Reducing Biomass and Kerosene Used For Cooking in Indonesia, in supporting the global efforts to reduce CO_2 Emission

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ABSTRACT
This paper is discussing Indonesian efforts in poverty alleviation within the background of national energy context. The statistic data of poverty line by provinces, number of people live below this line, the energy type used by the low income society and gender situation are given. Several approaches of energy provision for firewood consumers are described in the global context. It started with a field research initiative until a national program for socio–economic development including the World Bank involvement. Various demands of developments such as electricity development, overcoming the climate change disasters and infrastructure reconstruction leads to funding scarcity. Idea in getting funding by exhibit value in reducing CO_2 emission is described. The estimated of annual global costs of adapting to climate change and Cancun Agreement are briefly described within the funding scarcity context.

Keywords: biomass, CDM, climate change, kerosene, LPG, poverty line, renewable firewood, sun cooking.

1. BACKGROUND

Handbook of Energy and Economy Statistic of Indonesia 2012 [1] published by the Ministry of Energy and Mineral Resources (KESDM in bahasa) shows the National Primary Energy Provision in 2011 is 1,490,771 thousand of barrel of oil equivalent (BOE), that consist of: natural gas (458,952 10^3BOE); coal (334,143 10^3BOE); crude oil (327,422 10^3BOE); *biomass (280,171 10^3BOE)*; other fuel or minyak bakar in bahasa (200,795 10^3BOE); LNG (197,244 10^3BOE); biofuel (46,676 10^3BOE); hydro power (31,269 10^3BOE); other petroleum product (27,029 10^3 BOE); LPG (17,564 10^3BOE); geothermal (16,494 10^3BOE); electricity (1,558 10^3BOE). Data and Information Center, KESDM stated that firewood and charcoal used in household are classify under biomass energy. This makes biomass becomes the fourth larger primary energy need after natural gas, coal and crude oil.
If energy transformation, own uses, losses and statistic discrepancy are omitted from this National Primary Energy Provision, it becomes Final Energy Consumption of 1,114,767 10^3BOE that consist of consumption in: Industry (359,687 10^3BOE) ; *Household (320,369 10^3BOE*); Transportation (277,405 10^3BOE); Non-energy (98,413 10^3BOE); Commercial (34,077 10^3BOE); Other sector (24,816 10^3BOE). Household energy consumption was the second larger.

Statistic Indonesia 1999 [2] shows 52.54% of household in Indonesia use firewood. It declines to be 47.49% in 2009 [3], then decline to be 36.35% in 2012 [4]. Peoples use firewood as their economic conditions are limited. Black bar in Fig.1 is the percentage of households that use kerosene, it is almost none in Java and Bali. The use of LPG for cooking raised sharply than that in 2009 because of the government interventions, see section 3.4.
In East Nusa Tenggara, 81.26% household use firewood (in 2009 was 83.51%), Central Kalimantan 51.51 % (in 2009 was 60%), West Sumatera 51.29 % (in 2009 was 56%), South Kalimantan 43.16% (in 2009 was 50%).

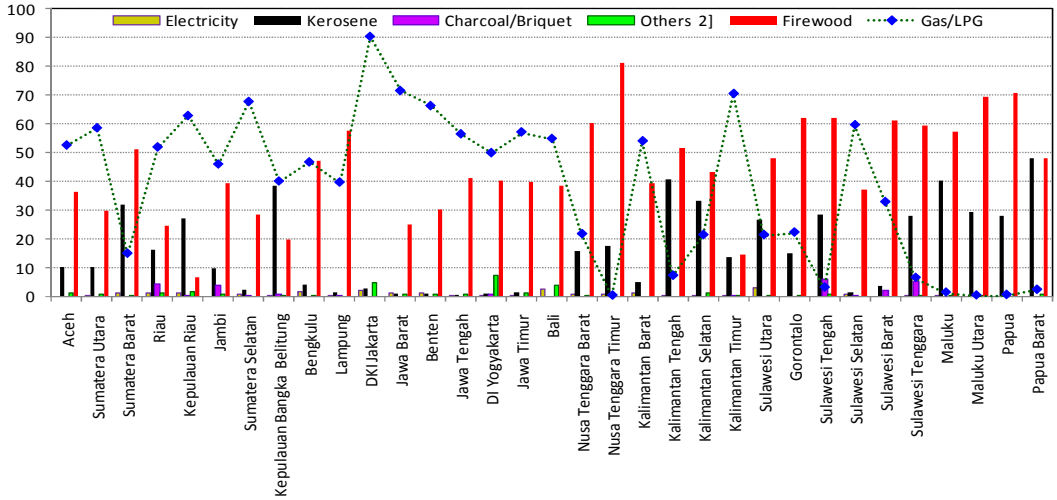


Fig. 1: Red bar is the percentage of households that use firewood by province, in 2012 [4].

Mainly reason for household that do not cook is saving money or do not have enough money. In East Nusa Tenggara (NTT), for example, the population per September 2010 was 4,683,827 peoples (in 2009 was 4,619,700 peoples); 98050 peoples in urban areas lives below the income of 321,163 IDR/capita/month, while 911,100 peoples in rural areas lives below the income of 234,141 IDR/capita/month.
Cooking with firewood is often done indoors that lack of efficient ventilation. The efficiency of this process varies widely, from 10% for a well made fire up to 40% for a custom designed charcoal stove [5]. In barren area and in climate change era, the firewood demand and the growing speed of trees are not in balance lead to scarcity of firewood. Efficient cooking technology reduces firewood combustion that means reduce green house gas (GHG) emission, smoke, and toxic particulates inhaled by the cookers and their children. Also, save human energy to collect firewood in a harsh climate of barren areas where firewood is scarce.
Smoking-related diseases are a major global health issue for all countries. Across the developing world, more than 1.6 million children die annually because of exposure to smoke from indoor cooking. Exposure to smoke throughout their life is reported to have a detrimental impact on the growth and development of more than 100 million children. This is a key barrier to successful socio-economic development and to make progress towards the Millennium Development Goals [6]. However, the program to reduce biomass for cooking should compete with many development programs. One of them is national electricity program. Helping the victims of natural disasters including those caused by Climate Change are urgent, while infrastructure reconstruction needs huge of national fund.

National Electricity Development to Compare the Urgency. PT. PLN stated that national peak load is 29500 MW, the installed capacity is 34,000 MW [7]. The reserve is only 15.25 %, while national electricity demand is growing 9 % a year. The growth rate for outside Java is about 12-18 %.
Oil replacement in power plants decrease the power plant capacity and life time. Ngurah Adyana, Java-Bali Operation Director of PT. PLN stated: " For a good security, the reserve should be 30% of the peak load of each operation area (wilayah)". Electricity crisis has emerged in North Sumatera. It is predicted will emerge in Java by 2018 [8; 9]. Jusuf Kala, Vice President 2004-2009 stated: *"Indonesia should build 10,000 MW every 3 year. The first 10,000 MW program was announced in 2007 and was planned to finish in 2010/2011. The second 10,000 MW program was announced in 2008 and was planned to finish in 2014. However, the first program was produced 8000 MW only, while the second program is not realized yet"* [7].
There is a systematically effort in the electricity development and there is a subsidy for electricity. Those who use electricity massively (industries and commercial sectors) receive more benefit of the subsidy. They are productive class and can decide the price of their products to aim payback. On the other hand, majority of household sectors are consumers. They do saving when the electricity price is high. Household that have no electricity could not feel any impact of the electricity subsidy and those who have no car could not feel any impact of the fuel subsidy.

2. INTERNATIONAL FUND FOR CLIMATE CHANGE ADAPTATION.

Figure 2 right shows CO_2 increased from 386 ppm in 2009 to 400 ppm in 2 May 2013, which means CO_2 increasing rate is 3.5 ppm a year. Copenhagen Accord states that CO_2 concentration in troposphere must not exceeding 450 ppm by 2100 so that the global temperature can be kept at 2C [10], this means 50 ppm left for 87 years actions (2100-2013). Human are allowed to emit only 0.57 ppm a year or less. International Energy Agency (IEA) informed that emission in 2010 from fossil burn had reached 30.6 Giga tCO_2 equivalent. The total including Land Use, Land-Use Change and Forestry *(*LULUCF*)* had reach 50 Giga tCO_2eq. In this speed, IEA predicted that CO_2 concentration will reach 420 ppm in 2017 [11]. IEA prediction indicates the CO_2 increasing rate is 5 ppm a year.

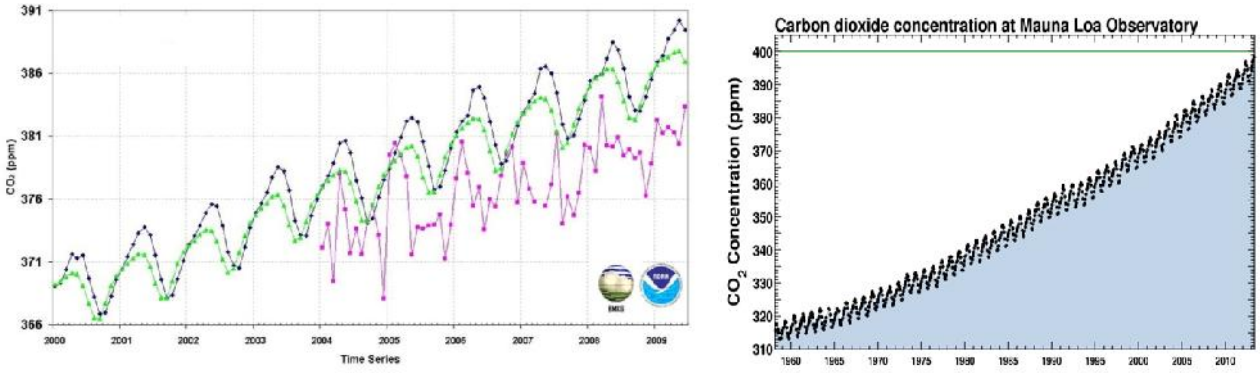


Fig. 2 left: CO_2 concentration from monitoring stations: Koto Tabang-Indonesia (purple) and Mauna Loa-Hawai (green), processed by NOAA. Global Average (black) [10*].
right: CO_2 concentration profile from Mauna Loa monitoring station show 400 ppm on 2 May 2013.

Cancun Agreement [12] suggests further discussion whether the global average temperature rise should be decreased to 1.5 C, in the next COP meeting 2015 in Paris. It writes a series of UN decisions on the scheme to help poor countries in cutting their carbon emission and to adapt climate change, to share and to develop green technology, to consider "a climate risk insurance facility" to help poor countries to cope with extreme weather impacts, and to pay poor countries not to chop down the trees.
Figure 2 left shows the warming of the climate system is "unequivocal". Low data of KotoTabang indicates sequestration impact of Indonesia forest. Therefore Indonesian Governments do a tighter measure to protect its rain forests and run a national afforestation and reforestation programs across the country.

Martin Parry et al. write a report [13] on the annual global costs of adapting to climate change estimated by UN Framework Convention on Climate Change (UNFCCC) as shown below:

- Water: The UNFCCC estimate only USD 11 billion, excluded costs of adapting to floods, no costs for transferring water within nations from surplus to deficit areas.
- Health: The UNFCCC estimate only USD 5 billion for assessing malaria, diarrhoea and malnutrition. This covers only 30-50% of the global total disease burden and excluded developed nations,
- Infrastructure: The UNFCCC estimate only USD 8-130 billion. This investment must increase in order to reduce poverty and thus avoid continuing high levels of vulnerability to climate change. This upgraded infrastructure could be eight times more costly than the estimation.
- Coastal zones: The UNFCCC estimate only USD 11 billion, excluded increased storm intensity and used low predictions of sea level rise published in the 2007 IPCC report. Including these points, the costs could be three times greater than the estimation.
- Ecosystems: The UNFCCC excluded the costs of protecting ecosystems and the services they can provide for human society. This could cost over USD 350 billion.

3. VARIOUS COOKING TECHNOLOGIES THAT USE SOLAR ENERGY, RENEWABLE BIOMASS AND LPG.

3.1. Solar Box Cookers Dissemination in Indonesia

Various design of solar box cooker was assessed since 1992. Sun cooking introduction is seen as an alternative way to reduce smoke inhaled by the firewood consumers, a low income society and having low education. Community education, in gender equity basis, is geared to improve their knowledge on a possible solution of their energy limitation and teach how to use and to make solar cookers. Development and field testing of user-made design was the approach used since 1995 combined with the involvement of international volunteers to widen the impact across the globe. The design shown in **Fig. 3** was the product of training.
Temperature inside the cooking chamber is 202-204 C without load. The cooking time depend on the design, the cooking pot used, the quantity of food to be cooked, air temperature, wind, latitude and the amount of solar energy.

Food cooks faster at 10:00 until 14:00 and slower between 8:00-10:00 and between 14:00-16:00. Sun cooking usually avoid stirring or turning the food since opening the cooking chamber will realized the heat and will slowing the cooking process. The food is copped in smaller size for faster cook. Different foods can be cooked simultaneously depending on the size of the cooking chamber. A family may use one or more solar cookers. Compared to cooking over a fire, the food does not have a smoky flavor and no pollutant generated by solar cooker.

The Indonesian Sun Cooking received 5-years field research grant (1994-1998) from The Center For Field Research in Earthwatch Institute, Massachusetts, USA. The project continues without this support until 2004 [14; 15; 16; 17; 18; 19; 20]. Slow acceptance is not a failure. As children watch their parent using solar cooker, they will grow up and might become a good seed with a new vision. In the longer term, greater understanding might arise from multiple sites and could help to shape a fundamental framing of policy needed. The field research findings into the broader impacts within the policy elite might help shift the policy debates in providing facilities and funding.

Fig. 3: Solar box cooker type HS 5521

3.2. Concentrated Cooker for CDM Solar Cooker Project Aceh

Clean Development Mechanism (CDM) provides a financial mechanism where the government and private sectors in Annex I countries can invest in greenhouse gas (GHG) mitigation projects. Proved emission reductions will be

credited to the country that invests to provide technology needed and the Certified Emission Reduction (CER) will be counted towards their national CO_2 emission reduction target. The participating developing country gains technology for the target user that has no purchasing ability. In this global understanding and agreement, solar cookers dissemination was arranged under the Clean Development Mechanism initiative.

In the meeting with Dieter Seifert at his exhibition booth at Umbutu Village, Johannesburg in Juli 2002, Herliyani gave a suggestion to expand solar cooker activity in Indonesia. Funding uncertainty drove her to write a proposal with title "Global Solar Cooker Programme", and was submitted to Alluminium Canada (ALCAN) - London in August 2002. The proposal informed the name of patent holder of solar cooker K14 for further communication. The idea was presented in World Renewable Energy Network Meeting in Brighton, UK, in October 2002.

Project design document (PDD): 0218-CDM Solar Cooker Project Aceh 1 dated 10 October 2005, category SSC 1c for switching non-renewable biomass /non-sustainable harvested firewood. Methodology used: CDM Project AMS-1C ver.6 - Thermal energy for user. Date of request for registration was 07 January 2006 - 05 February 2006. Registered in UNFCCC was on 6 February 2006. Host party: Indonesia. The project sites are in Sabang Islands and Badar in South East Aceh. A thousand set of *a solar concentrator cooker K14* plus *a wonder box* were transferred to the target users. One set for each household. The life span of K14 is more than 10 years. The *wonder box* is for cooking with heat retaining (simmering) and to keep the food hot during the meal time. It was the first registered CDM project for Indonesia and for Germany. ALCAN involves as investor that provide funding for this CDM. The funding was managed solely by the German side as they want 100% CER achievement. It is the "first" project that represents the global importance of CDM finance incorporate to community educational program to ensure best use of the cooking devices. Target users who used solar cooker have made an effort to contribute to reduce their CO_2 emission [18; 21; 22; 23; 24].

Fig. 4: Solar concentrator cooker K14

It is true that Indonesia government is willing to improve the energy infrastructure, to improve the condition of poor people and to keep the environment green. On the other side, there are business peoples from industrial countries, who are still producing CO_2 during their industrial productions to get profit, simultaneously looking for CER to fulfill the CO_2 reduction obligation through their involvement in the CDM project. These two contrasting standards of living meet in the CO_2 trading arena. In this way we all are hoping to clean the environment.
Have the targets of CO_2 emission reduction been achieved in this balance? [6].
In climate change era, the global temperature increase caused more sea water evaporation. Thick clouds hanging in the sky above Indonesia archipelago caused intermittently solar insolation, while in a clear day, the weather is very hot and the sun irritating the skin. This might affect sun cooking.

3.3. CDM Cook Stove Project Kupang

This CDM project was designed to distribute 30,600 set of an efficient stove "Save80" plus *a wonder box* to the household in Kupang, East Nusa Tenggara. The project provides thermal energy to replace the use of kerosene or other fossil fuel for cooking. The stove SAVE80, see **Fig. 6**, uses small amount of small pieces of firewood that is categorized as renewable. It is suitable to prepare all usual dishes. The lifetime in appropriate use is more than 12 years, the metallic parts in contact with the flames made of stainless steel. *A wonder box* is for cooking with heat retaining (simmering) in order to save fuelwood. The field test on 26 September 2005: the water temperature in the pot filled with 6 litres of boiling water and stored in the wonder box remains hot at 70°C after 7 hours.
The overall efficiency of SAVE80 is above 45%. The nominal effective thermal power is 1.45 kW, so the total thermal power of 30,600 SAVE80 implemented by the project will be 44.4 $MW_{thermal}$. It below the limit of small scale CDM projects, that is 45 $MW_{thermal}$. Therefore, the simplified methodology for small scale CDM projects applies.

Project Design Document finished in January 2006. Preliminary meeting with TUEV Sued-Munich in February 2006, the validation process and site visit was in May 2006. The promotion of SAVE80 in Kupang city hall was done on 31 May 2006. Preliminary field test was done since October 2006. National approval was signed on 27 December 2006. The registration to UNFCCC in Bonn followed. Production of 30,600 SAVE80 was planned to finish by June 2007.
The mean emission reduction by one "Save80" in combination with a wonder box is assumed 1.487 tCO2 eq.
For 30,600 stoves will be 42,379 tCO_2eq. a year. The emission reduction is assumed constant during the crediting period. Thus, the total emission reductions over the 10 years crediting period is 423,790 tCO_2 eq.

Fig. 6: Stove SAVE80, boiling water boiled inside the stove and the wonder box.

The crediting period is 1 July 2007 until 30 June 2017. The German side wanted 100% CER.
The project barriers and risks written in the project design document are: - lack of acceptance by the users, and - financial barriers. To overcome the first barrier, approach incorporate to community educational was designed to ensure best use of the cooking devices. Random visits during monitoring are done by skilled personnel enables permanent opportunities to correct mistakes and deficiencies. The second barrier is a reason why the project is proposed under CDM. Without CDM credits the entire project will not be self supporting, therefore pre-financing needed until the PDD was published in UNFCCC web. This CDM Cook Stove Project Kupang could not get investor. This means all efforts give no impact, no field research and no CERs to payback the capital invested [25; 26; 27].

3.4. LPG to Replace Kerosene for Cooking

The program "LPG to replace kerosene for cooking" in Indonesia started in 2007 to respond the Presidential Decree No.104/2007. This program distributes '*a set of tube filled with 3 kilogram LPG, burner and accessories'* to replace kerosene burner. Millions set of gas system for cooking were distributed in 21 provinces: Aceh, North Sumatera, Riau, Riau Island, Jambi, South Sumatera, Lampung, DKI Jakarta, West Java, Banten, Central Java, DI Yogyakarta, East Java, Bali, West Kalimantan, South Kalimantan, East Kalimantan, North Sulawesi, Gorontalo, West Sulawesi, South Sulawesi. It was started with disseminate 4,030,683 set in the year 2007; 15,407,777 set in 2008; 24,156,307 set in 2009; 4,239,078 set in 2010; and 5,283,834 set in 2011 [28].
Observing the data shown in Fig.1, the next program should be in West Sumatera, South East Sulawesi, Central Sulawesi and East Nusa Tenggara, Central Kalimantan, Maluku, Maluku Utara, Papua and West Papua.

A family with 7 members that having low total income needs 12 kg LPG a month or four of 3kg-tube of LPG.
In October 2013, the price of LPG in 3kg-tube at PT. Pertamina station was 12,750 IDR; at agent was 13,250 IDR; at "Pangkalan" was 14,500 IDR. In the market, it often sold at 15,000 IDR [29]. "The need of subsidized LPG in January 2014 was 6193 tonnes", stated by Rudy Biantoro, PT.Pertamina Marketing Operation Regional VI Kalimantan [30].

The price of non-subsidized LPG in 12 kg-tube per October 2009 was 5,850 IDR/kg. It often sold at 75,000 IDR.
On 1 January 2014, the price was raised to be 9809 IDR/kg, or 117,708 IDR/12kg [31]. It sold at 120,000-130,000 IDR.
The price is raised after BPK (Indonesian Supreme Audit Board) found that PT. Pertamina loss 7.73 Trillion IDR between 2001 until October 2012 [32]. Since the price of *non-subsidized LPG* in 12kg-tube increase, part of its consumers change to buy *subsidized LPG* in 3kg-tube allocated for the disadvantage peoples. This caused *subsidized LPG* in 3kg-tube become scarce and the price raised to 17,000 IDR.

Fig. 7: LPG tube of 12 kilogram (blue), and of 3 kilogram (green-melon) [33].

3.5. Green Stove for East Nusa Tenggara (NTT) Province

My first visit to Kupang in 1993, I saw a cluster of Kosambi trees and Lontar trees in the way to Oesapa. In 2005, I could not find those clusters. Kosambi wood has high calorific value. In Kupang city, the population depends on kerosene, firewood is a buffer to get their energy need. The 3-stone fireplace, see Fig. 8a, use widely, while logging of trees is forbidden. Firewood is transported from green areas and is traded. People buy it from the retailers. Inefficient use of firewood is often dismissing green area. However, some experts think '*it may be a minor cause of deforestation*', therefore it is negligible compared to deliberate destruction to clear land for agricultural use [34].

"*Getting kerosene is becoming more and more difficult. We could not buy direct as take and pay . We should queue to get 10 litres kerosene per week. Often we left a small plastic drum (jirigen in bahasa) at the retailer shop and take the filled drum per week. If we could not get kerosene we used our firewood stock collected from our garden. In May until November we use firewood to boil water. We only need to put three stone as fireplace in our garden. We can save 65.000 IDR per month. The price of subsidized kerosene is 3000 IDR/litre. This means we save 48% of our energy expenditure. Lately we only get 5 litres kerosene for weekly need. The firewood becomes scare. We use whatever dry wood we found. The famous Kosambi wood is difficult to find today"* Ignas, sms communication on 20 July 2012.


(a)

(b)

(c)

Fig. 8: (a) The 3-stone fireplace; (b) A renewable harvested firewood for cooking with the green stove; (c): The green stove is used to boil 5 litres of water [5]. Portability and self regulating air supply are the advantages.

Firewood consumers in NTT suffering limited kerosene supply and limited biomass resources.
Overcoming firewood crisis is one of the greatest challenges of humanity.
The program of *LPG to replace kerosene for cooking* for East Nusa Tenggara is still in a waiting list status.
In Kupang, 12 kg LPG plus tube is sold at 850,000-1,000,000 IDR. Changing empty 12kg-tube with one full of LPG cost 160,000-190,000 IDR. Only several shops do this business and their stock is only 10-20 tubes [35]. Therefore, only 0.37 % of population use gas for cooking, see Fig.1.
After "CDM Cook Stove Project Kupang" could not get investor, various stoves designs, their performances and prices are assessed to derive low cost project for wider reach and impact. A simple one was bought in Nepal from Sanu Kaji Shrestha. After serial test using small pieces of dry branches with a diameter less than 2 cm, see Fig. 8b, then we give a name as Tungku Hemat Energi in bahasa or Green Stove. It can also be made by chopping dead wood of a bigger size. The stove can boil 5 litres of water from 27°C within 30 minutes and needs 350 grams of small pieces of dry wood. The user can get a complete combustion easily leads to less smoke [36; 37; 38].

Survey in 2004 shows that the average need of kerosene in middle to upper level in the society is 1.5 litres a day, the maximum is 2 litres. The average need of kerosene in lower level is 0.5 litres a day, the maximum is 1 litre. The average need is: 1 - 1.5 litres kerosene a day, and 1 litre a day is used to derive CO_2 emission reduction [5].
Survey in 1998 to investigate the firewood demand [36; 39] shows:

- Families that buy firewood, the average buying is 300 kg/month.
- Families that collect firewood do 9 times a month. Each collection is 15-20 kg or 135-180 kg a month.

The luxurious need in bathing with warm water and the ability to buy raw cooking food dictated this different demand.
The average of firewood demand is 217.5 kg per month or 7 kg/day
The green stove needs 350 grams wood to boil 5 litres of water in 30 minutes. This means the stove should be used in 5.279 hours a day to compete with kerosene brazier that need 1 litre kerosene a day. If this operating time is used to boil the water, the need of small pieced of firewood is (5.279*60 minutes)/30 minutes*350 gram= 3.689 kg. The green stove is saving (3311/7000*100%=) 47.3% of firewood per day.
This means reduce almost a half of environmental burden, reduce smoke inhale and reduce CO_2 emission.
This Green Stove fulfils all pillars of frugal engineering: robustness, portability, simplicity, matching the local culture and gives a possibility of mega scale production. Big manufacturer was approached to back up the production for a wider dissemination. In July-August 2012, a combustion chamber was made of stainless steel that could resist temperature until 1500 C and could resist to heat corrosion for 5 years, but still in a cheap price.
The stoves will be transferred to the peoples via training to demonstrate its capability for cooking in efficiently use of firewood. Recruiting female participants in *training for trainers* and in monitoring will be exerted to adding the current effort done by local women organization (PKK) that is promoting how to cook local foods in efficient way.

Idea in Getting Funding. Years by years passed by, but effort in getting funding for the action described in section 3.3 were not come up. SAVE 80 could not be easily made locally. Therefore, the proposal described in this section apply easier technology that is considered can be made locally. The proposal is not registered as CDM project,

however, idea of counting to get 'Certificate of Emission Reduction (CER)' is shown to exhibit the value of project.
The estimated CO_2 emission reduction per Green Stove is 0.9297 tCO_2 eq. per year [5].
Note: The 1st year of counting is 2012 as the preliminary proposal was made in 2012, see Table 1.
If in the first year we have disseminate 10,000 green stoves, the total CO_2 emission reduction is assumed to be about 9297 tCO_2 eq./year. If the price of CER is 10 USD/t, this project will create CER of 92970 USD in the second year (2013). The stoves that had been implemented in the first year still give CER in the following years and it assumed constant. So, the dissemination of 50,000 stoves will give CO_2 emission reduction of about 46500 tCO_2 eq. /year. The CER that can be harvested in 2017 will be 465,000 USD at 100% abatement success. After 2017, the accumulated CER generated by the dissemination of 50,000 green stove is 1,393,820 USD. At the worst scenario, where the abatement success is 50%, while CER price is rated only 2 USD, this action still gives CER of 139,448 USD. If 'this CER value' can be diluted in advance, there will be a funding to start this project.
It is a need to bring the field finding into the attention of international policy makers in order to break the funding scarcity in helping the poor live in barren areas of the world. Therefore, this proposal was submitted to Indonesia Clean Energy Development (ICED) Program-USAID, a strong funding holder, on 20 April 2013, but it was not success.

Table 1: The estimated amount of CO_2 emission reductions and the possible CER harvested along the project period [5] .

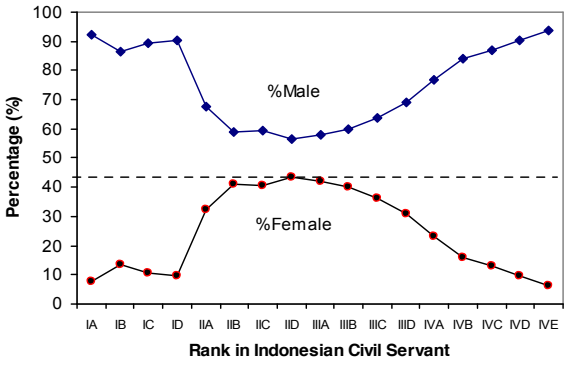
year	Stoves implemented	Abatement success				Various CER price/tonne: 10 USD/t; 5 USD/t and 2 USD/t								
		100%	75%	50%	25%	10 USD/t	5 USD/t	2 USD/t	10 USD/t	5 USD/t	2 USD/t	10 USD/t	5 USD/t	2 USD/t
		tonnes of CO2 eg.				USD	USD	USD	USD	USD	USD	USD	USD	USD
						100% abated			75% abated			50% abated		
2012	2012: 10000	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	2013: 10000	9297 for 10000 stoves	6973	4638	2319	92970	46380	18594	69730	34865	13946	46380	23190	9276
2014	2014: 10000	18594 for 20000 stoves	13945	9297	4649	185940	92970	37100	139450	69725	27890	92970	46485	18594
2015	2015: 10000	27891 for 30000 stoves	20918	13945	6473	278910	139450	46500	209180	104590	41836	139450	69725	27890
2016	2016: 10000	37100 for 40000 stoves	27825	18594	9287	371000	185940	74200	278250	139125	55650	185940	92970	37188
2017		46500 for 50000 stoves	34875	23250	11625	465000	232500	93000	348750	174375	69750	232500	116250	46500
	Total 50000					1393820	**697240**	269394	**1045360**	**522680**	209072	**697240**	348620	139448
	Minimum capital need 5*100000 USD/year or 500,000 USD for the five project period. If the abetement success reach 100%, at CER price of 5 USD/t , the project has shown pay back. If the abatement success reach 75%, at CER price of 5 USD/t , the project still able to give pay back. If the abetement success reach 50%, the CER price should be 10 USD/t to make the project able to give pay back.													

3.7. Effort initiated by The World Bank

The World Bank in cooperation with Dit.Jen EBTKE-KESDM arranged Multi-Phase Clean Stove Initiatives in Indonesia. The 1st phase consisted of 3 stages Consultation Workshops was held on May 7, July 12 and October 2012 [40; 41]:
The 1st meeting discussed the mapping of the existing activities and development of various stoves. It was found that market penetration for improved stoves is minimal. The 2nd discussed the intervention strategies.
The 3rd discuss further steps to prepare Phase II, and discussions on: - stove standard, test procedure and the institute who do the test; funding mechanism; - area of target, stove production and the possible line of supply; - monitoring and verification. The participants are from the government institutes in province and regency level across the country, the expert, private stake holder and various non government organizations. The World Bank is offering a loan. International money business meets in the arena of poverty alleviation and environmental development exerted by Indonesian Government. Can this effort be a part of solution discussed in the Cancun Agreement?

4. GENDER CONSIDERATION

In 2010, Indonesia population is 237,641,326 peoples, 101.4 males over 100 females. Female existence in various ranks of civil servant in the year 2000 is shown in Fig. 9 left [2].
At low rank the number of female presence is low, at the rank IIB until IIIB the presence of female is significant. However, it declines at the higher ranks means less access to decision making. Patriarchy system and societal mind-set sets a rule that *domestic tasks are female's,* nurturing tasks, supporting husband, societal biases in society are *a stigma to women*. Cooking is a women task including firewood gathering and all tasks related to cooking need. Married women in low income family bear all stigmas plus managing limited money. This absorbs their time makes them difficult to involve outside than domestic.
In civil servants, male and female at the same rank received the same salary. However, all stigmas cause women are un-likely than men leads to difficulties for women to path their carrier. Free competition in the job, made female far left behind. Although women have a broad body of knowledge, capacities and experiences with technologies and their use in their particular situation, women knowledge is often not been promoted leads to less advantage to the society.
In 2013, the gender situation shows an improvement; see Fig. 9 right.



X-profile of Male-Female existance in various ranks of Indonesian civil servant.

In the rank IIB until IIIB the presence of female is significant. However, it declines at the higher ranks.

Source: Statistik Indonesia 1999, BPS (2000: p75).

Occupation	Male	Female	Total	F/T (%)	M/T(%)
Specific Functional	935838	1316252	2252090	58.45	41.55
General Functional	1225945	751485	1977430	38	62
Structural	170766	67696	238462	28.39	71.61
5th echelon	2744	1240	3984	31.12	68.88
4th echelon	112734	53991	166725	32.38	67.62
3rd echelon	44633	10868	55501	19.58	80.42
2nd echelon	10110	1490	11600	12.84	87.16
1st echelon	545	107	652	16.41	83.59
Total	2332549	2135433	4467982	47.79	52.21

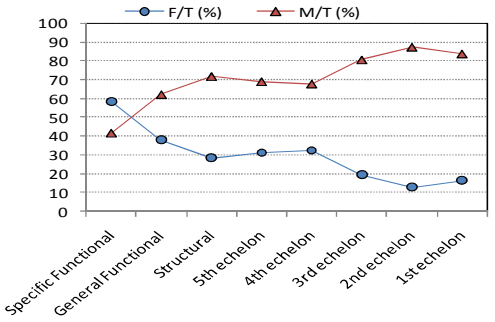


Fig. 9 left: Female existence in various ranks of civil servant in Indonesia [2], the highest rank is IVE right: Number of Civil Servants by Occupation and Sex [4]. The 1st echelon is the highest structural career.

There is a regulation that the highest rank in civil servant can be achieved via structural career and via functional career. There is a method to count each functional rank to analogy to the rank of the civil servant. Today, many women have working hard on the detail in every functional career. This regulation leads to increasing number of women presences at the highest rank in civil servant and is shortening the gap shown in Fig. 9 left. Although, majority women in this rank do not cook with firewood, they have a better view on female feeling and the difficult atmosphere face by women in low income society. This might raise the voice in debate and in giving a support in helping the poor.

5. CONCLUDING REMARKS

The used of various cooking technologies are rated appropriate. However, barriers such as lack of awareness and inappropriate government policy stand in a way. In many seminars that discuss technology dissemination, or poverty alleviate, it is often stated that “giving is not educated peoples” or “we are not social agent but businesses”. On the other hand, the poverty line of rural areas in some provinces is very low. East Nusa Tenggara, for example, where 81.26% of household use firewood, the poverty line is 234,141 IDR/capita/month, or 7553 IDR/day. If one person works, but he or she has two children, this 7553 IDR is only for food. As the children growing while the government support is only for basic school, mostly they stop as no funding for studying in a higher education. This condition might happen in many sites on the globe.

Forest is the resource of firewood. Forests are important to maintain global balance. It acts as carbon sinks. It use to conserve soil and water, to control avalanches and desertification, to stabilize sand dunes and to protect coastal areas from flood. It is good if dissemination-education approach of various cooking technology can be supported to reduce tree cutting that means support a national afforestation and reforestation programs across the country.

Annual global costs of adapting to climate change should include the costs of protecting ecosystems. Therefore, such as proposal described previously can be supported. It demonstrates a chance of change with wider community participation. It provides the path to promote RE deep into the root of the nation: the families. The efforts and the willing to initiate a change need to be appreciated. If we fully involve public in the process of science we shall not only give them understanding, we shall give the world a future. Need to give courage to raise optimism.

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