THE E^{3i} VILLAGE CONCEPT

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ABSTRACT

The E^{3i} concept stands for empowerment the rural society in getting a better access to renewable energy sources for economic and productive activities in an environmentally sound sustainable development. This concept, proposed by the author, is meant to create the spirit of self help among the rural society who have been living in prolonged poverty and lack of access to basic energy need, especially in recent years when the price of oil becomes uncertain. Indonesia, now, is a net oil import country. Therefore, the need to tap locally available renewable energy sources is becoming an important issue. Initial works to establish the E^{3i} village was first conducted in 1999 using the grassroots project from Japan in which several small processing units were installed in some villages in Java, Bali and West Nusa Tenggara. SPU as the value-added facilities could provide more jobs as source of income for the villagers. The paper provides more information on continuing activities in an effort to realize the E^{3i} village concept. The importance of making use locally available renewable energy sources as the main energy input for the SPU has now gradually being appreciated by both the central and local government including the private sector.

Key words: Renewable energy, Economical added value, Local resources, Small processing unit (SPU)

ABSTRAK

Konsep E^{3i} bertujuan memberdayakan masyarakat desa agar memiliki akses ke energi terbarukan untuk peningkatan ekonomi dan aktifitas produksi dalam pembangunan berkelanjutan yang berwawasan lingkungan. Konsep ini, yang diusulkan penulis, dimaksudkan untuk menciptakan semangat menolong diri sendiri diantara masyarakat pedesaan yang telah hidup sedemikian lama dalam kemiskinan dan kurang memiliki akses dalam memenuhi kebutuhan energi dasar, terutama pada beberapa tahun terachir dimana harga minyak tak menentu. Indonesia menjadi negara pengimpor minyak, karenanya kebutuhan untuk memanfaatkan sumber energi terbarukan setempat menjadi isu yang semakin penting. Kerja awal dalam membangun desa E^{3i} dimulai tahun 1999 dengan memanfaatkan proyek dari Jepang yang diterapkan pada tingkat akar rumput, dimana beberapa unit proses skala kecil (SPU) dibangun di beberapa desa di Jawa, Bali dan Nusa Tenggara Barat. SPU dapat memberikan lapangan pekerjaan yang menjadi sumber penghasilan bagi masyarakat desa. Makalah ini memberikan informasi tentang kegiatan lanjutan dari usaha merealisasikan konsep desa E^{3i}. Pentingnya memanfaatkan energi terbarukan setempat bagi SPU telah semakin dihargai baik oleh pemerintah pusat dan pemerintah daerah termasuk oleh sektor swasta.

Kata kunci: Energi terbarukan, Nilai tambah ekonomi, Sumberdaya lokal, Unit proses skala kecil (SPU)

1. INTRODUCTION

Millennium Development Goals (MDG) is set to reduce poverty around the world by 50% in 2025. For Indonesia and other developing countries in South East Asia, where percentage of poor people is still high, MDG's become a national target. According to the National Bureau of Statistics (BPS, 2002), the number of poor people in Indonesia reached 38.4 million or 18.2% of total population, and about 21.1% of the poor are residing in rural areas and 14.5% live in urban areas.

This condition is worsened by the continuing exodus of young people from the villages to the big cities and even to overseas to find job for better life. The villages then are left to the elders, which are weak and less productive to maintain food production for the increasing population of the country that now reaching more than 200 million peoples.
The government of Indonesia had put high priority in empowering small medium enterprises (SMEs) and local cooperatives to solve the current problems. It is also emphasized the need to explore the possibility to make use local natural resources effectively, such as from agriculture and marine sectors. Such as efforts can accelerate regional/local economic developments for creating equity and justice for entire national development programs toward sustainable development

The E^{3i} concept, proposed by the author, stands for empowerment the rural society in getting a better access to renewable energy sources for economic and productive activities to create environmentally sound sustainable development. This concept was meant to create the spirit of self help among the rural society who have been living in prolonged poverty and lack of access to basic energy need. Other concept of self help has also being proposed by the Ministry of Energy and Mineral Resources (MEMR) and by the Bureau of National Planning and Development (BAPPENAS) and known as the Energy Independent Village (EIV) or in Indonesian language Desa Mandiri Energi (DME). The MEMR concept states that EIV or DME should reach 60% self sufficient in electricity and fuel supply converted from local renewable energy sources. The EIV concept is envisaged to create self sufficiency in energy supply, particularly from renewable energy sources and to use them for productive activities to fight poverty. The BAPPENAS concept put more emphasize on social activities and economic aspect of an independent village.

Most of rural areas of Indonesia are rich in agriculture and marine resources but lacking in processing facilities. Traditionally the farmers or fishermen process their products/ fish by drying them in open air using direct sun drying. Sometimes they use both sides of the road as place to dry their products. Such as practices, is unhygienic for human consumptions since the products are easily contaminated with dirt and other foreign materials. They are also an easy target of infestation by insects such as flies and some are consumed by birds and rodent, this creates losses to the farmers and fishermen. By processing into finish product, post harvest losses can be reduced and the product can have a better price means gives more benefits to the producer.

In 1999 the author started to introduce a Small Processing Unit (SPU) concept in which local commodities could be processed into secondary or even tertiary processing stage in a system having greater content of local materials as well as better quality of products

(CREATA-IPB, 2000). This initial stage of implementation concept was supported by the Japanese government grassroots project, which later was also assisted by the ISESCO (CREATA-IPB, 2005). To maintain project sustainability, especially those located in West Nusa Tenggara, an agreement was made in which the project responsibility was handed over from CREATA-IPB to the Community Empowerment Office in Mataram.

The next step for the realization of the E^{3i} village concept would be to select the promising villages among those villages which already have SPU facilities. The selected villages will then be used as demonstration model of an ideal E^{3i} village.

2. MODEL OF E^{3I} VILLAGE

The basic idea in creating an E^{3i} village may take the form as shown in **Fig.1**. Gradually as the village developed then other important supporting facilities may grow, see **Fig 2**.

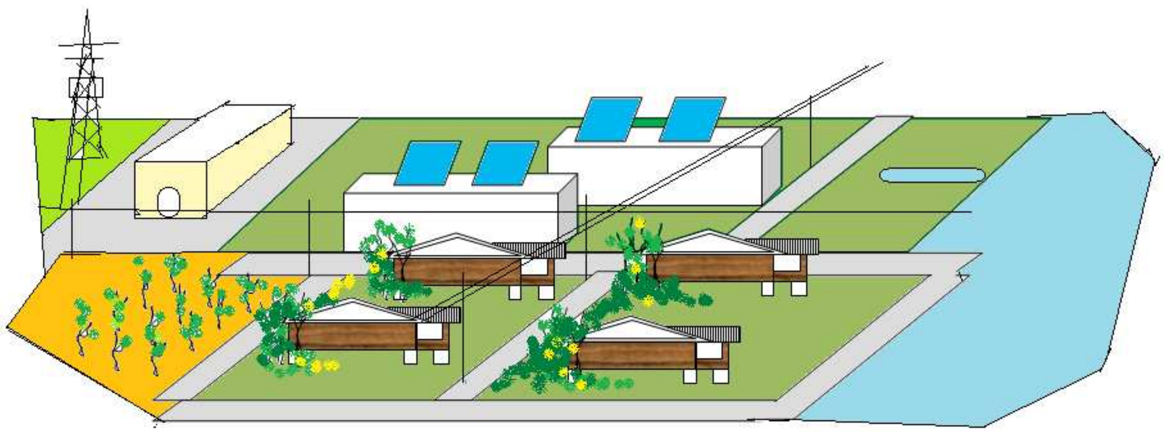

Fig.1. One possible configuration of a model E^{3i} village

Fig. 2. The growing E^{3i} village

The village should have a basic infrastructure such as a road connected to the market, industrial area and office (financial institution, school, health care, etc.) so their inhabitants can find a job and a pleasant housing environment making them to stay in the home village instead of seeking job outside the village.

Each E^{3i} village may be closely connected one to another make them easily exchanging their products or working together to manage a larger farms or industries. They may joint in collaboration to supply materials to the nearby "small - city", a grown up village with complete infrastructure.

Experiences have shown that the first approach as described above may take longer time for realization. Another approach will be to establish the village from new land such as in the transmigration areas, or in Java Island where open lands are still available.

Despite the difficulty in applying the first approach of providing stand alone small processing unit (SPU), such effort could be continued with more active participation of central and local authorities including local private sectors in adopting and nurturing the author's embryonic effort to make more SPU implemented. SPU should be promoted as a model small medium enterprise (SME) but its beneficiaries should be carefully selected.

Past experiences in introducing the SPU in Indonesian village, the following factors have to be considered in order to be successful, those are:

- The cooperative or individual entrepreneurs should already have :
    - enough working capital to run the SPU
    - captive market for their product.
    - full time managers and workers
- Renewable energy sources are available in sufficient amount to supply energy input for SPU operation
- All construction materials are available at local market
- Truth worthy and responsible manager

3. LESSON LEARNT

Establishment of SPU may start from stand alone processing unit such as solar dryer or solar cooling system as the basic handling method to extend life span of the product and hence reduce material and financial losses to the producer. An example on how these units could bring benefit to the users can be demonstrated using data taken by Anggita (2006) from Barrak Cooperatives in Cimahi, West Java who utilize hybrid solar dryer as one of the cooperative's important processing unit. Previously the cooperative used fuel wood to heat a cabinet type dryer. The manager found the fuel woods are becoming scarce in the area. Therefore, the introduction of a hybrid GHE solar dryer, as grant from the MEMR in 2004, had helped to continue the cooperative's business activities. Beside of being independent now on fossil fuel supply which is also becoming more expensive and scarce, the quality of the finished product was also found better than the earlier method of processing.

Field performance of the dryer installed in the cooperative is as shown in **Table 1**. The **Table 1** shows that the fraction of energy from the sun for the two test runs conducted is the largest in Run 02 in which the fraction is almost 100%. The use of electricity is the lowest for test Run 01 with 0.51%. From this test is quite clear that a GHE solar dryer could minimize the use of electricity and since auxiliary heating for the case of drying during night time or during bad whether condition can be supplied from biomass stove and thereby, minimize the dependency on fossil fuel.

Table 1. Typical performance of truncated pyramidal shape GHE solar dryer, for jerked banana spikes, installed in Cimahi, West Java (Diaz, 2006)

No.	Items	Run 01	Run 02
1	Initial mass of jerked banana spikes (kg)	46.75	46.75
2	Mass of dried products (kg)	12.61	12.90
3	Initial m.c.(%wb)	60.83	63.60
4	Final m.c. (%wb)	22.13	23.88
5	Average drying temperature (^{o}C)	41.60	40.60
6	Average ambient temperature (^{o}C)	37.50	34.40
7	Inlet air flow rate (m/s)	4.50	4.50
8	Drying time (hrs)	6.00	9.00
9	Solar energy (%)	37.92	98.6
10	Biomass energy (%)	61.56	0
11	Electricity (%)	0.51	1.38
	Total energy supply (MJ)	**20. 65**	**29.48**

The collected data on initial investment and yearly operating costs from Barrak cooperative in Cimahi, West Java, are shown in **Table 2**. The case consider that the cooperative has to find loan from a bank both for purchasing the dryer and to pay for the materials, labor, and other operating costs. The current commercial bank rate is at 17.5%/annum, however, there are schemes that can provide soft loan or revolving funds at 5-6%/annum.

The commercial rate of 17.5%/annum was applied in this analysis (Anggita, 2006). The analysis was based on the assumption that the cooperative would buy the machine rather than acquire it as a grant. The required working capital as shown in **Table 2** was Rp. 100.3 million or US$ 11,022.2 (1US$=Rp.9100), which include all the current asset of the cooperative except for building, the overhead cost, procurement of raw materials, etc.

The summary of cash flow analysis is shown in **Table 3**, where depreciation was included and the required capitals were acquired by borrowing from the commercial bank.

As shown in **Table 3**, with annual operating cost at Rp. 62,938,000, and income from expected sales at around 70% of the current price (Rp. 3500/pack). The pay back period will be less than 3 years, assuming economic life span of the dyer is 10 years. If the selling price went down to 60% of the current price, the pay back years would become 4 years.

Table 2. Data from installed GHE dryer in Cimahi City, West Java (Anggita, 2006)

No.	Item	Quantity	
1	GHE solar dryer cost /unit (Rp.)	33 000 000	
2	Cost of Raw materials (banana spikes) Rp/yr	23 200 000	
3	Drying capacity (kg/yr)	3 465	At 5hrs/batch
4	Administration, promotion, etc (Rp/yr)	6 910 533	
5	Electricity (Rp./year)	14 500	0.325 kWh/d.
6	Biomass energy cost (Rp/yr)	432 000	For 6 mo.
7	Operators (2 persons) –Rp/yr	19 200 000	
8	Working hours/year	275	
9	Total operational costs (depreciation transport, raw materials, packing) –(Rp/yr)	65 337 922	
10	Required working capital in the 1st year (Rp/yr)	100 302 000	Incl.dryer
11	Production cost (Rp/kg)	2 603.5	Rp.195/pack
12	Current selling price (Rp/package)	4 000	75 g/pack

Table 3. Summary of cash flow analysis for Barrak Cooperative

No	Item	Rp3 500/pack	Rp. 2 400/pack
1.	Pay back (yrs)	3	4
2.	NPV (million Rp.)	2 060	942

This simple analysis had demonstrated the great potential of the program to promote business activities using solar drying facility. It would be much more convincing if the bank and government could provide support by delaying loan repayment before the pay back period can be achieved. Beyond that period, all responsibilities as common in all business practice could be imposed to the cooperative and hope it could grow and operating in sustainable manner. In addition, easy access to working capital even at commercial rate will eventually attract more attention from the private sector to invest in the program.

Next is the case of coffee SPU located in Sumbawa island, West Nusa Tenggara. The facility was given the the local cooperative as grassroots project grant from the Japanese government in 1999. Although in the earlier stage the manager had agreed to set a side part of their revenue as revolving fund, the cooperative were asked to allocate some of their revenue as depreciation cost to enable them to purchase their own facility after the current facility becomes obsolete. The analysis as shown in **Tables 4, 5** and **6** indicated that the facility could bring benefit to the local beneficieries at reasonable amount with the calculated pay back period of 4 years, not to include other benefit from using the SPU for drying of candle nuts, ginggers, tumerics and other crops beside coffee beans. After several payments to the Project administration, however, the cooperative were unable to pay their due to the difficulties in getting access to microcredit promoted by the government.

Table 4. Analysis for coffee SPU in Batudulang village, Sumbawa.

Commodity: Coffee berries		Price (Raw)-US$/kg	0.086	
Load: (Arabica) (kg)	2000	Price: dried)-US$/kg	0.574	
		: ground)-US$/kg	1.264	
Roaster (kW)and kg/h	373	15	duration (h)	5
Husker (kW) and kg/h	746	400		
Milling (kW) and kg/d	373	185.4		

Table 5. Analysis for coffee SPU in Batudulang village, Sumbawa

Investment and Annual working capital (US$)	
1. Operational cost for drying (3 operators x US$50/mo x 3 mo)	450
2. Operation cost for milling (3 operators x US$50/mo x 7 mo)	1050
3. Maintenance cost	3.45E+02
4. Transportation &Packaging	800
5. Procurement of raw materials (=185.4 kg/d xUS$0.5/kg x7x30)/(0.75)+drying	3.00E+04
6. Variable cost for drying (30 timesx2000xUS$0.016/kg)	9.67E+02
7. Variable cost for milling (inc.hulling+roasting) (US$0.145/kgx 2x 184 kg/dx10x30 days/mo)	1.60E+04
8. Depreciation (US$)	1.50E+03
Total working capital +initial investment	5.11E+04

It is highly recommended that the Community Empowerment Office in Mataram, West Nusa Tenggara could be able to take care of the SPU by providing necessary assistance such as providing access to innovative financing scheme, technical and managerial training and continuous monitoring to the SPU until they reach a stage of self propelling growth.

Table 6. Analysis for coffee SPU in Batudulang village, Sumbawa

Year	Revenue	Cost	Interest rates (16%/y)	Net	Cumulative
0	5.11E+04			-5.11E+04	-5.11E+04
1	73418.4	5.11E+04	8.18E+03	1.41E+04	-3.70E+04
2	73418.4	5.11E+04	8.18E+03	1.41E+04	-2.28E+04
3	73418.4	5.11E+04	8.18E+03	1.41E+04	-8.68E+03
4	73418.4	5.11E+04	8.18E+03	1.41E+04	5.46E+03
5	73418.4	5.11E+04	0.00E+00	2.23E+04	2.78E+04
6	73418.4	5.11E+04	0.00E+00	2.23E+04	5.01E+04
7	73418.4	5.11E+04	0.00E+00	2.23E+04	7.24E+04
8	73418.4	5.11E+04	0.00E+00	2.23E+04	9.47E+04
9	73418.4	5.11E+04	0.00E+00	2.23E+04	1.17E+05
10	73418.4	5.11E+04	0.00E+00	2.23E+04	1.39E+05

4. CONCLUSIONS AND RECOMMENDATIONS

1) There are currently three proposed concepts of energy independent village, although they look different one from another, they share the common purpose on how to utilize locally available renewable energy sources for productive use and eventually to alleviate poverty in the village
2) The author had took initiative by installing SPUs in some villages since 1999, as the first step toward the establishment of the E^{3i} village. The installed SPUs were aimed to trigger the development of other related SMEs so that more job opportunities and source of income could be created locally.
3) Despite of the increasing interest from the central and local government including the private sectors on the potential benefit of the activities, more real actions are needed particularly in providing guidance and monitoring on continuous basis so that the cooperative or the manager of the existing facility may have easier access to market outlet and innovative financing schemes.

REFERENCES

Anggita, G., (2006). Graduation thesis, Department of Agricultural Engineering, Bogor Agriculture Institute (IPB), Bogor.

CREATA-LPPM-IPB, (2000). “Utilization of Environmentally Friendly Natural Energy to promote Agro-based Industry-a Japanese Government ODA Grassroots Project”, Final Report. Center for Research on Engineering Applications in Tropical Agriculture, the Research Institute of IPB, Bogor.

CREATA-LPPM-IPB , (2004). Final report to ISESCO.

Diaz Agriana, (2006). Graduation thesis, Department of Agricultural Engng., IPB, Bogor.

National Bureau of Statistics (BPS), (2002).