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**Agricultural Sciences, Food Security and Natural Resource
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Thesis

**Assessment of the Potential of Residues from Fruit
Production as Suitable Renewable Energy for Drying
Systems in Northern Thailand**

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SUMMARY

In Thailand, two-third of biomass energy is used in the domestic sector and one-third in industries. One major drying technology used in northern Thailand is the hot air bulk dryer operated by fossil fuel. With increasing oil prices renewable energy sources have become a preferred alternative and have received more attention by the Thai government. Among the promising renewable energy sources are tree prunings from orchards and fruit processing residues such as peels and seeds.

Limited information is documented on availability and fuel properties of fruit production residues especially for litchi and longan. The aim of this study was to assess the availability and fuels properties of pruning wood, seed and shells of mango, longan and litchi as potential energy sources for drying in northern Thailand.

To determine availability and current use of pruning wood and fruit processing residues, farmer interviews on pruning wood and a structured questionnaire on fruit processing facilities were conducted. To determine fuel properties of pruning wood and fruit processing waste, field work in which physical wood measurements and laboratory analysis of the field samples were done. The physical properties of pruned wood such weight, density, diameter, moisture content, and waste composition were determined through standard measuring procedures. For chemical properties proximate and calorimetric analysis were conducted on both pruning wood and processing waste.

Results from the interviews indicate that there is abundant potential for both pruning wood and waste. Current uses for wood included domestic and industrial uses. Waste from small –scale drying facilities was commonly used as source for organic fertilizer by owners. However, waste from large-scale processing facilities was under-utilised mostly ending up in dumping grounds.

Fuel wood properties were observed as follows: the wood density for all the investigated orchards ranged from 450 kg/m³ to 621kg/m³, highest density observed in longan; total dry matter content for wood ranged between 50 and 60%, while processing waste had 30 to 54%. Drying rate of pruning wood up to 50 mm diameter at ambient (under covered roof) and near ambient oven temperatures yielded similar final moisture content at any period.

Wood ash content ranged from 0.96 to 3.7% whereas waste had about 4% with longan having highest in both cases. Both wood and waste expressed high volatile matter contents of between 75 to 83%. Fixed carbon contents of between 15 and 24 % for both wood and waste were observed. Wood expressed high heating values (gross energy) of between 17 MJ/kg and 19 MJ/kg dry basis. Processing waste had between 17 MJ/kg and 20 MJ/kg dry weight basis.

The study concluded that there is great potential to utilise these fruit production residues because of the availability and competitive energy content. However, more research is necessary on the actual utilisable pruning wood and dehydration methods of processing waste to economically utilise these resources.