

Biomass Densification in Thailand

Preecha Kiatgrajai¹, Somkit Tugsinavisutti²
Rajanikorn Setthoe, Chamnong Adivadhanasit³

ABSTRACT

The objectives of this research are to review (1) the supply of briquetting equipment and scope for briquetting machine manufacturing, (2) the present and potential production of briquettes, (3) the present potential market of briquettes and (4) the present use of briquettes and potential use of briquettes in Thailand. Methodology of the study consists of (1) the review of literature on the subject proper and on related subjects, and (2) the field survey of briquette production and usage in selected provinces of the North, Northeast and Central region of Thailand. The result of the research could be summarized as follows : The briquetting machine and equipment was first manufactured in Thailand in the late 1970's following the import of a few screw extruders from Taiwan. It is V.S. Machien company that first manufactured the briquetting machine and equipment for commercial purpose and subsequently many other companies had followed suit. Presently only V.S. Machine company and B.S.C. Groups of Industry are found to continue manufacturing briquetting machines and equipments. Two types of briquetting machine are available : high pressure and low pressure briquetters.

The briquette under the present production is divided into four types : ricehusk briquette, uncarbonized sawdust briquette, carbonized sawdust briquettes (biocoal) and green fuel. For the most part, ricehusk briquette is produced by the factories in Central region and distributed through wholesalers to refugee camps in the areas bordering with Laos and Kampuchea. Carbonized and uncarbonized sawdust briquettes are found to be produced in the North and Central regions. The uncarbonized sawdust briquette is also supplied to the refugee camps whereas the carbonized sawdust supplied to South Korea as well as the domestic market. Green fuel has not been under the commercial production as it has been going through the demonstration step only in support of the Green Isarn Project. The market of briquettes is very limited and is confined to particular groups of users : the refugee camps, temples in Bangkok, South Korea, local restaurants and food vendors. Green fuel to be used by military units, jails, households and food vendors. The production and distribution of briquettes for commercial purpose is potentially possible if raw materials used for production, uncertain supply of the product, high price and poor quality of the products are eliminated.

¹ Dept. of Forest Products, Faculty of Forestry, Kasetsart University.

² Dept. of Agricultural Economics, Faculty of Economic and Business Administration, Kasetsart University.

³ Dept. of Sociology & Anthropology, Faculty of Social Sciences, Kasetsart University.

INTRODUCTION

Briquette, green fuel and carbonized briquette (biocoal), the densified fuels based on agricultural residues for usage as a substitute of wood fuel have recently played an important role in Thailand. The story of briquetting started when an entrepreneur in the late 70's imported a few screw extruders from Taiwan and set up an operation to produce sawdust briquettes for industrial use. The market did not grow well until the mass of refugees created a local energy problem. Literature of briquettes in Thailand can be traced back to the year of 1978 when Bunyakiat and Tasakorn started their study on densification technology. Since then, the standardization of the briquetting equipment, the briquette itself and the users have been so much concentrated that a lot of worthwhile works on the subject have been published.

OBJECTIVES & METHODOLOGY

The objectives of this study are to review (1) the supply of briquetting equipment and scope for briquetting machine manufacturing, (2) the present production and potential production in terms of financial and economic aspects, (3) the present market and potential market of briquette, and (4) the present use and potential use of briquettes in Thailand. Secondary data were collected from libraries of various educational institutions and primary data were obtained by interviewing persons, firms whoever had produced briquetting machine equipment, had done research on the project of similar kind and had used briquettes. The producers and users of sawdust and ricehusk briquettes

in 7 provinces were identified and picked up for the survey. Data were analysed systematically by using statistical method of percentage. The process of this study began in March 1990 and ended up in May, of the same year.

RESULTS

The results of the studied can be summed up as the followings.

The present supply of briquetting equipment and scope for briquetting machine manufacturing

All of briquetting machines in Thailand are a screw extrusion type with an original from Taiwan. Machines of each manufacture had a little difference due to their modification. Briquetting machine can be divided into high pressure which produced ricehusk and sawdust briquettes and the low pressure which produced green fuel. There are 5 manufacturers that produced high pressure briquetting machines as sideline of business. Two of them had marketed their products : V.S. Machine and TISTR., another three are the potential manufacturers (S.P. Energy, Changpeuk Saw Mill and B.S.C. Groups of Industry). For green fuel machine; Srikampaengsaen, B.S.C. Groups of Industry and Use are the manufacturers. Manufacturer's production capacity and suitable location of the factory can not be identified. None of them will not produce the machine before getting the order. Costs of production except the raw material and equipment can not be identified exactly especially fixed cost and labour cost. At present (1990), V.S. Machine sells at 120,000 Baht per machine which 40,000 Baht in composed of fixed cost, and profit. The B.S.C. Groups of Industry sells at 35,000 Baht per set (composed of chopping, mixing,

briquetter and dryer tray) to the Second Army Area, RTA and gets the profit of 500 Baht if the tax is exempted. There is no problem in producing the machine at present technology level, but the buyer have to wait for 1–3 months after placing the order. However, the market of the machine is in the stage of maturity at present. Therefore, all manufacturers are idle except the B.S.C. Groups of Industry that gets the order from the military for the Green Isarn Project.

The Present and Potential Production of Briquette

There are 4 types of briquettes that have been produced in Thailand : ricehusk, uncarbonized sawdust, carbonized sawdust (biocoal) and green fuel. Production processes of ricehusk and sawdust briquette are quite similar, especially, a briquetting machine processes of ricehusk briquettes is the simplest one. For the sawdust briquettes, sawdust must be dried and screened before densification. The carbonized briquettes or the biocoal is the further process of sawdust briquettes. The production process of the green fuel consumes more labor and time, starting from collecting raw material, chopping, mixing, densification and finally drying for 7 days.

There are 3 groups of ricehusk and sawdust briquette producers, (1) producers who have their own raw material and produce briquettes commercially (2) producers who buy the raw material and produce briquettes both for selling and using in their own business (3) producers who produce sawdust biocoal for sale and exporting. The production of green fuel is not commercialized and only the Second Army Area, RTA being a producer.

There are 24 producers of ricehusk and sawdust briquettes who occupy the total of 76

briquetting machines. Only 7 producers are still producing briquettes with only 27 working machines. The remaining 17 producers stop producing and stop running 49 machines. The production capacity of each producer was varied according to their modification and accessories added to machines.

Cost of Production and Return on Investment

Cost of production and returns of each producer are also varied. For ricehusk briquette, cost of production ranges from 0.61 Baht per kg for S.P. Energy to 1.62 Baht per kg for Chitralada Royal Project. Sawdust briquette of Mr. Loedvit costs 0.79 Baht per kg. Biocoal for Kittrattane Import-Export costs 3.22 Baht per kg whereas the production cost of green fuel is 3.18 Baht per kg. Ricehusk and sawdust briquettes as well as the green fuel were sold at 1.50 Baht per kg. Ninety percentages of biocoal were exported at 9.00 Baht per kg, the other 10% sold in domestic market at 5.00 Baht per kg at the factory. From the indicated price, profit and return on investment can be calculated. If the price of production factors and products themselves has undergone changing to the extent to which the briquette producer is thereby able to carry on his activity, the sensitivity analysis of the price must be undertaken by a given fact that the price of raw materials and that of briquettes must be also changed. And it is found that the price of ricehusk can be varied from 449 to 898 Baht per ton when the ricehusk briquettes is set at 1.00 to 1.50 Baht per kg respectively in case of S.P. Energy. While the price of sawdust and other wastes can be varied from 14 to 23 Baht per cum of log.

Problem of Briquette Production

There are not many technological problems in production of ricehusk and sawdust briquettes although screws are always repaired and bearings, die and heater are often changed. The major problems are : the market demand for the product, supply of raw materials, and quality and price of substitute products. Green fuel has some technical problem and the problem of lack of raw material.

The Present Market of Briquette

The traders of briquettes are categorized into 4 groups : (1) Producers of uncarbonized briquette and biocoal who sold briquette directly to the users or through middlemen (2) Producers of sawdust biocoal who bought briquettes from the producers and carbonized them for export and domestic market (3) Wholesalers who are mostly the winners of the bid for delivery of ricehusk and sawdust briquettes to refugee camps and (4) Retailers who are found in some supermarket in Bangkok. Numbers of these traders decreased in comparison between the year of 1988 and 1990. Considering the briquette marketing channel it is found that it is started at the uncarbonized producers who sell to wholesalers or the carbonized producers. The wholesalers, who win the bid from UNBRO, send the product directly to the refugee camps. The carbonized producers export mostly of their product, the rest is sold directly to the users such as households, vendors are restaurants or sold through the supermarkets (the retailers). Green fuel briquettes have been produced by some military units and jail just only for their own uses.

The market structure of the briquette differs in each level of traders. At the briquette

producer level the market is monopolistic competition, and at the biocoal exporters and the wholesalers level the market is oligopolistic as indicated by number of sellers, product differentiation and barrier to entry. The marketing margins can be calculated only from the channel from producer to wholesaler and finally at the refugee camps. Marketing margin is 50% of the delivery price which is composed of transportation cost of 3.60% and the rests are service charge and profit.

The Potential Market of Briquette

If the refugee camps give up the purchase of briquette, the domestic market for uncarbonized briquette will be very dim. Only ricehusk briquette will remain in use only for cremation at temples where only a small volume of briquette needed. The business activities will be closed down. Only carbonized sawdust briquettes that are still in demand in both domestic and foreign markets will have the potential market in the future. This is because biocoal has the characteristics such as quality, availability, capability in storage, application and price rather competitive to other alternative fuels. In addition, some pattern of cooking still prefers using charcoal or biocoal as fuel. Green fuel has many difficulties in the production process, if any technological has been executed to lessen such production difficulties it may be available in the market in place of firewood and charcoal in the near future.

The Present and the Potential Use of Briquettes

Most households in rural areas and small scale and medium scale industries normally depend largely upon firewood and charcoal fuels namely traditional fuels for cooking and giving

energy to the boilers. With rising income and urbanization the use of traditional energy has declined. The main substitute fuels are LPG and electricity. Briquette which is semi-modern fuel begins to play an important role in Thailand. The poors or the refugees and even the dead bodies are the users of uncarbonized briquettes. The biocoal or carbonized briquettes are used by those from the middle class, the upper-middle class, the urban people, the restaurant and the foreigners in Taiwan and South Korea. Green fuel which has not been commercially produced is not regularly used in the household. Only military units and jail of Nakhon Ratchasima province are the users of green fuel. The rural people who are the real target of Green Isan Project have less idea of green fuel but are waiting for the use of green fuel produced by themselves.

Demand for LPG and electricity for cooking will be highly increasing in both cities and villages in Thailand. People in the cities intend to change from charcoal to LPG, not to briquettes even though they have to pay more for it. Rural users of firewood for cooking will still be looking for free firewood or they will pay for other alternative fuels for cooking such as LPG or electricity instead of paying for biomass briquettes. They are so far away from briquette producers. And Thai people always gives value to the 'easiness' 'modernization' which can be found more easily from LPG and electricity, but less from fuelwood, charcoal and even biomass briquette.

However, there is quite a future for using biomass briquette in both domestic and foreign users if the quality is developed, if the price is not too high and if Thai people change their

social value of 'easiness' and 'modernization' which the latters can probably become true some day.

RECOMMENDATIONS

The followings are recommendations which are based upon the facts from the research findings.

1. The use of ricehusk, bagasse as other agricultural residues beside sawdust as raw material for briquette production may not be appropriate in the future because of other alternative use and may not be sufficient for commercial production. It is recommended that only sawdust has a better potential for briquette production.
2. At present, there are large numbers of briquetting machines in Thailand. Therefore, it is not necessary to set up more companies to manufacture the machines unless a development of new technology with well-designed and good quality briquettes is done. This newly designed machine should be able to produce and carbonized sawdust briquette simultaneously in order to save processing time and cost. Furthermore, the machine used for producing green fuel should be switched over to produce nursery block or green manure stick which would be more acceptable to the public.

3. More research fund should be provided for developing of carbonized sawdust briquette with low processing cost in order to compete with other source of fuel.

4. Government policy on briquette as an energy source should be geared toward the promotion and encouragement of private sector to carry out the production and distribution

of briquette by providing technical as well as financial facilities.

REFERENCES

- กัญจนา บุณยเกียรติ และ สมศักดิ์ ดำรงค์เลิศ, ภาควิชาเคมีเทคนิค คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย, การพัฒนาแกลบและฟางข้าว เพื่อเป็นเชื้อเพลิงในครัวเรือน, 2525-27.
- โครงการน้ำพระราชดุทัยจากในหลวง, โครงการเชื้อเพลิงเชื้อว, อรุณการพิมพ์, 2531, ศธร. ทก. 1 และ กอ.ร.มน. ภาค 2
- วัฒนา เสถียรสวัสดิ์ และคณะ, โครงการเชื้อเพลิงเชื้อว, ภาควิชาพืชสวน คณะเกษตร มหาวิทยาลัยเกษตรศาสตร์, มิถุนายน 2530.
- _____. เชื้อเพลิงเชื้อว (โครงการเชื้อเพลิงเชื้อว), ภาควิชาพืชสวน คณะเกษตร มหาวิทยาลัยเกษตรศาสตร์, มกราคม 2529.
- _____. “กรีนฟิวอัล เชื้อเพลิงทดแทนพืชและถ่าน”, ข่าวสารเกษตรศาสตร์ ปีที่ 29 ฉบับที่ 6 ธันวาคม-มกราคม 2527-28, หน้า 49-61.
- ศุนย์วิจัยและอบรมพัฒนา จุฬาลงกรณ์มหาวิทยาลัย, รายงานสรุปการศึกษาความเหมาะสมการผลิตไฟฟ้าและความร้อนจากวัสดุเหลือใช้เกษตร ในโรงงานอุตสาหกรรม, กันตอน, 2532.
- ส่วนโครงการพิเศษ ศธร. ทก.2 และ กอ.ร.มน.ภาค 2, “สรุปผลการดำเนินงานโครงการผลิตเชื้อเพลิงเชื้อว”, มีนาคม 2533, (เอกสารอัดสำเนา)
- Bhattacharya, S.C. et al. “State of the Art for Biomass Densification”. 22 p. *Energy Sources*, Volume. II. p.161 – 182. United Kingdom, 1989.
- _____. et al. “A Survey of Uncarbonized Briquettes and Biocoal Markets in Thailand”, *RERIC International Energy Journal*, Volume. II, No.1, June 1989.
- Brandt, H.J. *Biomass Densification Part I : Densification in Thailand a Pre-feasibility Study*, 117 p. Department of Mechanical Engineering/Technology and Development Group, University of Twente, Enschede. The Netherlands, 1988.
- _____. *Biomass Densification Part II : Design Study*, 115 p. Department of Mechanical Engineering/Technology and Development Group, University of Twente, The Netherlands, 1988.
- Dang, G.V. “Traditional Fuels in South East Asia (A review)”, 14 p. CIFOPE/AIT international seminar on energy development with the European Community, Pattaya, Thailand, 1989.
- Erikson, E., Prior M., *Briquetting Biomass Waste for Fuel (Summary Report)*, 30 p. SIDA/SERRA AB. Trosa, Sweden, 1989.
- Leach, G. *Household Energy in South Asia*, 111 p. Elsevier Applied Science, London, United Kingdom, 1987.
- NEA *Rural Thailand Energy Demand Forecast and Supply Situation*, Thailand paper for item 70 of the provision agenda, 15th Session of Committee on Natural Resource and Energy 1989, 17 p. Bangkok, Thailand, 1989.
- _____. *Thailand Energy Situation 1988*. 25 p. NEA, Bangkok, Thailand, 1988.
- NESDB/NEPO *Household Energy Demand Analysis*, 110 p. National Economic and Social Development Board/National Energy Policy Office, Bangkok, Thailand, 1987.
- Prince of Songkla University, *Agricultural*

- Residue Energy Potential : Village Case Studies for Thailand*, Department of Mechanical Engineering, Prince of Songkla University, Haadyai, Thailand, 1988.
- Royal Forest Department, *Charcoal Production Improvement For Rural Development in Thailand*, 163 p. Final report, Submitted to NEA, Renewable Nonconventional Energy Project, Thailand, 1984.
- Stevenson, G.G., Perlack, R.D., *The Prospects for Coal Briquetting in the Third World*, Energy Policy, June 1989.
- UN/ESCAP/RWEDP Utilization of Agricultural Residues as Energy Source for Production Activities, 104 p. Regional Energy Development Programme, UNDP and ESCAP, Bangkok, Thailand, 1985.
- UN/FAO/RWEDP *Regional Wood Energy Development Programme for Asia, Information Package : Package No. 6, Briquetting, Set I*. RWEDP/FAO Bangkok, Thailand.
- . *The Use of Wood Fuels in Rural Industries in Asia and Pacific Region*, 83 p. Regional Wood Energy Development Programme, FAO. Bangkok, Thailand, 1988.
- Wongvicha, P. *A Study of Briquettes and Biocoal in Thailand*, 96 p. AIT, Bangkok, Thailand, 1988.
- NEA/USAID *Sectoral Energy Planning Models : Supporting Studies of Thailand's Energy Master Plan* : page 72 : *Household Energy Consumption*, page 73 : *Rural Household Energy Demand*.
- UNBRO *Green Fuel Testing Result*, UNBRO, 1 p. Bangkok, Thailand, 1988.