

Title of paper: FACTORS INFLUENCING COMMUNITY ADOPTION OF GOOD STOVES

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FACTORS INFLUENCING COMMUNITY ADOPTION OF GOOD STOVES¹

Keywords: Energy, Stoves, Biomass, Community, Technology, Efficiency, Adoption, Processes, Decision

- Dr. N. Sai Bhaskar Reddy²

1. INTRODUCTION

There had been several Good Stove (GS) Programs facilitated and implemented for communities in different parts of the world with support from respective Governments, organizations, scientific institutions and funding agencies, since more than 5 decades³. The factors influencing community in adoption of good stoves are less understood by all the stakeholders. In this paper it is attempted to present various factors influencing decisions of the communities for adoption of Good Stoves and contributing to sustainability.

2. BACKGROUND

The United Nations estimates that 2 billion people a day are still cooking with open fires. Respiratory disease is the fifth-leading cause of death in the developing world, and 1.6 million people per year die from breathing wood smoke.

The biomass burnt in traditional cooking stoves is resulting in high fuel consumption and significant levels of indoor air pollution, causing poor health of women and children. And also biomass collection for fuel is linked with drudgery for women and children.

India is the home to more than 250 million people living on less than US\$1 per day and about 550 million people without access to electricity. Biomass is the major source of fuel for cooking, in rural areas it is more than 90% of the households. In this context there is also a need to understand why there are thousands of stove models / designs in use all over the world, which gives us a cue to understand the communities' decision making process to adopt Good Stoves.

The contribution of Green House Gases (GHGs) emissions from cooking with less efficient biomass stoves by millions of people is considerable. Fuel wood is still and will be for a long time to go as the only means of energy supply for cooking purposes for the low-income rural population. Keeping view the global warming, limited land resources to cope with growing population and ongoing food crisis, there is an urgency to develop and facilitate good stoves adoption by communities. The main beneficiaries of Good Stoves programs are women and those occupy the middle- and lower-income levels of society.

High numbers of illiterate people are living in rural areas and the illiteracy is high among women who are the main users of stoves, Cotlear (1990) observed that years spent in formal education may affect possibility of adopting an innovation and a likely source of inspiration for innovation. Makame Omar Makame (2007) says that empirical findings confirm that the role of information on what

¹ Good Stoves – Good Stoves are Improved Cook Stoves (ICS) designed with modifications over traditional one and also stoves designed using state of the art technology for increased efficiency, reduced smoke, etc.

² Founder and CEO, Geocology Energy Organisation [GEO], Hyderabad, India <http://www.e-geo.org> and <http://www.goodstove.com> is involved in designing and dissemination of Good Stoves for Communities.

Rogers (1983) considered as trialability and observability characters of innovation are very crucial ingredients in the diffusion and adoption of innovation in the social systems. Consumer innovation like stoves is relatively less observable, and thus diffuses at extremely slow rate unless it should be highly promoted. According to Hall (2003) culture may also be an important determinant for the diffusion rate. Karin Troncoso, et.al (2007) observed that the socioeconomic level was found positively correlated with the adoption of the improved cook stoves.

3. METHODOLOGY

The observations made by author on the adoption of good stoves are based on his own learning and experience with community over three years, in designing, testing, and facilitation for adoption of good stoves by community in the rural areas in India. The references cited in this paper were also taken into considered for validation of observations by the author. The factors identified were verified consulting relevant stakeholders. These factors were not prioritized, because the importance and influence of factors leading to sustainable adoption are also based on spatial, temporal, cultural aspects. These factors create broader understanding and can be used for reference and or as checklist while dealing with live projects or programs on adoption of good stoves.

4. FACTORS OF COMMUNITY ADOPTION AND SUSTAINABLE USE OF GOOD STOVES

From facilitation of Good Stoves the author learnt through experience that the adoption and sustainable use of Good Stoves by the community is dependant on the following factors.

- Acceptability based on local conditions: The stoves designed should be according to the peoples need, utility, culture and aesthetics.
- Biomass should be flexible: Flexible use of different types of locally available biomass and less requirement of biomass as compared to the existing stoves.
- Cost: The low upfront and maintenance cost is a positive factor for adoption.
- Design: Easy to understand, construct and maintain.
- Ergonomics : Sitting posture before the stove should be convenient
- Heat transfer: Good transfer of heat to the pot through - Conduction, Convection and Radiation, and greater control of heat as per requirement and less loss of heat.
- Safety: Safety from heat and flames to women, children and whole family.
- Health: Very less smoke released from the stove, it should not affect the health of user and their family. Smoke is the major cause of Health impacts, less efficient functioning of stove, Global warming, etc.
- Interest: Communities interest in adopting GOOD STOVES should developed through sensitization and awareness programs.
- Operatability: The operation of stove should be easy and the user should be able to cook all types of traditional food.
- Quality of the Stove: Stoves should be long lasting preferably made with locally available good quality material.

5. PROCESS FOR COMMUNITY ADOPTION OF GOOD STOVES

The process of facilitation plays an important role in community adoption of Good Stoves. The below processes were followed by author in successfully facilitating adoption of about 270 good stoves in the two villages in Andhra Pradesh State, covering more than 70% of households. This facilitation process took about 9 months duration.

1. **RECONNAISSANCE:** Study of the existing stoves, biomass and other fuels in use.
2. **AWARENESS AND SENSITIZATION:** Intensive awareness and sensitization was created at community level on biomass conservation and the need to adopt efficient stoves. The sensitization creates a sustainable motivation among the community.
3. **DESIGN:** The author designed stoves, using locally available raw material, tested the stove and improved the performance.
4. **DEMONSTRATION:** Shared the stove design and performance with community through village level demonstration workshops for community participation and awareness.
5. **PILOTING:** Selected leaders from the community for adoption of the good stoves on demand basis, for feed back to improve the design as per the user need, and also sharing with other people in the habitation for creating large scale awareness.
6. **SCALING UP:** Trained youth, women and local masons on construction and maintenance of Good Stoves. Linked with source of funds available with govt. and organizations etc and facilitated of stoves to majority of the households on demand basis.
7. **MONITORING:** Monitoring the performance of stoves is done and services were offered by the locally trained people for maintenance. This is a continuous effort.
8. **ACHIEVEMENTS:** Documentation of the number of good stoves being adopted by community.
9. **RECOGNITION:** Recognizing all the stakeholders starting from community, Facilitators, Donors, Support Organizations, Scientists and Institutions involved in the process.

6. FACTORS OF FACILITATION PROCESS IN SUCCESSFUL ADOPTION OF GOOD STOVES – MARKETING PERSPECTIVE

The below presentation is the experience of the author in facilitation of Good Stoves in two habitations in the Semi-arid area of Andhra Pradesh State, India.

During one of the field visits to the two villages⁴, the author found that majority of the existing stoves was created by using three stones, releasing large amounts of smoke. To find a solution to this problem the author developed “Good Stove⁵” based on Larry Winiarski’s⁶ 10 principles of designing efficient stoves and community participation.

4 Srirangapur village, Kondurg Mandal, and Kothur village, Midjil Mandal in Mahabubnagar District, Andhra Pradesh, India.

5 <http://e-goodstove.blogspot.com/>

6 Dr. Larry Winiarski, Technical Director, Aprovecho Research Center, Apro@efn.org

Rocket Stove Principles

- 1.) Insulate, particularly the combustion chamber, with low mass, heat resistant materials in order to keep the fire as hot as possible and not to heat the higher mass of the stove body.
- 2.) Within the stove body, above the combustion chamber, use an insulated, upright chimney of a height that is about two or three times the diameter before extracting heat to any surface (griddle, pots, etc.).
- 3.) Heat only the fuel that is burning (and not too much). Burn the tips of sticks as they enter the combustion chamber, for example. The object is NOT to produce more gasses or charcoal than can be cleanly burned at the power level desired.
- 4.) Maintain a good air velocity through the fuel. The primary Rocket stove principle and feature is using a hot, insulated, vertical chimney within the stove body that increases draft.
- 5.) Do not allow too much or too little air to enter the combustion chamber. We strive to have stoichiometric (chemically ideal) combustion: in practice there should be the minimum excess of air supporting clean burning.
- 6.) The cross sectional area (perpendicular to the flow) of the combustion chamber should be sized within the range of power level of the stove. Experience has shown that roughly twenty-five square inches will suffice for home use (four inches in diameter or five inches square). Commercial size is larger and depends on usage.
- 7.) Elevate the fuel and distribute airflow around the fuel surfaces. When burning sticks of wood, it is best to have several sticks close together, not touching, leaving air spaces between them. Particle fuels should be arranged on a grate.
- 8.) Arrange the fuel so that air largely flows through the glowing coals. Too much air passing above the coals cools the flames and condenses oil vapors.
- 9.) Throughout the stove, any place where hot gases flow, insulate from the higher mass of the stove body, only exposing pots, etc. to direct heat.
- 10.) Transfer the heat efficiently by making the gaps as narrow as possible between the insulation covering the stove body and surfaces to be heated but do this without choking the fire. Estimate the size of the gap by keeping the cross sectional area of the flow of hot flue gases constant. EXCEPTION: When using an external chimney or fan the gaps can be substantially reduced as long as adequate space has been left at the top of the internal short chimney for the gasses to turn smoothly and distribute evenly. This is tapering of the manifold. In a common domestic griddle stove with external chimney, the gap under the griddle can be reduced to about one half inch for optimum heat transfer.

The following facilitation processes were followed for successful implementation of the project. The analysis of the process of facilitation was done by Cornelio Torrijos⁷.

Intensive awareness

Dr. Reddy conducted community level workshops to explain the “need to adopt efficient stoves” using, Folk plays, Wall writings, and paintings⁸.

Analysis: This is the primary objective of most advertising and marketing communications, awareness of the problem and the possible solution/s. In a way advertising or marketing educates and prepares the target consumer/user. Advertising stimulates desire.

The target audience was made aware about the "need to adopt efficient stoves" in very creative ways -- 'local folk plays', and "wall writings and paintings." not expensive mass media but direct and effective use of what is otherwise known as "graffiti". A picture is often worth a thousand words. Wall paintings are also like billboards.

On demand basis

Once community started understanding, on pilot basis seven households⁹ in each village were selected and on demand basis the Good Stoves were constructed, replacing the old stoves.

Analysis: "On demand basis" – Marketing philosophy is serving consumer needs and

⁷ Cornelio Torrijos - Researcher and Marketing Consultant, Philippines, this analysis is found in group discussions www.Bioenergylists.org

⁸ Folk plays: A combination of songs, dramas, street plays, skits, dancing, etc. performed with focused script on the theme by local professional artists in the language understood by rural people.

Wall writings: Slogans written on the walls on the benefits / advantages in adoption of Good Stoves.

Wall Paintings: For creating awareness with focus on illiterates and catching the attention of people, through paintings / sketches on the walls related to the theme, with small comments / labels / slogans.

⁹ These are the leaders from community who are willing to take the risk and try the Good Stoves, and provide feed back and share their experience / results with the community.

wants. Continuing and repeat demand is what sustains the production of a product and income for producers/marketers.

Identifying the most likely adopters

"In the process it was found that women who were ready for adopting the Good stoves were literate and were young and middle aged."

Analysis: Identifying the most likely adopters is key for when the promotion or extension process is intensified and extended to other areas. There are primary and secondary target segments in a population. Some are more willing than others to adopt changes. For greater immediate success, producers of new and improved stoves would do well to direct their persuasion efforts for the adoption of new designs to the individuals with the following characteristics: "literate, young and middle aged."

Motivation factors

"Other problems, which they were facing was shortage of fuel wood (especially in One Village)."

Analysis: This takes advantage of a local situation where the need for greater fuel efficiency was a motivating factor for change.

Price right

"Other attractive adoptability factors were, low cost of the stove as the raw material required was locally available (bricks, clay and dung) and easy to construct and maintain..."

Analysis: A great way to make the price right -- production in the community, use of locally available raw materials. Here the project motivation is not profit for a city based industrial producer but community service which included profit for the local producer.

Capacity Building

...if trained once, efficiency (25-30% fuel wood is conserved as compared to old stoves for the same amount of cooking over older stoves), good heat transfer, less hazardous as all the flames and embers are contained in the stove and more importantly very less smoke is released as compared to their older traditional stoves.

Analysis: In the participatory process, the benefits of the improved stoves are made better known to the user through training. Yes, there is smoke but the smoke is less. Also, the technical subject of heat transfer was explained more fully in their own language and not simply as an efficiency number. No transportation constraints or costs with local production and sales. No city businessman makes millions of dollars of profit either. Just plain local production for local consumption -- a concept being promoted by the International Labor Organization (ILO).

Feed back

"Three months was the pilot field testing phase during this period improvement in the design was made based on the continuous feed back from the women.

Apart from rice, people ate *Jowar*(Sorghum) *roti* every day in these villages. As this bread has less elasticity, it was breaking while lifting it from the *roti* making plate on the floor onto

the pan. The people explained that this is because the height of the Good Stove was relatively high as compared to the traditional stoves. This extra height was to create chimney effect and increase the efficiency of the stove. Although people were explained several times about the significance of this height for reducing the smoke and increasing the efficiency, they still complained about the practical problem of making *Jowar roti*. This issue has become a major problem for adoptability of Good Stoves in these villages, therefore keeping in view the peoples needs, two inches height of the good stove was reduced (compromising on reducing the chimney effect to some extent).

Analysis: It takes some humility for some scientists and experts from afar to desire feedback from others less educated. But feedback was good because it led to better design and greater fit or suitability of the product to the end consumer/user.

Early adopters have defined the product characteristics more important to them, which helped in finalizing the design.

Success

Within next couple of months 70% of the Households have adopted Good Stoves. Still there is demand from rest of the families in the two villages and neighboring villages.

Analysis: We are back to the marketing philosophy. What a great pleasure for me to read the report for its marketing content. The four P's of marketing by Kotler came alive here -- product, price, place and promotions. Also the three A's: awareness, acceptance and accessibility. In accessibility the key principle is "bring the product within arms' length of desire.

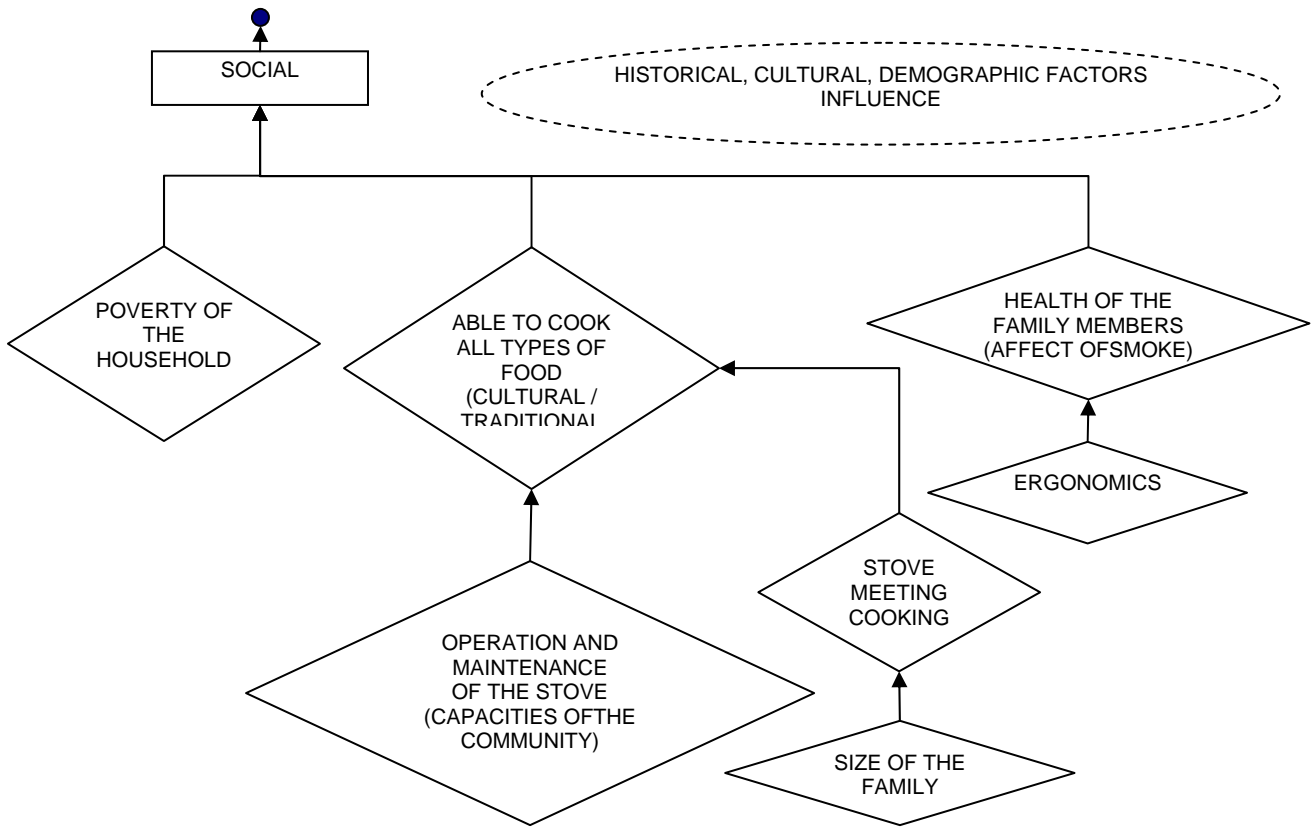
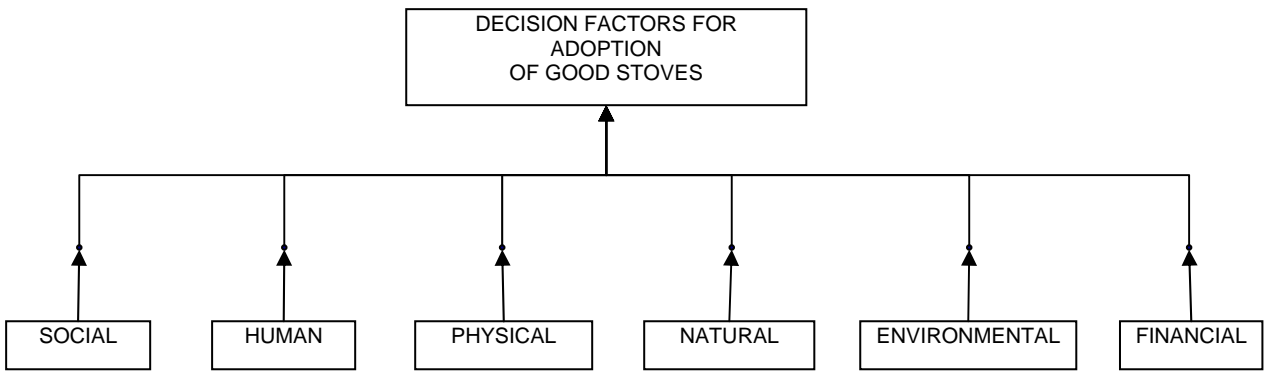
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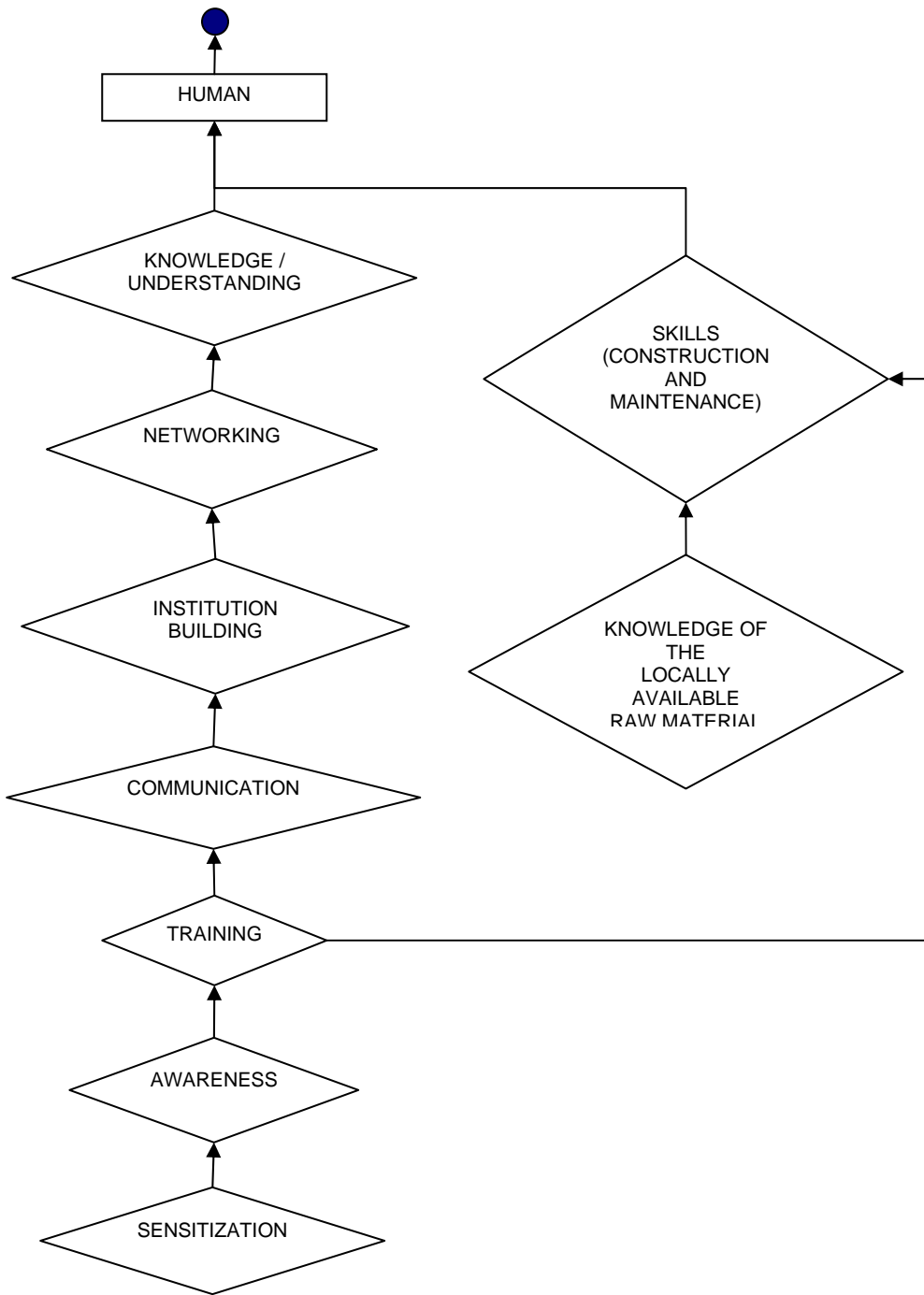
This experience show that however efficient our technology could be, but for sustainable implementation of the community level interventions, the participatory technology development processes are necessary.

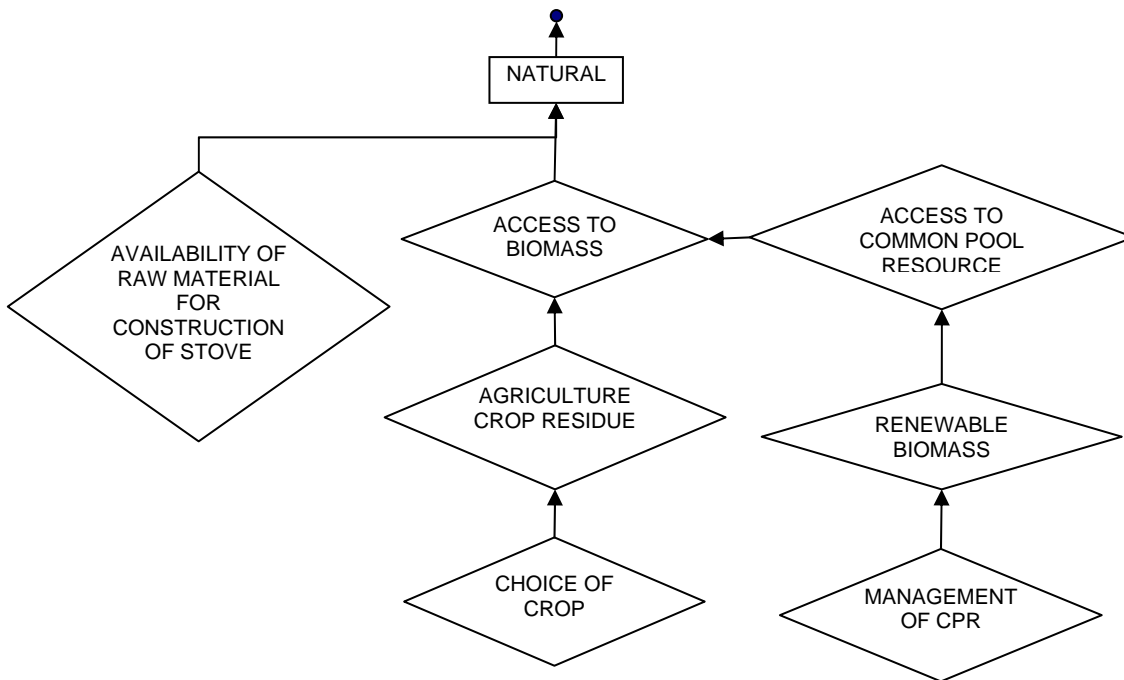
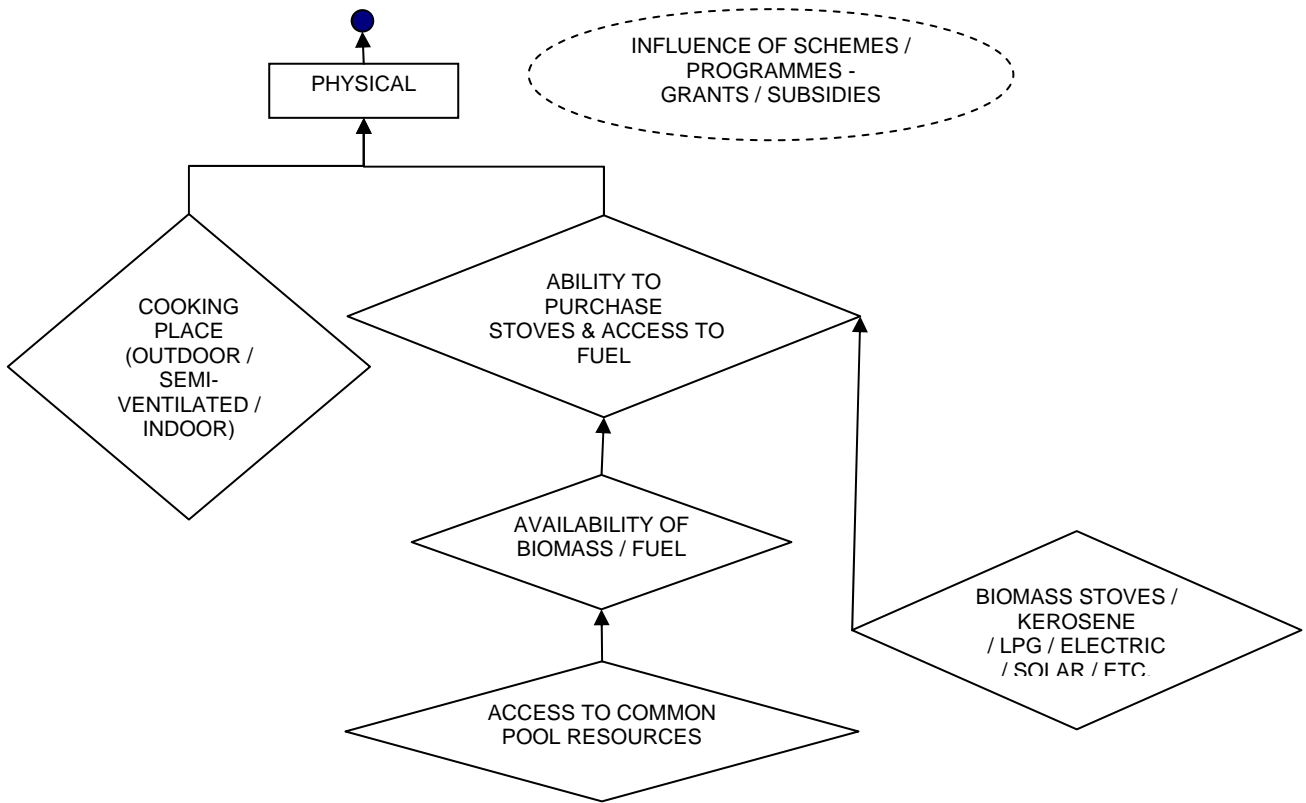
7. COMMUNITY DECISION FACTORS

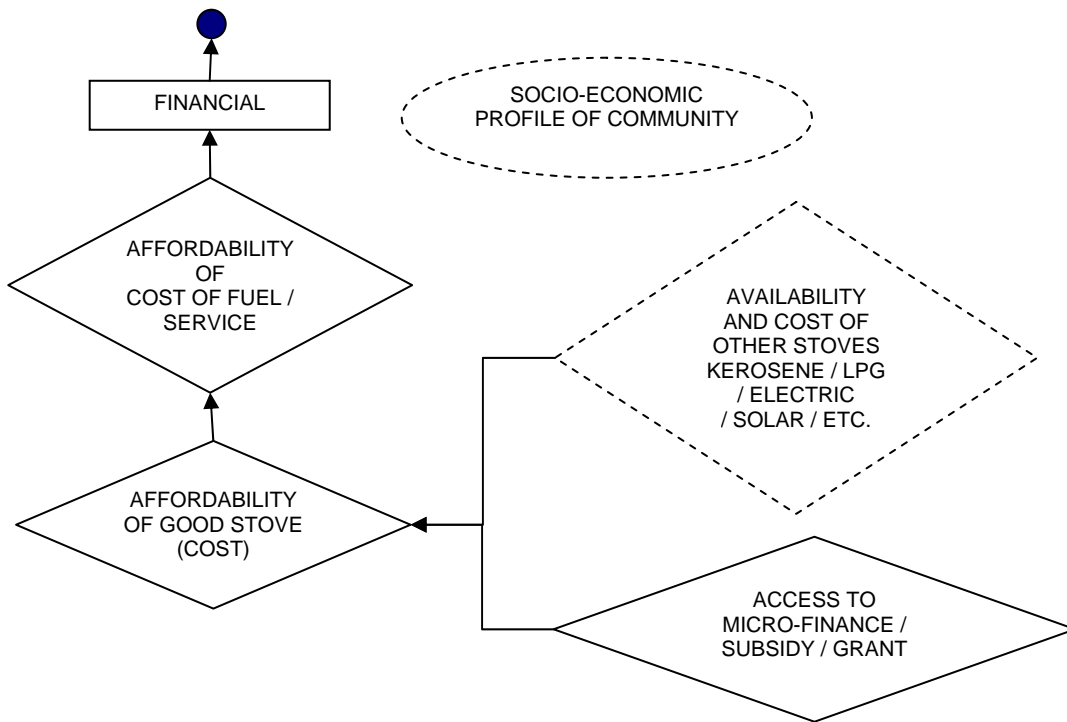
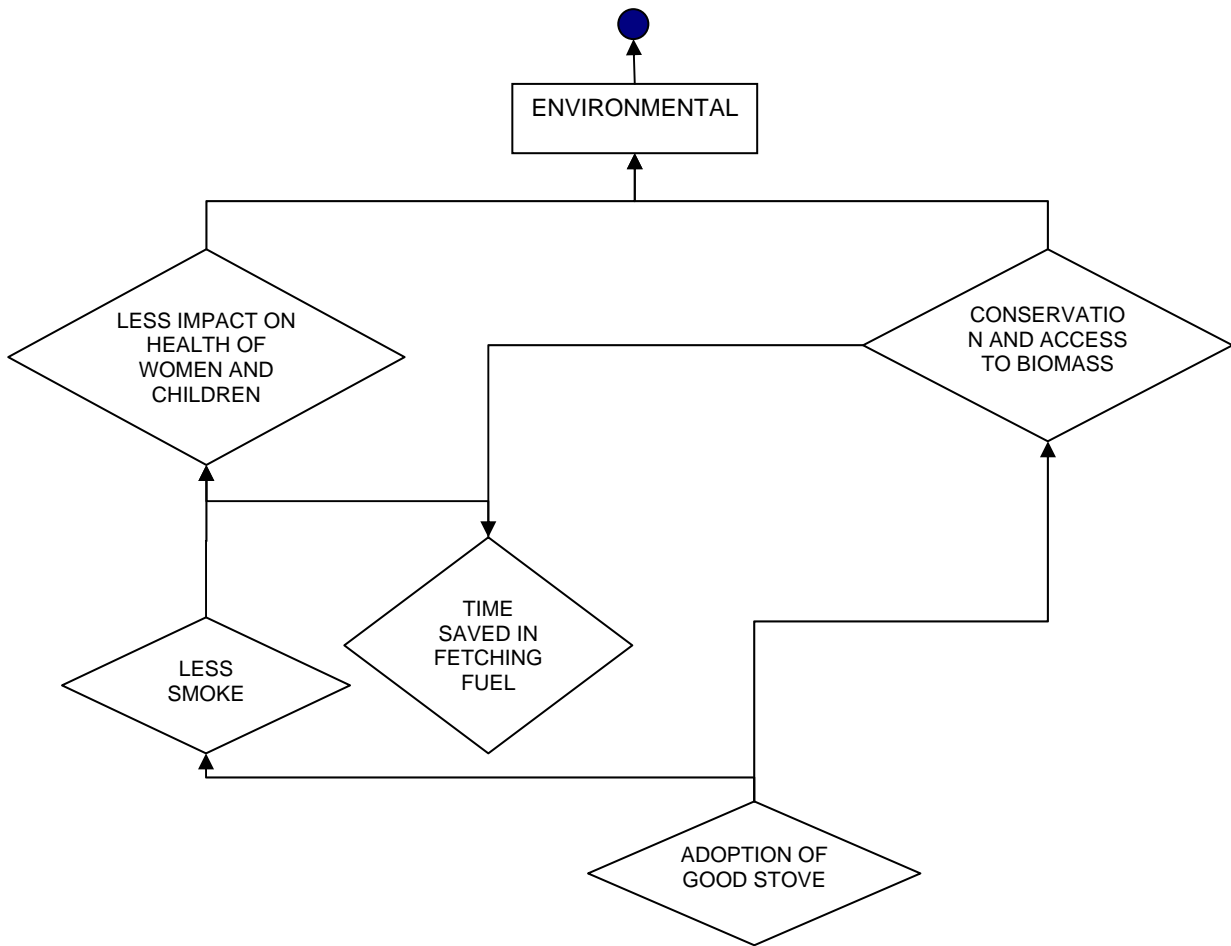
The decision of the community and at household level to adopt Good Stove is the result of several factors, changes in space and time, and dependant on the strength of Human, Social, Economical, Physical, Natural and Environmental capitals at the regional or habitation or Household level. The majority of these factors also influence the sustainability of livelihoods.

Here the decision factors are explained in simple network flow charts which would help the primary and secondary stakeholders involved in Good Stoves adoption and dissemination Programs respectively.









8. CONCLUSION

Apart from the above factors, the technology developed should be a joint effort, where Community, Government, Support Organizations' and Scientists role is envisaged in development and dissemination of good stoves. Through Capacity Building Programs communities' knowledge on the advantages of a Good Stove should be propagated. There should be monitoring and feed back for improvement of stove technology and it is a continuous effort. Technology development should be participatory incorporating local community knowledge for successful adoption. The research should be focused on simple, affordable (low cost), accessible and efficient Good Stove technologies. These stoves created should be easy to operate and use the stove. Optional designs should be made available, which improves the utility and adoptability of the stove. Spatial (Geographic), Temporal, socio-economic, environmental, human skills aspects should be considered while designing the stoves. The stove should be durable and rustic to withstand the local weather conditions. Ultimately the zeal for a common cause and to be part of mitigating climate change should lead for active participation of all stakeholders in developing, facilitating adoption of Good Stoves.

By considering all / some of the factors discussed in this paper and factors specific to each area / region, COMMUNITY ADOPTION OF GOOD STOVES can be facilitated successfully in any project or programme.

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ABOUT GEO

GEOECOLOGY ENERGY ORGANISATION [GEO] is an initiative to mitigate climate change through adaptation. GEO is presently intensively working on GOOD STOVES, RURAL ENERGY, LIVELIHOODS, TERRA PRETA, SUSTAINABLE AGRICULTURE, WATER RESOURCES, DISASTER MITIGATION AND ADAPTATION themes. It has designed about 14 types of stoves which are low cost and simple in design and based on the scientific principles, and declared them as CREATIVE COMMONS for common good.

The mission of GEO is to facilitate 1 million good stoves, in partnership with community, support organizations and donors. Presently it is working with a network of partner organizations to work with about 100 thousand families on Good Stoves for facilitation and dissemination in parts of Andhra Pradesh State and Karnataka States. The work done till now on designing different types of stoves was self funded. GEO had been part of dissemination of about 300 Good Stoves; the list of adopters is published

<http://spreadsheets.google.com/ccc?key=pxqBXdOJdD5Yw3oj65rgsbA&hl=en&pli=1>

It is also helping communities in different parts of the world through sharing technology, knowledge and experience on good stoves; more than 200 people are accessing GEO web links per day. GEO is a member of PCIA.

<http://www.e-geo.org/>

ABOUT THE AUTHOR:

Dr. N. Sai Bhaskar Reddy, is the founder and CEO of GEO. Has designed 14 good stoves and declared them as creative commons. Successfully designed Terra Preta experiments and processes to reclaim alkaline and degraded soils.

For more details please see http://docs.google.com/Doc?id=ddtcnc28_52wg5n6n&hl=en