000 tons	528	275	374	540	506	533

Pulp and paper mills are located in Svetogorsk (OAO "Svetogorsk"), Sovetsky (OAO "Vyborgskaya tseluloza") and Syasstroy (OAO "Syasky TsBK"). Svetogorsky P&P consumes 1.5 mill m^3 u. b. of pulpwood per year, "Vyborgskaya tseluloza" 0.3 million m^3 per year, and Syasky P&P 0.3 million m^3 per year respectively.

The sawmill industry includes approximately 100 companies. Three largest companies produce 80% of the total sawn timber in Leningrad region. The most important sawmills are OOO "Svir-Timber" (Metsäliitto-Botnia, Podporozhye), OOO "Swedwood-Tikhvin" (IKEA, Tikhvin), OOO "Mayr-Melnhof-Holz Efimovsky" (Efimovsky), OOO "Priozersky DOZ" (Priozersk), and OAO "Lubansky LDOK" (Luban).

The wood-based boards industry in Leningrad region include fiberboard mill "Lesplitinvest" in Priozersk and particle-board mill "Zavod Nevsky Laminat" in Dubrovka.

The energy wood industry in Leningrad region includes pellet production. There are over 10 mills with the total capacity of about 100 thousand tons per year. The most important mills are "Biotek" (Nevskaya Dubrovka), "Biotoplivo" (Gatchina), "Green Pauer" (Gatchina), "Rospolitechles" (Ist-Izhora), "Salotti" (Lomonosov), "Ekopel" (Kirovsk), "Ekoresurs" (Lodeynoye Pole) and "Ekotech" (Podporozhye).

Figure 2 shows the key forest industry enterprises in the Leningrad region. Most of the forest industry capacity is concentrated among few administrative districts with well developed logging industry, such as Tikhvinsky, Vyborgsky, Priozorsky and Podporozhsky.

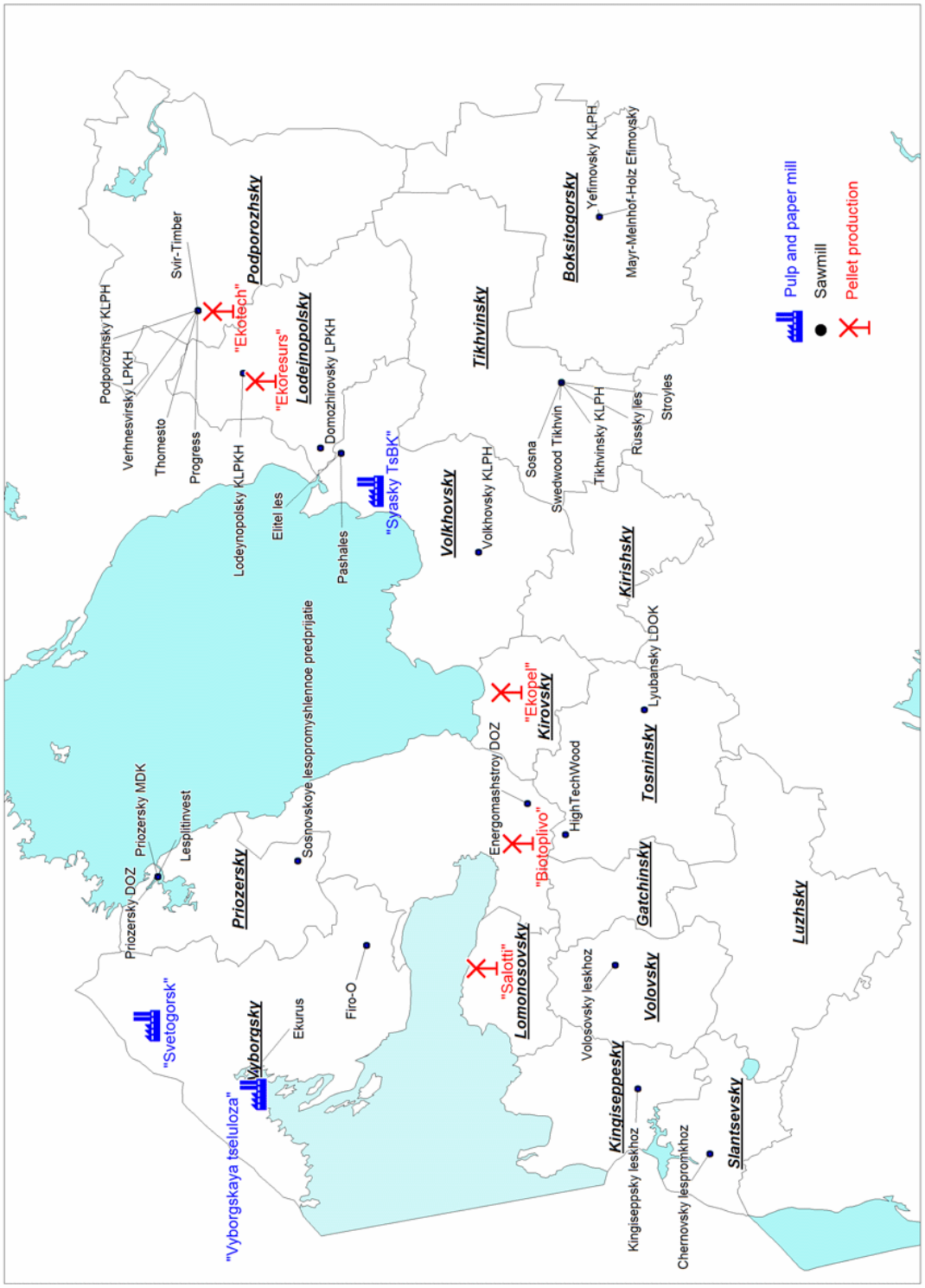

Figure 2. Location of the biggest forest industry enterprises in the Leningrad region. Administrative district underlined.

1.3 Overview of the market for wood harvesting and supportive machinery

The wood harvesting and supportive equipment markets in Russia have been driven by the demand in the domestic wood products markets and export. Growth in demand for wood harvesting machinery has historically been cyclical. Russia's wood harvesting and supportive machinery market corresponded to 330 million m^3 wood harvesting in 1990. Between 1990 and 1998, total market demand decreased to one third in real terms, and thus wood harvesting to 110 million m^3. Between 1998 and 2001, the total Russian demand for wood harvesting and supportive machinery increased as also wood harvesting increased to 150 million m^3 where it has been since then (Russian Forests 2005). Tree-length, full-tree and cut-to-length harvesting methods are common in Russia.

Tree-length or full-tree methods dominate in Russia. Approximately 75% of the logging is done with these methods, mostly using domestic machinery. The Russian forest harvesting equipment industry includes machinery, equipment, parts, and tools for harvesting trees, and moving raw logs. This technology has been developed for large scale clear felling operations and is used to extract commercial wood from forest stands. There are altogether 30 Russian producers for wood harvesting machinery. Only two of them are large: Onego and Altay tractor plants produce 12 models and approximately 500 machines per year. Major foreign supplier to Russia has been John Deere, known for its skidders and feller bunchers.

Cut-to-length harvesting, a system in which trees are processed into assortments at the stump, is growing in popularity all over the Northwest Russia. Common technology is to use machinery that can perform several tasks. Multipurpose machinery, such as rubber-tired harvester, is therefore expected to increase in number as this method is getting more and more common. As size of logging plots is decreasing, thinnings are introduced, smaller and more mobile forestry machinery will be needed. These machines should be able to move to new locations with ease, as less time is spent harvesting trees in each location.

Foreign manufacturers have about 80% of the market in Russian wood harvesting and supportive equipment for cut-to-length method. Major suppliers to Russia include John Deere, Ponsse and Komatsu Forestry, which are know for their harvesters and forwarders. Nordic forest harvesting and supportive equipment is recognized for its reliability, power, and robustness and is well suited to Russian customers who need it both for clear cutting and thinnings.

Earlier mentioned technology is currently used for traditional wood harvesting. Currently there is no specific machinery for energy wood harvesting as this is not common in Russia yet. Potentials are, however, substantial, as there is large amount of non-industrial wood in forests and felling residues are not used for energy production yet. Most of the current machinery is not suited for energy wood harvesting. Technology that has been developed and used for this purpose in Finland and Sweden would be suitable also in Russian conditions for this purpose.

2 Indentification of the market

The total global market for forest machinery is likely to be 6 000-8 000 machines per year, of which 3000 could represent cut-to-length machines (Asikainen 2005). If the logging business in Europe and Russia will be mechanised rapidly and if the marketing takeover in South and North America is successful, the annual volume may rise to 10000 machines.

The fleet of tree-length forest machines in Russia is estimated to 23 000 machines including 2 000 imported machines from North America (Eremeev 2007). The fleet of cut-to-length technology in Russia is estimated to 2 000 machines including 1 890 imported machines mostly from Finland (Nekhamkin 2007). One thousand harvesters and forwarders are working in Northwest Russia.

The forest machines fleet of Leningrad region is likely to be more than 750 machines for traditional technology and approximately 120-150 machines for cut-to-length technology (Volkov 2007).

2.1 Tree-length machinery

The tree length or full tree harvesting methods using Russian machinery is the most common technology today. In a typical method Russian caterpillar tractor manually skids felled trees to a stacking area. Delimbing can be done manually in a felling area (tree length method) or with a delimbing machine in a stacking area (full tree method) prior to transport. Timber trucks then transport the delimbed stems to a centralised and mechanised yard (so-called "lower landing/нижний склад") where they are cross-cut into different timber assortments. The assortments are then processed on site or loaded to railway wagons for transportation to domestic or export markets. Some enterprises use western machinery. A caterpillar feller-buncher fells and bunches trees on a strip-road where they are skidded using a wheel tractor with a clam-shell to a stacking area. A caterpillar harvester can also be used as a processor for delimbing and cross-cutting.

There are 22 enterprises producing forest harvesting and supportive equipment in Russia (Nekhamkin 2007), but the market has oligopoly character: over 90% of the forest machines are produced by Onego (37%) and Altay (54%) tractor plants (OTZ 2007). The total production of Russian forest machines is 400-500 machines per years (Rosstas 2006). There are 26 models of skidders and 16 models of feller-bunchers and delimbers.

Western forest machines for tree-length method are available on the Russian market as well, such as:

- Caterpillar – 12 models of feller-bunchers, skidders and delimbers
- John Deere – 11 models of feller-bunchers, skidders and delimbers.

However, the share of western machinery in the total Russian tree-length fleet is small, only 8% (Eremeev 2007).

Traditional producer of wood harvesting machines for Northwest Russia and Leningrad region is Onego tractor plant, which produced 360 machines in 2005 and 200 machines in 2006 (Government of Karelia 2007, Kareliastat 2006), mostly skidders. At least twenty five skidders were purchased by logging enterprises in Leningrad region in 2004. Some enterprises of Northwest Russia produced feller-bunchers, feller-skidders, delimbers, chap loaders etc based on skidders manufactured by Onego tractor plant.

Between 1970 and 1988 Onego tractor plant produced 10-12 thousand skidders per year (50% of the total production in the USSR). Production dropped dramatically during the "perestroyka" period (Figure 3).

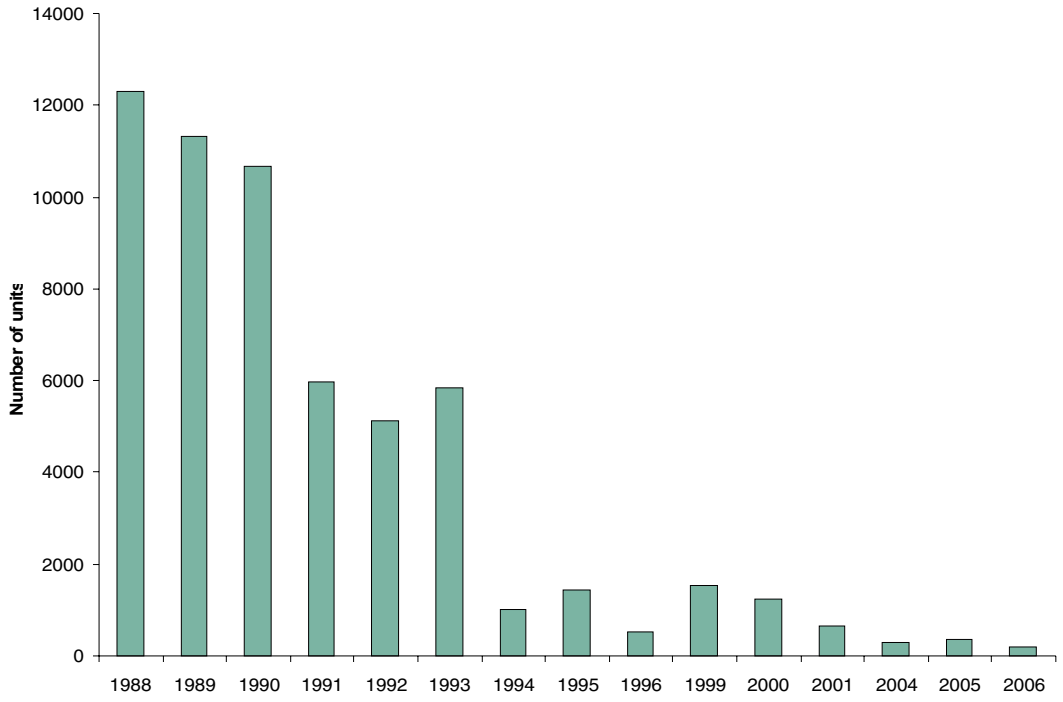

Figure 3. Production of skidders in Onego tractor plant between 1988 and 2005.

The crisis in skidders production immediately influenced production of other forest machines in other companies. The production of delimbers was cut down in Syktyvkar. This fact influenced directly on competitiveness of Russian forest construction industry.

In 2002 the plant tried to overcome the difficulties: marketing policy was changed and the dealer network was created. Onego tractor plant has produced since 2002 cable model TLT-100A (Figure 4) and crane model TB-1MA-15 (Figure 5). TLT-100A is the most important skidder for traditional Russian technology. TB-1MA-15 tractors are produced by order. Quality

and design of tractors are quite poor. Ergonomics of skidders correspond to Russian standards, but do not meet the Nordic requirements. New model TLT-300 with better ergonomic characteristics has been designed (Figure 6).

Figure 4. Cable model of caterpillar skidder TLT-100A (OAO “Onego tractor plant”).

Figure 5. Crane model of caterpillar skidder TB-1MA-15 (OAO “Onego tractor plant”).

Figure 6. Skidder TLT-300 (OAO “Onego tractor plant”).

Now the wood harvesting construction industry in Northwest Russia continues only in Onego tractor plant with two models of traditional caterpillar skidders.

According to Derfler et al. 2003 the average age of machines increased in from 5 to 12 years between 1992 and 2000 (Figure 7). Eighty presents of machines are utilized over normative assigned lifetime. As a result, availability rate of the machinery has decreased from 0.9 to 0.5 (Figure 8). It means that only half of the total Russian forest machine fleet is in a good state, i.e. operating/working conditions satisfy the conventional requirements.

Rate of wear of domestically made machines (worth loss of fixed assets) is 0.7-0.8.

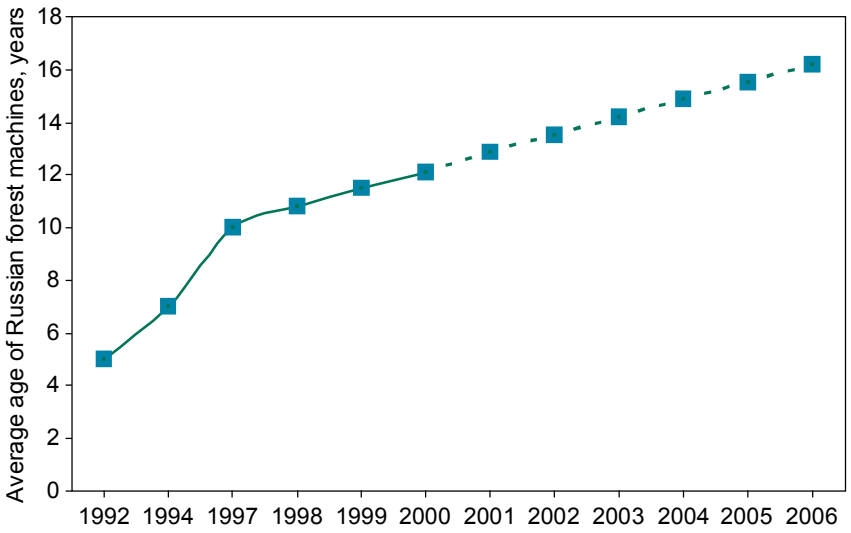

Figure 7. Average age of Russian forest machines, values after 2000 extrapolated.

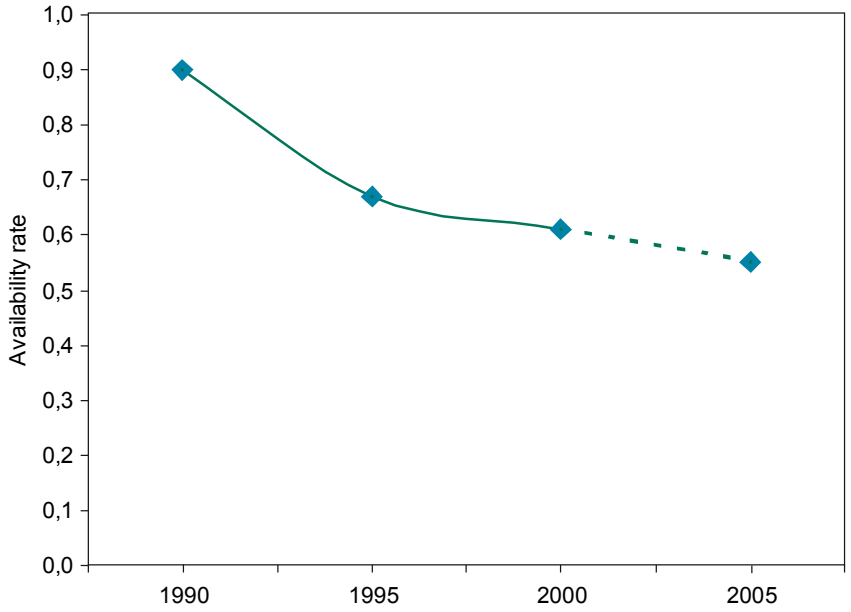

Figure 8. Availability rate of Russian forest machine fleet, values for 2005 extrapolated.

Tree-length technology is badly adapted to thinning operations - heavy caterpillar machines skids too long packages of trees and thus damages remaining trees. Logging enterprises continue to use this technology due to lack of alternative, appropriate technology at the moment.

Traditional Russian tree and full-tree harvesting methods fit well to energy wood harvesting. Most non-industrial wood is transported to central processing yard for further processing such as woodchips or firewood. In case of full-tree method, logging residues are collect to road-side

storage after delimbing. In case of tree-length method, logging residues can be collected to road-side storage by special machine (Figure 9) in cutting area.

Figure 9. Loader skidder LP-18K-2P (OAO ”Kraslesmash”).

2.2 Cut-to-length machinery

Harvesting technology is being reorganized all over Northwest Russia. More than 70% of round wood is harvested with tree-length method. Cut-to-length method is getting more and more common. Logging in the Leningrad region is experiencing large changes due to economical, ecological and social pressures from both inside and outside of Russia. As a result traditional Russian wood harvesting systems are being used side-by-side with Nordic technology. The share of cut-to-length technology in the Leningrad region is already about 70% and continues to grow. As a result the Finnish forest technology export has been growing.

In the cut-to-length method, trees are already cross-cut to assortments at the cutting-site with a harvester or a chain-saw. The assortments are then forwarded to a road-side with a forwarder for further transportation to domestic or export markets. Some enterprises use both traditional tree-length and cut-to-length harvesting methods.

The share of fully mechanized cut-to-length technology has been increasing since 2000. The reason is increasing import of harvesters and forwarders mainly produced in Finland. Inter-changeability of harvesters and forwarders is constantly growing and machines are working in 2-3 shifts.

Approximately 100 harvesters and forwarders are imported to Russia annually: 60% of the forwarders and 50% of the harvesters have a brand name (Belikov 2007). Three manufactures dominate cut-to-length machinery market in Northwest Russia: John Deere Forestry with 55%, Ponsse with 20 % and Komatsu Forestry with 16 % (Market shares Belikov 2007, Nekhamkin 2007).

Market shares in the Republic of Karelia are presented in Fig. 10 (Gerasimov et al. 2005, 2007).

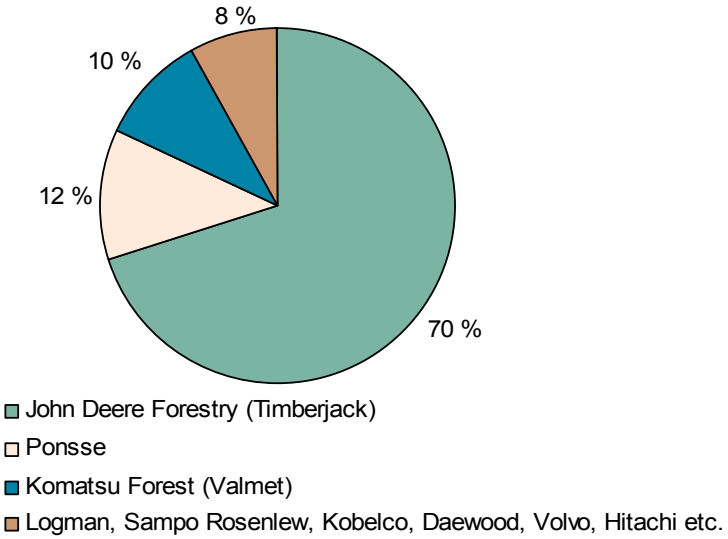

Figure 10. Market shares in cut-to-length machinery in Karelia in 2006.

The cut-to-length machinery available on the Russian market may be classified as:

- Light/small machine – 4 models of harvesters and one model of forwarders
- Basic machine – 17 models of harvesters and 30 models of forwarders
- Heavy/big machine – 60 models of harvesters and 26 models of forwarders.

The most common are basic machines such as John Deere Forestry (harvester 1270 and forwarders 1010/1410), Ponsse (harvesters Ergo and Beaver, forwarders Buffalo) and Komatsu Forest (harvesters Valmet 911/901, forwarder Valmet 860). Light or small size harvesters are not that common (for example Sampo Rosenlew 1046X, Logman 801). Heavy or big harvesters are usually based on excavators (Volvo EC210BF, Kobelco SK 135 SRL, Hitachi Zaxis 230).

Russian forest machine manufacturers have tried to design and produce domestic harvesters and forwarders, but have been unsuccessful. The current trend is to buy western technology. Big Russian machinery construction holding "Tractor Plants" bought 80% of shares of a Dutch harvester producer Silvatec for 10 million euros in 2006. The holding is going to import 30 harvesters in 2007 and 100-130 harvesters in 2008 (Belikov 2007). Moreover, the technology will be transferred to Russia to Onego tractor plant, as "Tractor Plants" owns Onego tractor plant at the moment.

There are two examples of small scale producers of harvesters and forwarders in Russia. Company "Harvy Forest" assembles approximately 10 Finnish Pinox machines per year in Medvez-

hegorsk, the Republic of Karelia and Logman Forestry Systems Russia assembles the same amount of machines in Rybunsk, Yaroslavl region.

Cut-to-length technology is well adapted to thinnings operations - a wheel machine forwards short-wood and causes much less damages to remaining trees than skidders. Most logging enterprises use this technology at the moment for thinnings.

Cut-to-length technology is not very attractive for energy wood harvesting from clear cut areas. Non-industrial wood and logging residues are left in cutting areas, thus requiring collecting and forwarding to road side, chipping at road side and long distance transporting. Technology is quite attractive for energy wood harvesting from thinning areas. On the other hand, energy wood could become similar commercial assortment as sawlog and pulpwood when forwarding and transporting could be done similarly.

2.3 Energy wood machinery

One of the future trends in Russian forest machinery construction sector could be production of energy wood harvesting machinery. The market for energy wood harvesting machinery should be developing during the next 5-7 years. Introduction of energy wood machinery should be synchronised with development of cut-to-length machinery.

The most well-known Russian producer of mobile chippers is "GOZBO" located in Gatchina in Leningrad region. This company produces mobile wood chippers UPR-1 (Figure 11, Korobov & Rushnov 1991), which consists of a base wheel tractor T-150, crane on a tractor chassis, and wood chipper MRGS-6 on a trailer. The productivity of the machine is 15 m^3/h.

Another Russian chippers producer is "Petrozavodskmash" located in Petrozavodsk. Company has produced more than 200 chippers since the plant was established in 1970 (Petrozavodskmash 2007). Mobile chipper UPR-500 was produced for woodchips based boiler-houses in Karelia. The machine consists of a chipper MPP-500T, a trailer 89661-010, and a crane SF-65S with lift cabin (Figure 12). Productivity of the machine is 5-30 m^3/h. Two mobile chippers were produced in 2003.

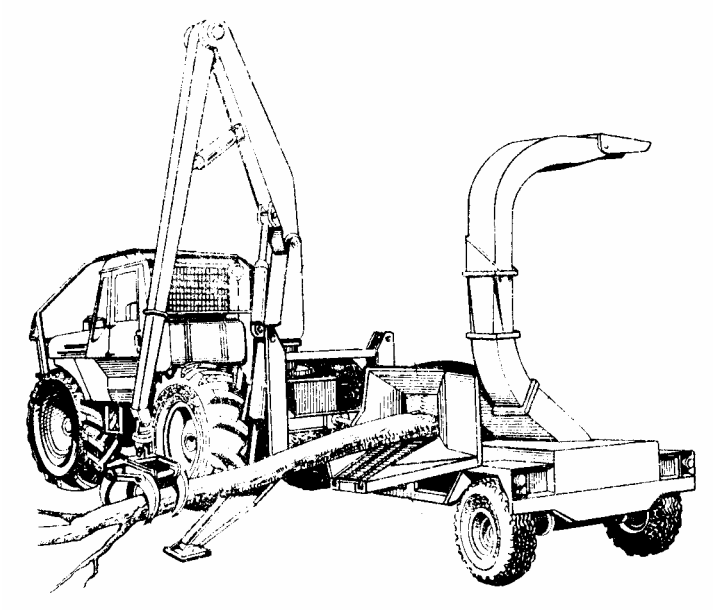

Figure 11. Mobile wood chipper UPR-1.

Figure 12. Mobile wood chipper UPR-500. (http://www.consys.spb.ru/)

The mobile chipper MRGS-5 was produced for chipping wood in cutting areas. The machine has a caterpillar tractor chassis (Onego tractor plant) and productivity of 5 m^3/h.

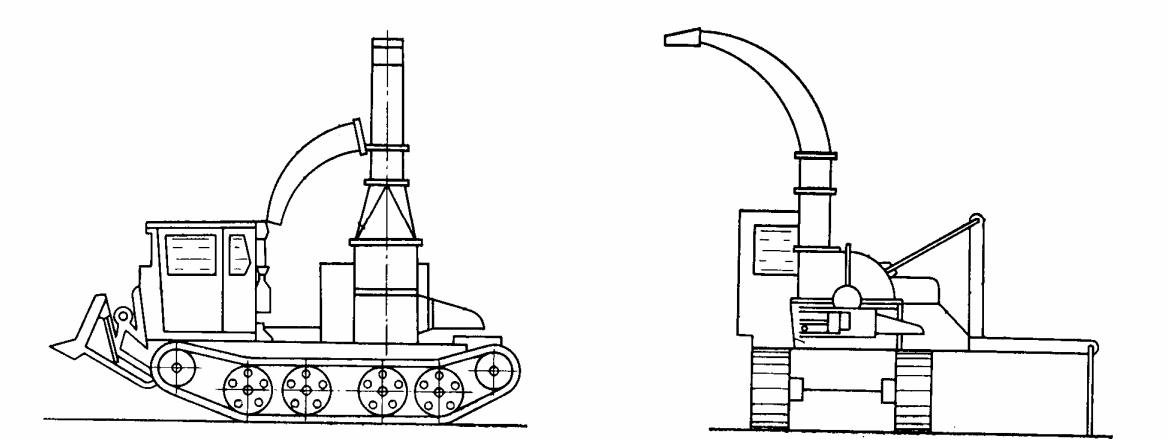

Figure 13. Mobile wood chipper MRGS-5.

Russian chip trucks are produced by ZAO "ALGARITM" in Naberezhnye Chelny for woodchip transporting from cutting areas. It is based on KamAZ-53229 (Figure 14, ALGARITM 2007). The capacity is quite low, only 12 tons. Another model of chip semi-trailer is 9308-010 produced by "Machine-constriction plant" ("Mashinostroitelny zavod") in Tavda. The volume of the chip container is 40 m^3 and price 14 000 Euros. Another model is dump-body semitrailer TONAR 95232 produced by machine-constriction plant TONAR in the Moscow region. The volume of chip body is 75 m^3 and price 36 000 Euros (TONAR 2007).

Figure 14. Chip trucks based on KAMAZ chassis ("AlGATITM", "Machine-constriction plant").

Foreign wood energy machinery available in Russian market include:

- FARMI FOREST wood chippers (Finland)
- KESLA wood chippers (Finland)
- JUNKKARI wood chippers (Finland)
- JENZ wood chippers (Germany)
- BRUKS wood chippers (Sweden)
- SCANIA chip trucks
- SISU chip trucks
- VOLVO chip trucks
- MAZ chip trucks
- VALMET WoodPac residue baler.

Only one international project aiming at producing mobile chippers has been announced in Russia at the moment by a Russian-Finnish consortium, where belong partner "Kirovsky Zavod" from Saint-Petersburg and three Finnish enterprises, Heinola Sawmill Machinery Inc., Oy Sisu Auto Ab and Loglift Jonsered Oy Ab. The price of a mobile chipper is quite expensive – 0.5 million euros, which hampers the progress of business in Russia.

2.4 Economical indexes of technology development

In order to create a rough idea of customers for energy wood technology, the first step was to identify supply and demand patterns. Data from the State Statistical Committee of Russia 2000-2005 was used for logging development for big and medium sized logging enterprises of Leningrad region.

Big and medium sized logging enterprises have increased removals significantly since 2001 (Figure 15) and would have been able to harvest 3.5 million m^3 in 2005 with their machinery. The reasons for this increase have been lack of capacity and wear of fixed assets in the past. Utilization of productive capacity was 100% and the rate of wear of fixed assets was 48% in 2001 (Figure 16). Due to small capital investments into logging in 2003-2005 (4.4 - 5.0 million Euros per year), the rate of wear of fixed assets dropped to 50% in 2005. Other economical indexes of technology development have continued to show good dynamics – the renewal rate was 14% and the retirement rate was 5%, both better than earlier.

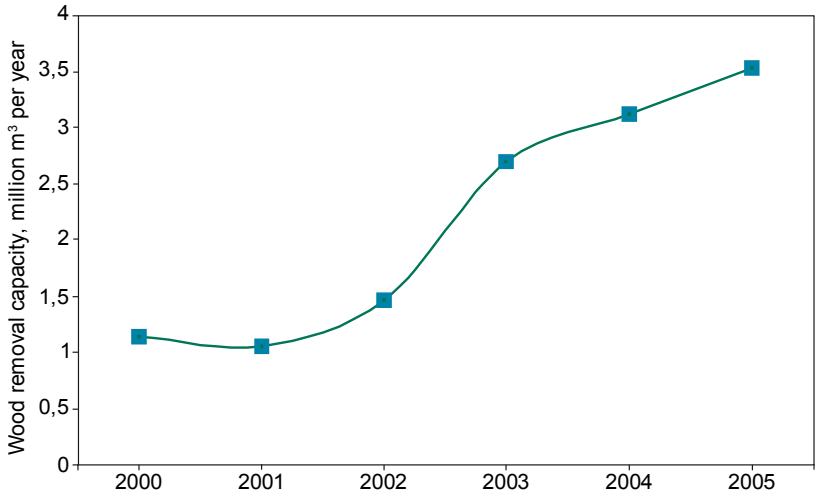

Figure 15. Wood harvesting capacity in Leningrad region in 2000-2005.

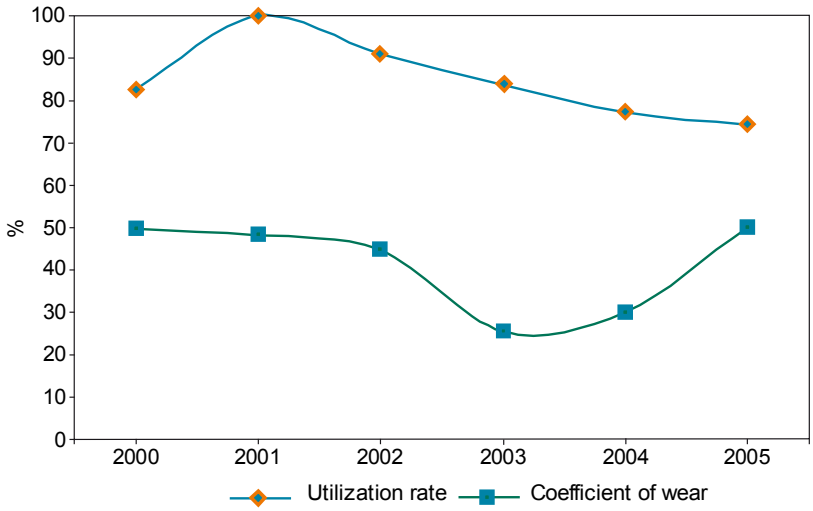

Figure 16. Utilization of wood harvesting capacity and rate of wear of fixed assets in Leningrad region in 2000-2005.

Renewal rate means the intensity of fixed assets renewal and is calculated as a ratio between costs of new and total fixed assets in a year. Retirement rate means the intensity of fixed assets retirement and is calculated as a ratio between costs of retirement and total fixed assets in a year. Three times higher renewal rate compared to retirement rate means that reproduction of fixed assets has been positive in logging industry of Leningrad region in 2005. Table 2 shows also the values of renewal, retirement and wear of fixed assets in transition period 1990-1999 (Kondratuk 2002, Skorobogatova 2002). During transition period situation was opposite - retirement was up to five times higher than renewal due lack of investments. This means that logging enterprises are now in much better position to renew machinery and technology than earlier. There are now much better possibilities to finance purchase of technology.

Table 2. Rates of wear, renewal and retirement of fixed assets in logging, sawmilling and pulp and paper industry.

	Rate of wear			renewal			retirement		
	1993	1999	2005	1990	1999	2005	1990	1999	2005
Logging	41	57	50	6	3	14	12	15	5
Sawmilling	46	50	12	6	3	20	6	11	2
Pulp&Paper	52	60	45	6	3	11	9	10	3

3 Indentification of customers

Once the key markets for wood harvesting technology in the Leningrad region were identified, the next step was to identify segments and customers that make up a large potential for forest machines sales in the region.

Russian end-users of forest harvesting and supportive equipment are generally logging companies and in some cases contractors of forest leasers. Some large firms have tree-harvesting employees within the firm. Most of the companies that contract out or hire tree-felling employees are large firms that are specialized in producing lumber, pulp and paper, or both.

Due to productivity and environmental pressures, those end-users need mobile, versatile, efficient, and environmentally friendly forestry equipment. Technological and environmental changes and requirements mean continuing growth and development of this market. The challenge of adhering to strict environmental regulations in the face of intense competition has increased the demand for new and innovative solutions to forest harvesting.

3.1 Customer screening

Logging is concentrated into large and medium size enterprises which usually belong to international pulp and paper and sawmills. The four largest logging companies with an annual cut of more than 200 000 m^3, i.e. OOO "Russky Les" (Stora Enso), ZAO "Tikhvinsky KLPKh" (UPM-Kymmene), OAO "Svetogorsk" (International Paper), OOO "Metsyaliitto Podporozhje" (Metsäliitto), represent the key players in pulp and paper industry. They are logging 26% of the annual actual cut in the Leningrad region. The companies harvesting 100 - 200 thousand m^3 per year, i.e. OOO "Svedwood-Tikhvin" (IKEA), ZAO "Timberlehnd-Vihborg", ZAO "Kompaniya Vinnehr", OOO "Timber-Kholding", ZAO "Efimovsky KLPKh" (Mayr-Melnhof-Holz), represent the biggest players in sawmilling. The share of these companies is approximately 20% of the annual actual cut in the Leningrad region. This means that 9 key logging companies procure approximately half of the region's round wood. Next 14 companies which cut 50 - 100 thousand m^3 per year provide about 30% of the annual actual cut in the Leningrad region. Approximately 50 small companies procure rest of the 20% annual logging (Figure 17).

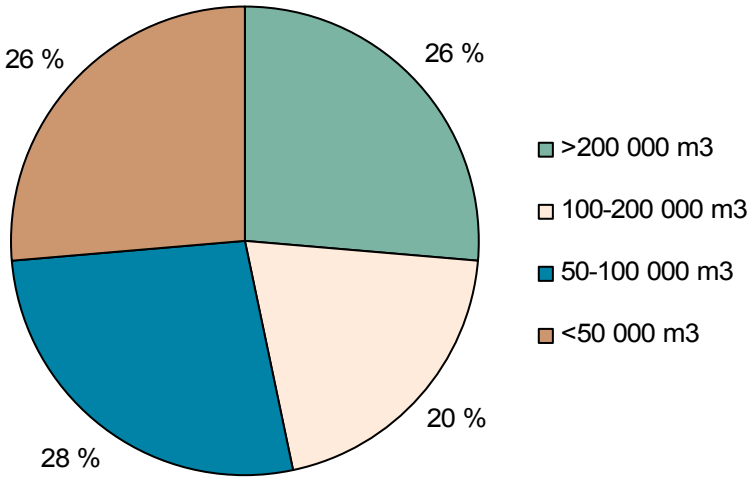

Figure 17. Distribution of logging enterprises based on their annual actual cut.

Figure 18 shows the operation areas of the biggest logging enterprises in the Leningrad region. Most of the logging capacity is concentrated among few forest districts with well developed forest industry, such as Tikhvinsky, Priozorsky and Podporozhsky.

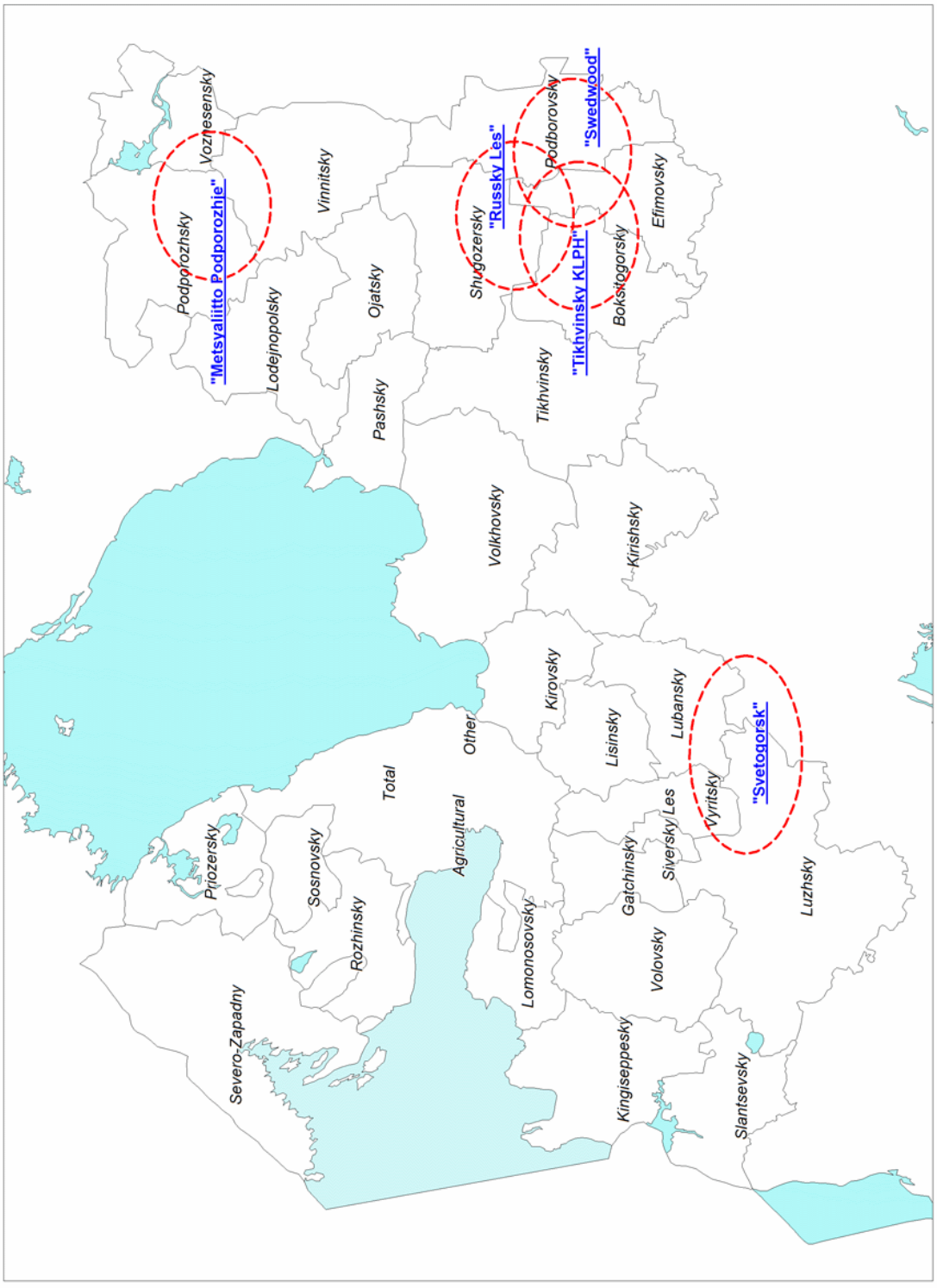

Figure 18. Location of the biggest logging enterprises in the Leningrad region.

3.2 Target enterprises

The total number of enterprises registered in logging industry was 1287 in 2006, employing altogether 19 870 persons in logging (Petrostat 2007, Business Karta 2007). Only hundred enterprises have leased forests. The tables 3 and 4 provide 30 biggest logging enterprises based on annual actual cut and annual allowable cut in leased forests in the Leningrad region. It should be noted that there can be big differences between the forest leasers in the utilization of the annual allowable cut. Allowable cut of the 30 biggest forest leasers was about 5 million m^3 and actual cut 3 million m^3 in 2006. Table 5 shows technologies applied in the biggest logging enterprises.

Table 3. Thirty biggest forest leasers based on their annual actual cut in the Leningrad region and location of their main forest units in 2006.

Rank	Company	Forest unit
1	OOO "Russky les"	Tikhvinsky, Shugozersky, Boksitogorsky
2	ZAO "Tikhvinsky KLPKh"	Tikhvinsky, Shugozersky, Boksitogorsky
3	OAO "Svetogorsk"	Kirishsky, Lyubansky, Luzhskiy
4	OOO "Metsyaliitto Podporozhje"	Podporozhsky, Voznesensky
5	OOO "Svedwood-Tikhvin"	Tikhvinsky, Shugozersky, Podborovsky
6	ZAO "Timberlehnd-Vihborg"	Severo-Zapadny, Luzhsky, Roschinsky
7	ZAO "Kompaniya Vinnehr"	Severo-Zapadny
8	OOO "Timber-Kholding"	Lodeynopoljsky
9	ZAO "Efimovsky KLPKh"	Efimovsky, Boksitogorsky
10	OOO "Zavod Lamelj"	Kirovsky
11	OOO "Chathinsky lesopunkt"	Gatchinsky, Vihricky
12	OOO "Gatchinskaya lesnaya gruppa"	Gatchinsky, Vihricky
13	ZAO "Lesnoyj kompleks"	Severo-Zapadny
14	ZAO "Firo-O"	Roschinsky
15	ZAO "Intersolar"	Sosnovsky, Lomonosovsky, Volosovsky, Gatchinsky, Roschinsky
16	OOO "Stroyjles"	Shugozersky
17	OAO "Verkhne - Svirsky LPKh"	Podporozhsky
18	OOO "Krona"	Pashsky, Efimovsky, Boksitogorsky, Volkhovsky
19	OAO ''Priozersky DOZ"	Priozersky
20	ZAO "Tarpan-V"	Roschinsky
21	ZAO "Lemo-Vud"	Priozersky, Sosnovsky
22	OOO "Leon"	Volkhovsky, Podborovsky
23	OAO "Kingiseppskoe LPP"	Kingiseppsky
24	OOO "Kirishi-Lesprom"	Kirishsky
25	OOO "Forest"	Volosovsky
26	ZAO "Volosovsky LPKh"	Vihricky
27	OAO "Domozhirovsky LPKh"	Oyatsky, Lodeynopoljsky
28	OOO PKF "Kvinteks"	Severo-Zapadny
29	OOO "Piramida"	Podborovsky, Boksitogorsky
30	ZAO "Oyatsky lespromkhoz"	Oyatsky

Table 4. Thirty biggest forest leasers based on their annual allowable cut and location of their main forest units in the Leningrad region in 2006.

Rank	Company	Leskhoz
1	OOO "Metsyaliitto Podporozhje"	Podporozhsky, Voznesensky
2	ZAO "Tikhvinsky KLPKh"	Tikhvinsky, Shugozersky, Boksitogorsky
3	OAO "Svetogorsk"	Kirishsky, Lyubansky, Luzhskiy
4	ZAO "Timberlehnd-Vihborg"	Severo-Zapadny, Luzhsky, Roschinsky
5	OOO "Russky les"	Tikhvinsky, Shugozersky, Boksitogorsky
6	OOO "Svedwood-Tikhvin"	Tikhvinsky, Shugozersky, Podborovsky
7	ZAO "Efimovsky KLPKh"	Efimovsky, Boksitogorsky
8	ZAO "Intersolar"	Sosnovsky, Lomonosovsky, Volosovsky, Gatchinsky, Roschinsky
9	OOO "Stroyjles"	Shugozersky
10	OOO "Timber-Kholding"	Lodeynopoljsky
11	ZAO "Kompaniya Vinnehr"	Severo-Zapadny
12	ZAO "Firo-O"	Roschinsky
13	ZAO "Petrovles-Podporozhje"	Podporozhsky,Vinnicky
14	OOO "Kirishi-Lesprom"	Kirishsky
15	OOO "Gatchinskaya lesnaya gruppa"	Gatchinsky, Vihricky
16	ZAO "Volosovsky LPKh"	Vihricky
17	OOO "Forest"	Volosovsky
18	ZAO "Sodruzhestvo"	Kirovsky, Lyubansky
19	OOO "Krona"	Pashsky, Efimovsky, Boksitogorsky, Volkhovsky
20	ZAO "Pashales"	Pashsky
21	OOO "Chathinsky lesopunkt"	Gatchinsky, Vihricky
22	OOO "Zavod Lamelj"	Kirovsky
23	OAO "Verkhne - Svirsky LPKh"	Podporozhsky
24	ZAO "Tarpan-V"	Roschinsky
25	ZAO "Oyatsky lespromkhoz"	Oyatsky
26	OOO "Privus"	Sosnovsky
27	OOO "Piramida"	Podborovsky, Boksitogorsky
28	ZAO "Petrovles-Pasha"	Volkhovsky, Pashsky
29	OOO "Sofid"	Vinnicky, Voznesensky
30	OOO "Svirjles"	Oyatsky, Lodeynopoljsky

Table 5. Applied wood harvesting technologies in the biggest logging enterprises in 2005-2006.

Rank	Company	Dominating technology
1	OOO "Russky les"	Cut-to-length, harvester + forwarder
2	ZAO "Tikhvinsky KLPKh"	Tree-length, chainsaw + TDT-55
3	OAO "Svetogorsk"	Cut-to-length, harvester + forwarder
1	OOO "Metsyaliitto Podporozhje"	Cut-to-length, harvester + forwarder
2	OOO "Svedwood-Tikhvin"	Cut-to-length, harvester + forwarder
3	ZAO "Timberlehnd-Vihborg"	Cut-to-length, harvester + forwarder
4	ZAO "Kompaniya Vinnehr"	Cut-to-length, harvester + forwarder
5	OOO "Timber-Kholding"	Cut-to-length, chainsaw/harvester + forwarder
6	ZAO "Efimovsky KLPKh"	Tree-length, chainsaw + TDT-55
7	OOO "Zavod Lamelj"	Cut-to-length, chainsaw + forwarder
8	OOO "Chathinsky lesopunkt"	Tree-length, chainsaw + TDT-55
9	OOO "Gatchinskaya lesnaya gruppa"	Cut-to-length, harvester + forwarder
10	ZAO "Lesnoyj kompleks"	Tree-length, chainsaw + TDT-55
11	ZAO "Firo-O"	Cut-to-length, harvester + forwarder
12	ZAO "Intersolar"	Cut-to-length, chainsaw + forwarder
13	OOO "Stroyjles"	Tree-length, chainsaw + TDT-55
14	OAO "Verkhne - Svirsky LPKh"	Cut-to-length, chainsaw/harvester + forwarder
15	OOO "Krona"	Tree-length, chainsaw + TDT-55
16	ZAO "Tarpan-V"	Cut-to-length, chainsaw/harvester + forwarder
17	OAO "Domozhirovsky LPKh"	Tree-length, chainsaw + TDT-55
18	OOO PKF "Kvinteks"	Cut-to-length, harvester + forwarder
19	OOO "Piramida"	Cut-to-length, chainsaw + forwarder
20	ZAO "Oyatsky lespromkhoz"	Tree-length, chainsaw + TDT-55
21	ZAO "Petrovles-Podporozhje"	Cut-to-length, chainsaw + forwarder
22	ZAO "Petrovles-Pasha"	Cut-to-length, chainsaw + forwarder
23	ZAO "Kingiseppsky lespromkhoz"	Tree-length, chainsaw + TDT-55
24	OOO "Privus"	Cut-to-length, chainsaw + forwarder
25	OOO "Sofid"	Cut-to-length, chainsaw/harvester + forwarder
26	OOO "Kirishi-Lesprom"	Cut-to-length, chainsaw/harvester + forwarder
27	OOO "Svetochj"	Cut-to-length, chainsaw + forwarder
28	OOO "Severo-Zapadnihyj les"	Cut-to-length, chainsaw + forwarder
29	OOO "P I M"	Cut-to-length, chainsaw/harvester + forwarder
30	OOO "Marlen"	Cut-to-length, chainsaw/harvester + forwarder

4 Size of the market

The overall development of wood procurement in the Leningrad region and woodchip production in particular will require large amount of forestry machines and wood transport vehicles.

Three scenarios for the development of energy wood resources have been analysed in Gerasimov et al. (2006). The scenarios are based on trends in logging and sawmilling. Due to lack of reliable data from Leningrad region, annual productivities of machinery have been calculated from statistical data (Finnish Forest Research Institute 2005). Underlying assumptions about productivities are presented in Figure 19.

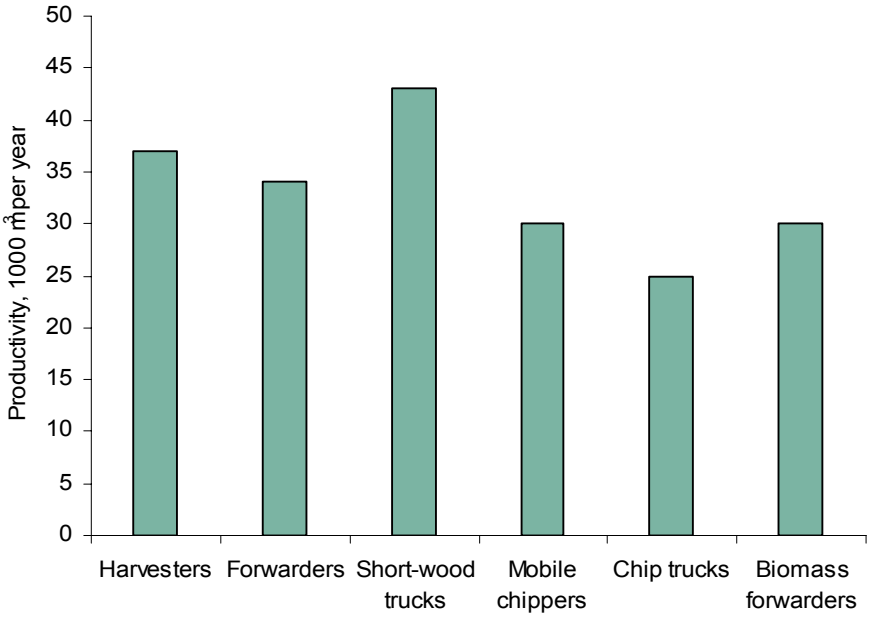

Figure 19. Calculated productivities for different round wood and energy wood harvesting machines.

Scenario "Actual" is based on availability of energy wood from recent logging and sawmilling operations. It means current utilization of annual allowable cut, 40% use of cut-to-length method, and current sawn wood production.

Scenario "Allowable" assumes increasing availability of energy wood resources based on full utilisation of annual allowable cut, utilising current logging technology and increasing sawn timber production according to on-going green-field projects, as Svir-Timber sawmill, Mayr-Melnhof-Holz Efimovsky etc, see Figure 2.

Scenario "Potential" assumes increasing availability of energy wood due to implementation of intensive forest management resulting from significant increase of thinnings, full utilisation of annual allowable cut with cut-to-length technology and increasing sawn timber production according to available sawlogs output in the region (no export).

4.1 Estimation for machinery need in the region

Estimation for the cut-to-length and energy wood machinery need in three scenarios (Table 6):

- Scenario "Actual". The estimated potential for energy wood from logging operations is 3.5 million m^3/year based on 7.9 million m^3 actual cut in 2004. About 2.3 million m^3 is non-industrial round wood and felling residues in the cutting areas and 1.2 million m^3 derives from the central processing yards. The volume harvested with cut-to-length technology is 3.2 million m^3 within 40% of the total annual actual cut in 2004.
- Scenario "Allowable". The amount of energy wood available from logging could be as high as 5.3 million m^3 if the entire annual allowable cut of 9.5 million m^3 would be utilised, i.e. 54% more than the actual amounts in 2004, if collected. About 3.3 million m^3 is non-industrial round wood and felling residues in the cutting areas. The volume harvested by cut-to-length technology is 4.9 million m^3 (40% of the total allowable cut).
- Scenario "Potential". The amount of energy wood available from logging could be as high as 7.2 million m^3 if also thinnings would be done in full scale, i.e. 124% more than the actual amounts in 2004, if collected. Assumption is that all is harvested with cut-to-length technology, i.e. 15.3 million m^3 of which 40% from thinnings.

Table 6. An estimation of the need for cut-to-length and energy wood machinery fleet in three scenarios in the Leningrad region.

Source	Scenario for round wood (RW) and energy wood (EW) harvesting					
	Actual		Allowable		Potential	
	RW	EW	RW	EW	RW	EW
Logging, mill. m^3	3.2	2.3	4.9	3.3	15.3	7.2
- Mobile chippers, units		77		110		240
- Chip trucks, units		92		132		288
- Forwarders for round wood and loose logging residues, units	93	31	144	44	451	240
- Harvesters, units	28		88		417	
- Trucks, units	74		114		356	

Scenario "Allowable" means that annually harvested stem wood volume in the final felling would increase from the 2004 level of 5.1 million m^3 to 9.5 million m^3. It is assumed that current proportions in logging technologies remain, i.e. 40% of CTL method, but that the share of felling by harvester increases from 1/3 to 2/3. In the Scenario "Potential" thinnings would increase from the 2004 level of 1.5 million m^3 to 4.6 million m^3 and 100% implementation of mechanised cut-to-length technology (harvester and forwarder).

Current cut-to-length machinery fleet is about 100 forwarders, 30 harvesters and 70 short-wood trucks. The theoretical energy wood machinery fleet in Leningrad region for full utilisation of energy wood recourses at current cutting areas could be 80 mobile chippers, 90 chip trucks and 30 forwarders for loose logging residues.

If allowable cut will be realized in Leningrad region based on current level of mechanisation, the need for cut-to-length machinery fleet would be about 140 forwarders (+50%), 90 harvesters (+200%) and 110 short-wood trucks (+50%). Theoretical energy wood machinery fleet in Leningrad region would be 110 mobile chippers, 130 chip trucks and 44 forwarders for loose logging residues.

The maximum theoretical need for machinery in the Leningrad region could be about 400 units of forwarders, harvesters and short-wood trucks, plus about 250 units of mobile chippers, chip trucks and forwarders for loose logging residues.

Table 7 shows the estimated need for of the cut-to-length and energy wood machinery when also need to renew machinery is taken into account and replaced by cut-to-length machinery:

- Scenario “Actual”. Annual actual cut is stable; a traditional technology replaces by cut-to-length technology according to machinery wear out; the felling process mechanised by 1/3; forest machines replaced every 7th year
- Scenario “Allowable”. Annual actual cut growing from 7.9 to 15.3 million m^3 by 5% per year; traditional technology replaced by cut-to-length technology according to machinery wear out; the felling process mechanised by 2/3; forest machines replaced every 7th year
- Scenario “Potential”. Annual actual cut of 15.3 million m^3; traditional technology totally replaced by cut-to-length technology; fully mechanised felling process with harvester; forest machines replaced every 7th year.

The current use of cut-to-length machinery according to *Scenario Actual* would require annual purchase of about 30 forwarders, 20 harvesters and 25 short-wood trucks. Theoretical annual need for energy wood machinery could be 10 mobile chippers, 10 chip trucks and 4 forwarders for loose logging residues, if energy wood from current logging operations would be collected.

If allowable cut will be realized in the Leningrad region based on current level of mechanisation, need for cut-to-length machinery market could be 40 forwarders (+20%), 30 harvesters (+40%) and 30 short-wood trucks (+20%). In this case theoretical need for energy wood machinery in the Leningrad region could be 15 mobile chippers, 20 chip trucks and 6 forwarders for loose logging residues.

Table 7. Estimation of cut-to-length machinery need in the Leningrad region.

Source	Scenario for round wood (RW) and energy wood (EW) harvesting					
	Actual		Allowable		Potential	
	RW	EW	RW	EW	RW	EW
Timber harvesting, mill. m^3	3.2	2.3	4.9	3.3	15.3	7.2
- Mobile chippers, units		11		16		34
- Chip trucks, units		13		19		41
- Forwarders for round wood and loose logging residues, units	32	4	40	6	64	34
- Harvesters, units	21		30		60	
- Trucks, units	26		30		51	

If also thinnings would be done in full scale, theoretical need for energy wood machinery in the Leningrad region could be 50-60 units of forwarders, harvesters and short-wood trucks, plus 30-40 units of mobile chippers, chip trucks and forwarders for loose logging residues.

4.2 Estimation of machinery needs in logging companies

As mentioned earlier in chapter 3.2 lot of small size companies are operating in the Leningrad region without financial possibilities to make investments into modern technology. Therefore, it is useful to make more detailed estimations on company level.

Tables 8-10 show need for cut-to-length and energy wood machinery fleets based on assumptions as in Table 6, but on company level, i.e.

- Number of harvesters, forwarders and short-wood trucks (cut-to-length machinery) and mobile chippers, biomass forwarders and chip trucks (energy wood machinery), calculated based on fellings in leased forests of individual enterprise
  - Table 8 - actual cut in 2006
  - Table 9 - allowable cut in 2006
  - Table 10 - potential cut, implementation of intensive forest management (i.e. full scale implementation of thinnings)
- Energy wood potential of leskhozes where leased forests are located taken into account (Gerasimov et al. 2006)
- Data about leased forests provided by the Federal Forest Agency of Russia
- Whole volume harvested by cut-to-length technology, process fully mechanised (using only harvesters and forwarders)

– Annual productivity of machines as presented in Figure 19
– Number of machines rounded.

Figure 20 show the need for cut-to-length machinery in three scenarios and Figure 21 the need for energy wood machinery. Only one third of the forest leasers in the Leningrad region have enough forest resources and could be considered as users of Nordic cut-to-length technology based on *Actual cut scenario*. The capacity of these 41 enterprises could be 270 machines - 90 harvesters, 100 forwarders and 80 trucks. The number of companies for energy wood harvesting is few less, 37. The capacity would be about 50 chippers and biomass forwarders and 60 woodchip trucks to procure energy wood as assumed in the actual cut scenario. The share of 10 biggest enterprises is a half of the total fleet.

Sixty percents of the forest leasers in Leningrad region have enough forest resources and could be considered as users of Nordic cut-to-length technology based on *Allowable cut scenario*. The capacity of these 68 enterprises could be 500 machines - 160 harvesters, 190 forwarders and 150 trucks. Fifty six companies for energy wood harvesting would need about 100 chippers and biomass forwarders and 110 woodchip trucks. Again the share of 10 biggest enterprises is a half of the total fleet.

Also sixty percents of current forest leasers in the Leningrad region have enough forest resources and could be considered as users of Nordic cut-to-length technology based on *Potential cut scenario*. These 71 enterprises would need 770 machines - 260 harvesters, 280 forwarders and 230 trucks. Seventy companies for energy wood harvesting would need 150 chippers and biomass forwarders and 180 woodchip trucks.

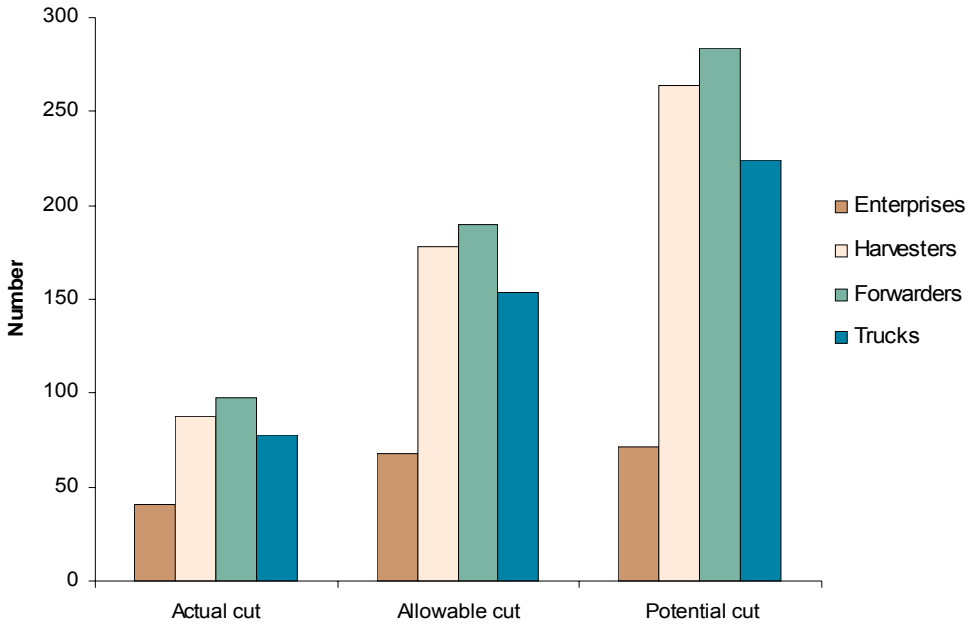

Figure 20. Need for cut-to-length machinery in three scenarios in the Leningrad region.

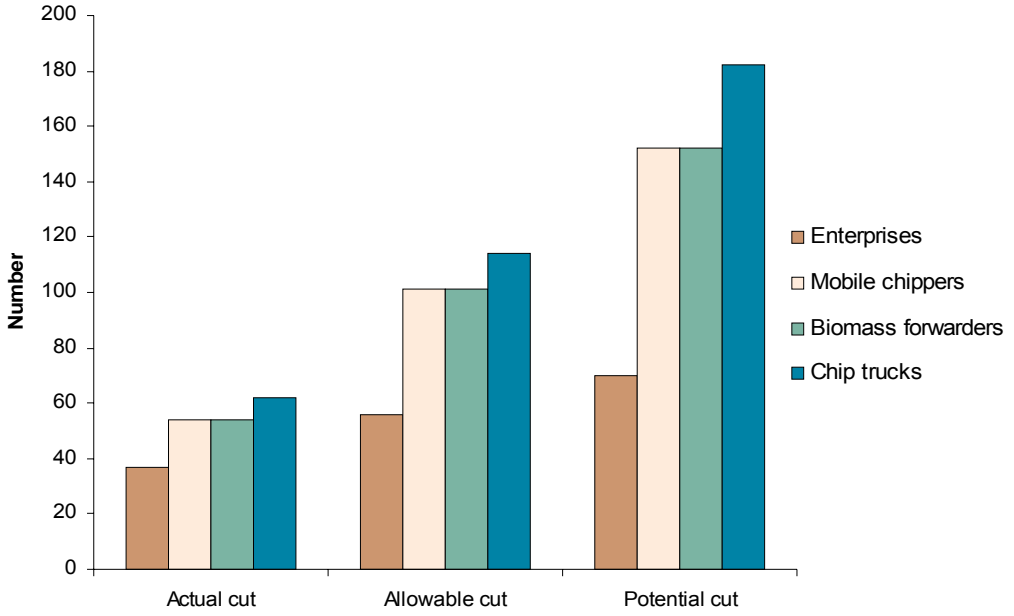

Figure 21. Need for energy wood harvesting machinery in three scenarios in the Leningrad region.

Table 8. Estimation of machinery needed by the forest leasers according to *Actual scenario*. AAC is annual allowable cut, AC is actual cut.

Leaser	AAC in leased area, 1000 m^3	AC in leased area, 1000 m^3	Harvesters	Forwarders	Timber trucks	Mobile chippers	Biomass forwarders	Woodchip trucks
OOO "Metsyaliitto Podporozhje"	>400	>100	5	5	4	2	2	3
ZAO "Tikhvinsky KLPKh"	>400	>200	7	8	6	4	4	5
OAO "Svetogorsk"	>400	>200	7	7	6	4	4	5
ZAO "Timberlehnd-Vihborg"	>300	>100	4	4	3	2	2	3
OOO "Russky les"	>200	>200	7	8	6	4	4	5
OOO "Svedwood-Tikhvin"	>200	>100	4	5	4	3	3	3
ZAO "Efimovsky KLPKh"	>200	>50	3	3	2	1	1	2
ZAO "Intersolar"	>200	>50	2	2	2	1	1	2
OOO "Stroyjles"	>200	>50	2	2	2	1	1	1
OOO "Timber-Kholding"	>100	>100	3	4	3	2	2	2
ZAO "Kompaniya Vinnehr"	>100	>100	4	4	3	2	2	2
ZAO "Firo-O"	>100	>50	2	3	2	1	1	1
ZAO "Petrovles-Podporozhje"	>100	>30	1	1	1	1	1	1
OOO "Kirishi-Lesprom"	>100	>30	1	1	1	1	1	1
OOO "Gatchinskaya lesnaya gruppa"	>100	>30	2	3	2	2	2	2
ZAO "Volosovsky LPKh"	>100	>30	1	1	1	1	1	1
OOO "Forest"	>50	>30	1	1	1	1	1	1
OOO "Krona"	>50	>50	2	2	2	1	1	1
OOO "Chathinsky lesopunkt"	>50	>50	2	3	2	2	2	2
OOO "Zavod Lamelj"	>50	>50	3	3	2	1	1	2
OAO "Verkhne - Svirsky LPKh"	>50	>50	2	2	2	1	1	1
ZAO "Tarpan-V"	>50	>50	2	2	1	1	1	1
ZAO "Oyatsky lespromkhoz"	>50	>30	1	1	1	1	1	1
OOO "Privus"	>50	>30	1	1	1	0	0	0
OOO "Piramida"	>50	>30	1	1	1	1	1	1
ZAO "Petrovles-Pasha"	>50	>30	1	1	1	1	1	1
ZAO "Lesnoy kompleks"	>50	>50	2	3	2	1	1	1
OAO ''Priozersky DOZ"	>50	>50	2	2	1	1	1	1
OAO "Domozhirovsky LPKh"	>50	>30	1	1	1	1	1	1
ZAO "Lemo-Vud"	>50	>50	1	2	1	1	1	1
OOO "Leon"	>50	>50	1	2	1	1	1	1
OAO "Kingiseppskoe LPP"	>50	>50	1	1	1	1	1	1
OOO "Lyubanj Les"	>50	>30	1	1	1	1	1	1
ZAO "Kingiseppsky lespromkhoz"	>50	>30	1	1	1	1	1	1
OAO "LDOK"	>50	>30	1	1	1	1	1	1
ZAO "Lyubanskoe DPP"	>50	>30	1	1	1	1	1	1
OOO "Andronovskiyj LPKh"	>30	>30	1	1	1	0	0	0
OOO PKF "Kvinteks"	>30	>30	1	1	1	1	1	1
OOO "Tosno-Les"	>30	>30	1	1	1	0	0	0
OOO "Lesnihe tekhnologii"	>30	>30	1	1	1	0	0	0
OOO "Volosovskiyj LPK"	>30	>30	1	1	1	1	1	1
Total			**88**	**98**	**78**	**54**	**54**	**62**

Table 9. Estimation of machinery needed by the forest leasers according to *Allowable scenario*. AAC is annual allowable cut.

Company	AAC in leased area, 1000 m^3	Harvesters	Forwarders	Timber trucks	Mobile chippers	Biomass forwarders	Woodchip trucks
OOO "Metsyaliitto Podporozhje"	>400	13	14	11	6	6	7
ZAO "Tikhvinsky KLPKh"	>400	12	13	10	7	7	8
OAO "Svetogorsk"	>400	11	12	10	7	7	9
ZAO "Timberlehnd-Vihborg"	>300	9	10	8	5	5	6
OOO "Russky les"	>200	8	8	7	5	5	6
OOO "Svedwood-Tikhvin"	>200	7	7	6	4	4	5
ZAO "Efimovskiyj KLPKh"	>200	6	7	5	4	4	4
ZAO "Intersolar"	>200	6	7	5	4	4	5
OOO "Stroyjles"	>200	5	6	5	3	3	4
OOO "Timber-Kholding"	>100	5	5	4	3	3	3
ZAO "Kompaniya Vinnehr"	>100	4	4	3	2	2	2
ZAO "Firo-O"	>100	3	4	3	2	2	2
ZAO "Petrovles-Podporozhje"	>100	3	3	3	2	2	2
OOO "Kirishi-Lesprom"	>100	3	3	3	2	2	2
OOO "Gatchinskaya lesnaya gruppa"	>100	3	3	2	2	2	2
ZAO "Volosovskiyj LPKh"	>100	3	3	2	2	2	2
OOO "Forest"	>100	3	3	2	2	2	2
ZAO "Sodruzhestvo"	>50	3	3	2	1	1	2
OOO "Krona"	>50	2	3	2	1	1	2
ZAO "Pashales"	>50	2	3	2	1	1	1
OOO "Chathinskiyj lesopunkt"	>50	2	2	2	1	1	2
OOO "Zavod Lamelj"	>50	2	2	2	1	1	2
OAO "Verkhne - Svirskiyj LPKh"	>50	2	2	2	1	1	1
ZAO "Tarpan-V"	>50	2	2	2	1	1	1
ZAO "Oyatskiyj lespromkhoz"	>50	2	2	2	1	1	1
OOO "Privus"	>50	2	2	2	1	1	1
OOO "Piramida"	>50	2	2	2	1	1	1
ZAO "Petrovles-Pasha"	>50	2	2	2	1	1	1
OOO "Sofid"	>50	2	2	2	1	1	1
OOO "Svirjles"	>50	2	2	2	1	1	1
ZAO "Lesnoyj kompleks"	>50	2	2	2	1	1	1
OAO ''Priozerskiyj DOZ"	>50	2	2	1	1	1	1
OAO "Domozhirovskiyj LPKh"	>50	2	2	1	1	1	1
ZAO "Lemo-Vud"	>50	2	2	1	1	1	1
OOO "Leon"	>50	2	2	1	1	1	1
OAO "Kingiseppskoe LPP"	>50	2	2	1	1	1	1
OOO "Lyubanj Les"	>50	2	2	1	1	1	1
OOO "Lenoblehnergostroyj"	>50	2	2	1	1	1	1
ZAO "Kingiseppskiyj lespromkhoz"	>50	2	2	1	1	1	1
OAO "LDOK"	>50	1	2	1	1	1	1
ZAO "Lyubanskoe DPP"	>50	1	2	1	1	1	1
OOO "Severo-Zapadnihyj les"	>30	1	1	1	1	1	1
OOO "Megatekh"	>30	1	1	1	1	1	1
OOO "Marlen"	>30	1	1	1	1	1	1

OOO "Andronovskiyj LPKh"	>30	1	1	1	1	1	1
OOO PKF "Kvinteks"	>30	1	1	1	0	0	0
OOO "Svetochj"	>30	1	1	1	1	1	1
OOO "Chistyakov"	>30	1	1	1	1	1	1
OOO "Lemo-Plehneri"	>30	1	1	1	1	1	1
ZAO "Petrovles-Volosovo"	>30	1	1	1	1	1	1
OOO "Logos"	>30	1	1	1	1	1	1
OOO "Tenzometr"	>30	1	1	1	1	1	1
OOO "Onega Les"	>30	1	1	1	1	1	1
OOO "Progress"	>30	1	1	1	1	1	1
OOO "FASS"	>30	1	1	1	1	1	1
OOO "Tosno-Les"	>30	1	1	1	1	1	1
OOO "Vertikalj"	>30	1	1	1	0	0	0
OOO "Lesnihe tekhnologii"	>30	1	1	1	0	0	0
OOO "Chart"	>30	1	1	1	0	0	0
OOO "Volosovskiyj LPK"	>30	1	1	1	1	1	1
OOO "Kirkon"	>30	1	1	1	0	0	0
OOO "LPK "Staropoljskiyj"	>30	1	1	1	0	0	0
OOO "Krug"	>30	1	1	1	0	0	0
OOO "Inrost"	>30	1	1	1	0	0	0
OOO "Koglomerant"	>30	1	1	1	0	0	0
OOO "Amadeo"	>30	1	1	1	0	0	0
OOO "KirovskLes"	>30	1	1	1	0	0	0
OOO "Svirj"	>30	1	1	1	0	0	0
Total		**178**	**190**	**154**	**101**	**101**	**114**

Table 10. Estimation of machinery needed by the forest leasers according to *Potential scenario*. AAC is annual allowable cut.

Company	AAC in leased area, 1000 m^3	Harvesters	Forwarders	Timber trucks	Mobile chippers	Biomass for-warders	Woodchip trucks
OOO "Metsyaliitto Podporozhje"	>700	20	21	17	9	9	11
ZAO "Tikhvinsky KLPKh"	>600	17	19	15	10	10	12
OAO "Svetogorsk"	>600	17	19	15	11	11	13
ZAO "Timberlehnd-Vihborg"	>400	13	14	11	7	7	9
OOO "Russky les"	>400	12	13	10	7	7	8
OOO "Svedwoodd-Tikhvin"	>300	10	11	9	6	6	7
ZAO "Efimovsky KLPKh"	>300	10	10	8	6	6	7
ZAO "Intersolar"	>300	9	10	8	6	6	7
OOO "Stroyjles"	>300	8	9	7	5	5	6
OOO "Timber-Kholding"	>200	7	8	6	4	4	5
ZAO "Kompaniya Vinnehr"	>200	6	6	5	2	2	3
ZAO "Firo-O"	>100	5	5	4	2	2	3
ZAO "Petrovles-Podporozhje"	>100	5	5	4	2	2	3
OOO "Kirishi-Lesprom"	>100	5	5	4	3	3	3
OOO "Gatchinskaya lesnaya gruppa"	>100	4	5	4	3	3	3
ZAO "Volosovsky LPKh"	>100	4	4	3	3	3	3
OOO "Forest"	>100	4	4	3	3	3	3
ZAO "Sodruzhestvo"	>100	4	4	3	2	2	3
OOO "Krona"	>100	4	4	3	2	2	2
ZAO "Pashales"	>100	4	4	3	2	2	2
OOO "Chathinsky lesopunkt"	>100	3	4	3	2	2	3
OOO "Zavod Lamelj"	>100	3	3	3	2	2	2
OAO "Verkhne - Svirsky LPKh"	>100	3	3	3	1	1	2
ZAO "Tarpan-V"	>100	3	3	3	1	1	2
ZAO "Oyatsky lespromkhoz"	>100	3	3	3	2	2	2
OOO "Privus"	>100	3	3	3	1	1	2
OOO "Piramida"	>100	3	3	3	2	2	2
ZAO "Petrovles-Pasha"	>100	3	3	3	2	2	2
OOO "Sofid"	>100	3	3	2	2	2	2
OOO "Svirjles"	>100	3	3	2	1	1	2
ZAO "Lesnoyj kompleks"	>100	3	3	2	1	1	1
OAO "Priozersky DOZ"	>50	3	3	2	1	1	2
OAO "Domozhirovsky LPKh"	>50	3	3	2	1	1	2
ZAO "Lemo-Vud"	>50	3	3	2	1	1	2
OOO "Leon"	>50	2	3	2	1	1	2
OAO "Kingiseppskoe LPP"	>50	2	3	2	1	1	1
OOO "Lyubanj Les"	>50	2	3	2	2	2	2
OOO "Lenoblehnergostroy"	>50	2	2	2	1	1	2
ZAO "Kingiseppsky lespromkhoz"	>50	2	2	2	1	1	1
OAO "LDOK"	>50	2	2	2	1	1	2
ZAO "Lyubanskoe DPP"	>50	2	2	2	1	1	2
OOO "Severo-Zapadny les"	>50	2	2	2	1	1	1
OOO "Megatekh"	>50	2	2	2	1	1	1
OOO "Marlen"	>50	2	2	1	1	1	1

OOO "Andronovsky LPKh"	>50	2	2	1	1	1	1
OOO PKF "Kvinteks"	>50	2	2	1	1	1	1
OOO "Svetochj"	>50	2	2	1	1	1	1
OOO "Chistyakov"	>50	2	2	1	1	1	1
OOO "Lemo-Plehneri"	>50	2	2	1	1	1	1
ZAO "Petrovles-Volosovo"	>50	2	2	1	1	1	1
OOO "Logos"	>50	2	2	1	1	1	1
OOO "Tenzometr"	>50	1	2	1	1	1	1
OOO "Onega Les"	>50	1	2	1	1	1	1
OOO "Progress"	>50	1	2	1	1	1	1
OOO "FASS"	>50	1	2	1	1	1	1
OOO "Tosno-Les"	>30	1	1	1	1	1	1
OOO "Vertikalj"	>30	1	1	1	1	1	1
OOO "Lesnihe tekhnologii"	>30	1	1	1	1	1	1
OOO "Chart"	>30	1	1	1	1	1	1
OOO "Volosovsky LPK"	>30	1	1	1	1	1	1
OOO "Kirkon"	>30	1	1	1	1	1	1
OOO "LPK "Staropoljsky"	>30	1	1	1	1	1	1
OOO "Krug"	>30	1	1	1	1	1	1
OOO "Inrost"	>30	1	1	1	1	1	1
OOO "Koglomerant"	>30	1	1	1	1	1	1
OOO "Amadeo"	>30	1	1	1	0	0	0
OOO "KirovskLes"	>30	1	1	1	1	1	1
OOO "Svirj"	>30	1	1	1	1	1	1
OAO "Syasjsky CBK"	>30	1	1	1	1	1	1
OOO "Sfinks"	>30	1	1	1	1	1	1
OOO "Lenprom"	>30	1	1	1	1	1	1
Total		**264**	**284**	**224**	**152**	**152**	**182**

5 Conclusions

Need for timber and energy wood harvesting machinery in the Leningrad region has been analysed in this report.

The Leningrad region is one of the key customers for wood harvesting machinery in Russia as the region is important producer of forest industry products. Actual cut during the last years has been about 8 million m^3 and may not increase in near future due to challenges in implementation of the new Forest Code and increasing customs duties for round wood export.

Recent development of forestry practices in Leningrad region includes fast implementation of cut-to-length harvesting, transfer of technology, introduction of commercial thinnings and energy wood harvesting.

The forest machinery fleet in the Leningrad region is about 750 machines for traditional technology and approximately 120-150 machines for cut-to-length technology. The fleet of domestic machinery is very old. Approximately 80% presents of machines are utilized over normative assigned lifetime, machine availability rate has decreased from 0.9 to 0.5. It means that only half of the Russian forest machine fleet is in good state, i.e. operating/working conditions satisfy the conventional requirements. The wear rate of domestically made machines is 0.7-0.8.

Currently the wood harvesting construction industry in Northwest Russia continues in the Onego tractor plant with production of two models of traditional caterpillar skidders. Production of this plant dropped from 12 000 to 200 machines per year since 1988. Import of cut-to-length machinery is replacing domestic tree-length machinery.

Total capital investments into logging were 46 million Euros in 2005. The rate of wear of fixed assets is about 50% and needs improvement. The economical indexes of technology development show positive signals, as the renewal rate is 14% and the retirement rate is 5%, both better than earlier. This means that logging enterprises are now in better position to renew machinery and technology that in the past. Now there are also better possibilities to finance purchase of technology.

The total number of enterprises registered in logging industry was 1287 in 2006 and altogether 19 870 employees were involved in logging. Only 113 enterprises have leased forests and can be taken into account as major customers for forest machinery producers.

Logging is concentrated into large and medium size enterprises which usually belong to international pulp, paper and sawmills. The four largest logging companies with an annual cut of more than 200 000 m^3, i.e. OOO "Russky Les" (Stora Enso), ZAO "Tikhvinsky KLPKh" (UPM-Kymmene), OAO "Svetogorsk" (International Paper), OOO "Metsyaliitto Podporozhje" (Metsäliitto), represent the key players in pulp and paper industry. They are logging 26% of the annual actual cut in the Leningrad region. The companies harvesting 100 - 200 thousand m^3 per year, i.e. OOO "Svedwood-Tikhvin" (IKEA), ZAO "Timberlehnd-Vihborg", ZAO "Kompaniya

Vinnehr", OOO "Timber-Kholding", ZAO "Efimovsky KLPKh" (Mayr-Melnhof-Holz), represent the biggest players in sawmilling. The share of these companies is approximately 20% of the annual actual cut in the Leningrad region. This means that 9 key logging companies procure approximately half of the region's round wood. Next 14 companies which cut 50 - 100 thousand m^3 per year provide about 30% of the annual actual cut in the Leningrad region. Approximately 50 small companies procure rest of the 20% annual logging. Most of the logging capacity is concentrated among few forest districts with well developed forest industry, such as Tikhvinsky, Priozorsky and Podporozhsky.

The results indicate that the annual need for cut-to-length machinery is approximately 20-30 harvesters, forwarders and short-wood trucks. Need could be 30-40 units per year in the near future, if allowable cut would be utilised or even 50-60 harvesters, forwarders and short-wood trucks per year, if also thinnings would be done in full scale.

The annual need for energy wood machinery is approximately 4 biomass forwarders, 10 mobile chippers and wood chip trucks per year. Need could be about 15-20 units per year in the near future, if allowable cut would be utilised or even 30-40 biomass forwarders and mobile chippers per year, if also thinnings would be done in full scale.

Only one third of the current forest leasers in Leningrad region have enough forest resources and could be users of Nordic cut-to-length technology based on *Actual cut scenario*. These 41 enterprises need 270 machines - 90 harvesters, 100 forwarders and 80 trucks. Thirty seven companies in energy wood harvesting wood need 50 chippers and biomass forwarders and 60 woodchip trucks. The share of 10-top enterprises would be half of the total fleet.

Sixty percents of forest leasers in the Leningrad region have enough forest resources and could be users of Nordic cut-to-length technology based on *Allowable cut scenario*. These 68 enterprises need 500 machines - 160 harvesters, 190 forwarders and 150 trucks. Fifty six companies in energy wood harvesting wood need 100 chippers and biomass forwarders and 110 woodchip trucks. The share of 10-top enterprises would be half of the total fleet.

Sixty percents of current forest leasers in the Leningrad region have enough forest resources and could be users of Nordic cut-to-length technology based on *Potential cut scenario*. These 71 enterprises would need 770 machines - 260 harvesters, 280 forwarders and 230 trucks. Seventy companies in energy wood harvesting would need 150 chippers and biomass forwarders and 180 woodchip trucks.

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