APPENDIX E

Wood Utilization Business Decision Support Tool
JNF-KKL Thinnings, Salvage and Slash, Israel

Utilization of Logs and Residue From JNF-KKL Plantation Management Activities
Israel Technical Assistance Mission
July, 2012

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No.	Raw Material Category	Product Category	Technology Risk[1]	Capital Investment Required[2]	Competition for Market[3]	Raw Material Supply Requirements[4]	Comments
1	Chips or Ground Material	Mulch, Non-Commercial Agriculture (e.g. "green space") and Residential Applications	Low	Low to Medium	Low (market does not appear well-developed)	Low to Medium	Education and outreach program needed.
2	Chips or Ground Material	Mulch, Commercial Agriculture Applications (e.g. orchards)	Low	Medium	Low (market does not appear well-developed)	Low to High	Current state of R&D not known. Education and outreach programs appear to be needed, but unclear what is being done currently.
3	Chips or Ground Material	Mulch, Special Applications (e.g. playgrounds)	Low	Medium	Unknown	Low to Medium	Product needs careful screening to ensure size consistency.
4	Chips or Ground Material	Soil Amendments, Compost, Non-Commercial Agriculture Applications	Low	Low to Medium	Medium	Low to Medium	Current state of Israeli R&D not known. Veolia makes up to 800,000 m^3/yr from animal manure and biosolids primarily.
5	Chips or Ground Material	Soil Amendments, Compost, Commercial Agriculture Applications	Low	Medium	Unknown	Low to High	Ag. compost market is unknown.

[1] **Technology Risk Rating**: Low - Long-term commercially deployed; Medium - Commercially deployed, limited operating experience; and High - Pilot or Research & Development stage, no commercial scale operation.

[2] **Capital Investment Required**: Low - Less than ILS ₪200,000 (USD <$50,000); Medium – Less than ILS ₪1,000,000 (USD <$250,000); and High - More than ILS ₪1,000,000,000 (USD >$250,000).

[3] **Market Competition**: Low – The same or equivalent products are not readily available or competitively priced; Medium – The same or equivalent products are available and competitively priced; High – The same or equivalent products are readily available and priced lower.

[4] **Raw Material Supply Requirements**: Low – Within current and projected supply availability using one or more contractors; Medium – Requires up to 25% more supply than currently produced within 50 mi; and High – Requires 25% more supply than currently available within 50 mi radius.

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6	Chips or Ground Material	Bedding, Large Animal (e.g. confined, cattle, dairy, horses etc.), Commercial Agriculture Application	Low	Low to Medium (depends on size and consistency requirements)	Unknown	Low to Medium	See also "animal bedding shavings" below under "roundwood" (Knaebe 2012, PPT Slides 45-47, small animals).
7	Chips or Ground Material	Thermal Energy, Power or Combined Heat & Power (CHP)	Low to High	Medium to High	Low to Medium	Low to High	Variety of scale and technologies possible. Veolia's Galaam plant is a small-scale example of direct combustion.[5]
8	Chips or Ground Material	Biofilters, Odor Reduction	Low	Medium to High (grinder and screening required)	Unknown Market	Low	Requires market research to determine interest, need and competition. Potential installations range from highly-engineered systems to simply moist piles of chips or ground material with odiferous air pumped through them.
9	Chips or Ground Material	Biofilters, Water Filtration	Low	High (grinder or chipper and screening required)	Unknown	Low	Requires market research to determine interest, need and competition. Applications range from storm drain "pillows" to engineered installations to intercept and filter runoff water with heavy metals. See Item 18 for more refined manufacturing process.[6]

[5] Biomass Energy Technology Pathways: 1) Thermo-Chemical – Combustion (heat), gasification (gases) and pyrolysis (liquids); 2) Biological – Fermentation (liquids and gases); and 3) Physiochemical – Hydrolysis (produces liquids).

[6] Mark Knaebe, FPL, noted that since the wood and bark are negatively charged, this application works best for positively charged pollutants, such as metals. Can also change polarity so the same material can attract negatively charged pollutants.

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10	Chips or Ground Material	Erosion Control (Surface)	Low	Low to Medium (grinder or chipper, and screening required)	Unknown	Low	Can spread chips or particles on-site or use to fill fabric tubes that are placed and staked in specific locations (also called "wattles" in U.S.).
11	Chips or Ground Material	Fuel, Compressed Wood Products, such as Fire Logs and BioBricks	Low	High (i.e. firelogs USD $250,00 and up and BioBricks USD $1.0 million and up)	Unknown (these products are used in fireplaces and wood stoves)	Medium to High (requires at least 5,000 bone dry tons in U.S.)	Additional grinding, screening and drying is necessary prior to final processing into final products. May have niche markets in Israel, but will be higher cost than firewood.
12	Chips or Ground Material	Fuel, Pellets	Low	High (i.e. in U.S. a commercial plant may cost $5.0 million and up)	Low (number of pellet stoves already installed is unknown, but suspect very small, if any)	High (i.e. in U.S. would require 10,000 bone dry tons minimum if plant is located where sawdust is generated, 40,000 bone dry tons if not)	Further grinding, screening and drying necessary before processing into pellets. Clean sawdust is preferred raw material. Pellet stoves can be automated so will work when owner is absent (Knaebe 2012, PPT Slides 33-34).
13	Chips or Ground Material	Pellets, Animal Bedding	Low	See Item 11	See Item 11	See Item 11	See Item 11. Fuel pellet market is necessary precursor to developing animal pellet bedding market, but can extend seasonal market period.
14	Chips or Ground Material	BioChar	Medium	Medium to High	Unknown	Low	Biochar is similar to ground-up charcoal, but different species may have different characteristics. In U.S. much of the biochar being sold is a waste product of gasification.

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15	Chips or Ground Material	Organic Composites (roofing shakes)	Low	High (could set-up small plant for USD $1 million)	Unknown	Low to Medium	Mark Knaebe notes that roof shakes are 50/50 wood/recycled milk jugs. Pigment needs to be added for longer life. Cement composites tend to have only a small percent wood (Knaebe 2012, PPT Slides 40-45).
16	Chips or Ground Material	Wood-Plastic Extruded Lumber	Low	High	High (imports)	Medium to High	Example of a product would be decking. Also uses 50/50 wood/recycled milk jugs. Pigments is needed for longer life.
17	Chips or Ground Material	Composite Panels (i.e. particle board, medium density fiber board (MDF), strand board, oriented strand board (OSB) and others)	Low	Very High	Medium to High (depending on product line)	High	Unlikely to see an MDF or particle board plant in Israel, given failure of previous attempt within last 10 yrs, lack of supply to obtain economies of scale and international competition.
18	Chips or Ground Material	Wood Fiber Mats	Low	Medium	Unknown	Low to Medium	Woven wood fiber mats can be chemically impregnated and used for mine reclamation, water filtration and other purposes (Knaebe 2012, PPT 16, 25-31). See also Footnote No. 6.
19	Chips or Ground Material	Wood Fiber Plastic Composites	Low	Medium to High	Medium to High (depending on product line)	Low to Medium	Extruded or pressed products can absorb less-processed raw material, but mold-injected products have very specific specs. for raw material (Knaebe 2012, PPT Slides 35-39).

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20	Chips or Ground Material	Pulp/Paper	Low	Very High	High	High	Assume that large quantity of corrugated container board is imported for ag. export shipping, but not investigated.
21	Needles or Leaves	Essential Oil Extractives for Health and Beauty Products	Low	Medium	Medium	Low	Only one manufacturer visited during this trip, May Hasharon Timber Co., is using eucalyptus leaves are used to make various health and beauty products. Owner said he needs to spend more on promotion and marketing.
22	Bark	Extractives or Filler for Other Products (besides mulch)	Low	High	Unknown	Medium to High	Bark from some species can be profitably steam-distilled for extractives or can be fine-ground for use as filler in various products, such as glue and ag. chemical application).
23	Roundwood (variety of diameters)	Natural Form, Architectural Accents, Interior and Exterior, and Supports	Low	Medium	Low to Medium	Low to Medium	Examples visible at May Hasharon and Weiser Sawmill (includes fencing, railings, support columns, shade structures etc);
24	Roundwood (all diameters, but ≥30 cm might obtain higher value as sawlogs in Israel) (12+ in.)	Firewood	Low	Low to Medium	Medium	Medum	Significant portion of logs from KKL-managed lands go into the firewood market. No modern firewood processors were observed.

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No.	Raw Material Category	Product Category	Technology Risk[1]	Capital Investment Required[2]	Competition for Market[3]	Raw Material Supply Requirements[4]	Comments
25	Roundwood (usually less than 20 cm diameter) (8 in) *Also can use chips or ground material for higher production plant that makes briquettes.	Charcoal	Low	Low to Medium	Unknown (there do not appear to be any major producers in Israel)	Low to Medium	Uncertain about how air quality standards might affect location and operation of traditional charcoal kilns. There are high-tech options though.
26	Roundwood (10-25 cm would be common) (4-10 in.) (Note: Can also use slabs.[7])	Shavings (made by whole-log shavings machines)	Low	Medium to High (depends on if dryer is needed)	Unknown	Low to Medium	Example of custom-built whole-log shaver is at Hula Valley Sawmill (Adnan Ibrahim) (no dryer). Shavings from some tree species may have antimicrobial effects, such as cypress and cedar.
27	Roundwood (5-10 cm) (2-4 in.)	Semi-Processed Poles (i.e. machine peeled)	Low	Low	Unknown	Low to Medium	Eucalyptus poles were observed at May Hasharon and Weiser Sawmills and both mills had some type of peeler.
28	Roundwood (usually 10-15 cm) (4-6 in.)	Semi-Processed Post/Poles, Furniture Market (machine-peeled or -doweled[8])	Low	Low to Medium	Low	Low	Interior and exterior rustic furniture.

[7] Slab – Exterior portion of log removed as log is being sawn, with one flat and one rounded side. Also can refer to piece of sawn wood with bark still on one or both edges.

[8] Peeled or Doweled – Machines that peel follow taper of log or sapling. Machines that dowel make the entire log or sapling the same diameter.

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29	Roundwood (usually 10-20 cm diameter) (4-8 in.)	Semi-Processed Post/Poles, Post/Pole Market (either machine-peeled or -doweled)	Low	Low to Medium	Unknown	Low to Medium	Utility poles, fencing, structural accents and supports, play equipment, shade structures etc.
30	Roundwood (usually 10-20 cm diameter) (4-8 in.)	Semi-Processed Post/Poles, Structural Market (machine-peeled or -doweled)	Low	Medium (added complexity due to design, special fasteners and fabrication requirements)	Low	Low to Medium	Engineered structural components, such as roof and flooring systems, pedestrian and other kinds of bridges etc. (Knaebe 2012, PPT Slides 48-86).
31	Saw Logs (usually greater than 20 cm diameter) (8 in)	Rough-Cut Lumber[9], Green, Construction and Concrete Forms	Low	Low to Medium	High	Medium to High (low profit margins mean that need higher production and volumes to compete)	Lower grade lumber is often used for temporary bracing, concrete forms and other basic construction uses.
32	Saw Logs (usually greater than 20 cm diameter) (8 in)	Rough-Cut Lumber and Timbers[10], Green, Treating Market	Low	Low to Medium	High	Medium to high (low profit margins mean that need higher production and volumes to compete)	Low-grade lumber for treatments and preservatives market (usually requires some air drying to allow treatments or preservatives to penetrate).
33	Saw Logs (usually greater than 20 cm diameter) (8 in)	Pallet Lumber	Low	Medium	High (from imported wood)	Medium to High	Existing market in Hebron for "pallet logs" and possibly a few other locations. Given imported lumber pricing and availability, only viable where have low cost labor.

[9] Rough Cut – Surface is same as when the piece was first sawn. Not surfaced (i.e. sanded or planed).

[10] Timbers – Lumber that is at least 13 cm (5 in.) in its smallest dimension.

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34	Saw Logs (greater than 30 cm) (12 in.)	High-Value, Custom Sawn Products (e.g. ranges from thick slabs with natural edges to long beams)	Low	Medium to High (slabs and beam may require planing and kiln drying for specialty markets)	Medium to High (due to competition from imports for many product categories)	Medium to High (due to sizes needed and possibly specific species, such as Atlantic cedar)	Only lumber kiln observed during visit was at May Hasharon Timber Co.
35	Sawlogs, "Woods Run" (greater than 30 cm) (12 in.)[11]	Lumber, Kiln-Dried, Remanufac-turing Market[12]	Low	High (requires kilns, and finger-joint and edge-glue equipment)	High (lots of competition from European imports)	High (need larger scale to justify investment and compete with imports)	Probably unlikely except in conjunction with another operation, such as May Hasharon Timber Co. (Knaebe 2012, PPT Slides 11-15).

[11] Woods Run Logs – Logs that are minimally sorted at the landing by species, minimum diameter and length, but not for defect such as rot, large limbs, high taper or sweep.

[12] Remanufacturing Market – Lumber is ripped along its long edge and defects chopped or sawn out. Remaining pieces are then finger-jointed or finger-jointed and edge-glued back together to be used as is (e.g. finger-jointed stud) or panels that are then manufactured into other products, such as doors.