RURAL ELECTRIFICATION BY SOLAR POWER IN INDIA

TOOLS OF THE TRADE TAKE-AWAY PAPER

"As part of the global drive to reduce carbon emissions and in order to provide millions of Indians with access to electricity, the Indian Government recently announced an ambitious solar energy plan. This plan envisages that India will install a number of solar power plants across the country and generate 20GW of power from sunlight by 2022, providing 20 million rural homes with solar lighting and making India less reliant on coal for generating electricity. The Indian Government has requested that developed nations provide technological and financial support to implement the plan.

"Put together a stakeholder analysis, identifying the main stakeholders, assessing their importance and influence and outlining any actions you might take to engage with each group. Provide an explanation of the analysis."

India – Country Profile

India is located in South Asia, the 7th largest country in the world, and with a population of over 1.1 billion, India is the world's most populous democracy. Previously a British colony, India declared independence in 1947, and as accompanied by fierce violence, two separate states were created, India and Pakistan (CIA World Factbook n.d.). Since independence India and Pakistan have fought 3 wars.

India is a lower-middle income country, with a rural population of 50% of the total population, and around 37% of land area is dedicated to agriculture (World Bank n.d.). Main challenges to the country include widespread poverty and inadequate physical and social infrastructure.

Carbon Emissions and Climate Change

Concerns over carbon emissions and greenhouse gases have increased since the late 20th Century. Increased levels of carbon emissions create a multitude of health and environmental problems, for example acid rain, along with climate change. Particulates for example are small particles emitted from power stations which effect the respiratory system, they can travel long distances and easily penetrate indoors, making exposure difficult to avoid (World Coal Association n.d.; Avakian et al. 2002). Illnesses relating to carbon emissions are varied, from asthma attacks to lung cancer (Smith 2002).

Although climate change is most likely to cause more economic damage in developed countries, the human health detriment is more likely to affect developing countries (Avakian et al. 2002). Furthermore, there is a paradoxical relationship between poverty and fuel, meaning that commonly it is the poorest populations that tend to use the most expensive and unclean fuels, such as unprocessed coal and biomass fuels (Shukla 1996; World Bank 1999). The United Nations (UN) Kyoto Protocol (1998) was created and signed in an effort to lower carbon emissions on a global scale, to reduce emission and limit climate change (UN 1998).

Renewable energy and India

Economic development in India has been energy- and carbon- intensive, domestic coal is the primary energy source, accounting for around 70% of current production (Shukla 1996; World Bank 1999). Furthermore, India is the 5th largest consumer of oil in the world (CIA Factbook n.d.). India has already begun to implement some renewable energy projects, for example western India is home to Asia's largest wind farm, with more than 800 wind turbines (Ramesh 2008). 83% of India has access to electricity, leaving 17% of rural India un-electrified (World Bank 2010). In accordance to this, India has created a programme aiming to achieve full rural electrification, implemented primarily through extensions of the energy grid (Ohja 2010).

Stakeholder analysis

A stakeholder analysis is a way in which to identify and evaluate all individuals and groups which have an interest, stake or role in a project. By determining the various stakeholders, the stakeholder analysis then establishes the different advantages and disadvantages each stakeholder will experience due to the project. The stakeholder analysis is carried out in every stage of the activity cycle, but especially in the design and the implementation stages. I will be using the UK's Department for International Development (DFID) model for the following stakeholder analysis (DFID 2003). I will implement stakeholder analysis in the design and appraisal stage of the programme, before approval and implementation of the project.

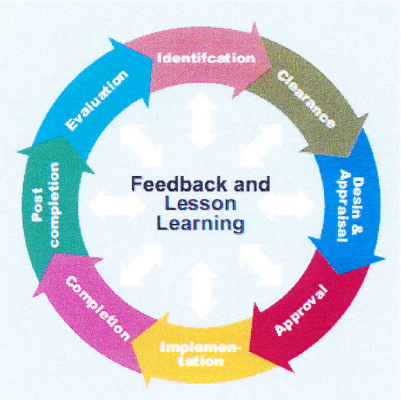

Fig 1. The DFID Activity Cycle (DFID 2003, pp.1.2)

A second tool which can be very useful when performing a stakeholder analysis is a risk assessment. A risk assessment of the project will raise further key issues and concerns, and stakeholders can be identified in relation to these risks.

Stakeholder Table

	RURAL ELECTRIFICATION BY SOLAR POWER IN INDIA		
	Stakeholder	**Likely impact of the project**	**+ive/-ive**
Key	United Nations	Less funding for other projects Funding of Indian project meaning funding demanded for similar projects in other developing countries	- -
	Indian government	Less funding for other needs Less funding for energy needs in urban areas Good reputation for supporting renewable energy Achieve target of rural electrification and Kyoto protocol aim	- - + +
Primary	Energy companies - Solar power - Coal	 Increased efficiency, increased consumer base Decreased demand, decreased employment	 + -
	Rural population	Increased access to energy Landowners losing land and general population relocated to build the solar power plants	+ -
	Rural businesses	Increased access to energy Increased efficiency and communication	+ +
	Rural schools and hospitals	Increased access to energy Increased efficiency, improved hygiene and communication	+ +
	Rural agricultural workers	Increased access to energy and water Increased efficiency and productivity	+ +
	Population local to power plant site	Relocation of population from chosen site of power plant High levels of noise, dust, deterioration of surroundings and scenic quality during construction Increased risk of encountering hazardous industrial waste	- - -
Secondary	Global population	Lower levels of CO_2	+
	Indian population	Lower levels of CO_2 Increased health and standard of living	+ +
	Indian hospital staff	Decreased levels of certain illnesses related to coal energy	+
	Indian energy consumer	Better energy efficiency	+
	Electrical appliance retailers	Increased sales of electrical appliances Increased consumer base Increased sale of refrigerators	+ + +/-
	Indian workers	Increased employment during construction of power plants and infrastructure Decreased employment for upkeep of power plants Decreased employment in coal industry Increased likelihood of exposure to electromagnetic fields and hazardous industrial waste	+ - - -
	Urban population	Less funds to improve or maintain energy provision Lower levels of CO_2	- +
	Solar power designers and engineers	Increased demand for solar panels Provision of solar panels at lower price	+ -
	NGOs - Animal rights - Health - Employment	Destruction of animal habitat, danger to birds flying by power plant due to concentration of sun's rays on panels Increased standards of health Increased and decreased employment due to plant	- + +

	- Rural rights	Increased access to energy, water	+
	Coal miners and workers	Decreased employment	-
	Coal industry	Decreased demand	-
	Other developed nations	Increased likelihood to access UN funding for similar renewable energy projects	+

The above stakeholder table lists all stakeholders related to the rural electrification by solar power project in India. I have used the UK Department for International Development (DFID) model for the stakeholder chart, but also included the different categories of stakeholders, with key stakeholders (the institutions or individuals with significant influence or power over the project), primary stakeholders (those principally affected, either positively or negatively, by the project) and secondary stakeholders (all others not directly involved but still with an interest or stake in the project) (DFID 2003). Along with a list of stakeholders is a simple list of the different likely effects that will occur due to the proposed project, and whether this affect is advantageous or disadvantageous to each specific stakeholder.

❖ **Key Stakeholders**

The United Nations (UN) is a key stakeholder in the solar power initiative as India has requested a large amount of funding from the organisation. India argues that development should be supported and funded by the developed world, seeing as developed nations have grown rich due to their over dependence and high use of fossil fuels (Rahman 2008).

The request for funding by India has wider international and development implications. With the proposed allocation of UN funding to India for the renewable energy programme, this could be seen by other developing nations in two ways: firstly as preferential treatment of India; or secondly, as a gateway for them to also access UN funding for renewable energy. A fair system of funding for renewable energy and a protocol to allocate funds must be created by the UN to avoid any conflict or unfair demands. In terms of specific countries funding the India programme, there are further development implications. Funding from a particular country would increase the country's reputation for supporting development and increased access to renewable energy. Furthermore, a certain country which desires a favourable relationship with India, for example in the agricultural sector, may offer funding to India as a bargaining tool.

The Indian government has a crucial role in the solar power project. A primary concern with the workings of the Indian government is corruption, and the prevalence of bureaucratic barriers. In the

2010 Corruption Perceptions Index, India had a rating of 3.3 out of 10 (10 being highly clean and 0 being highly corrupt); governmental corruption could severely hinder the effectiveness of the project (Transparency International 2010). Furthermore, the Indian government has a large role in the energy industry, thus the corruption and related issues are impossible to avoid.

Without the support and cooperation of the UN and the Indian government, this project could not be undertaken; however there is a need to also monitor the Indian government, as it has a closely connected relationship with the programme's efficacy.

- **Primary Stakeholders**

The clear beneficiaries of the rural electrification project are those in the rural areas gaining increased access to energy: the rural households, businesses, school and hospitals and so on. A key advantage of energy access in agricultural areas is the use of powered water-pumps. Increased access to running water greatly increases the standard of living for the rural populations, and increases agricultural efficacy. Furthermore, with a growing reliance on solar power as opposed to coal energy, the negative environmental and health effects from carbon emissions will be seriously reduced again increased standards of living and agricultural productivity.

Solar power plants need very large areas of land for their construction, it is estimated that 6.4 acres of land is required for a 1MW power plant (George & Banerjee 2011). The need for large land areas will inevitably equate to rural populations being relocated from their homes to use the land for the construction site. Agricultural workers may lose their land, equalling a loss in livelihood strategies, but also a decrease in production. Other rural populations will also be moved, again causing a reduction in livelihood strategies. For the populations who are not moved, but live near the power plant, other risks are increased. For example, a broken solar panel contains hazardous waste and chemicals, which can leech into the soil and increase health risks to the environment and the local population. Furthermore, with construction there will be increased noise, and erosion and detriment of the area (Tribal Energy and Environmental Information Clearinghouse (TEEIC) n.d.).

- **Secondary Stakeholders**

With an increased access to renewable energy by solar power and a reduction in the use of coal and other fossil fuels, the world as a whole will experience lower levels of CO_2 emissions. Furthermore, lower levels of illness and disease which is linked to working with or using coal will be experienced.

Both the global population and the Indian population, rural and urban, will reap the health benefits, as will the environment (World Coal Association n.d.; Avakian et al. 2002).

The effect on energy consumers is problematic. Prior to the solar energy project, coal and other energy access in rural areas was greatly subsidised, meaning that though it was accessible monetarily, the energy industry had little funds, thus unable to reduce inefficiencies in the system and develop further (World Bank 1999). With the funding and new construction of the solar power plants, solar energy promises to be far more efficient, and after paying for start up costs, the costs of up-keep are minimal. However, start-up costs of the solar power plant would be large; energy would need to be subsidised in the short- or medium-term in order that rural households can afford it (World Bank 2010). Overall, it seems that with government subsidisation energy consumers would be able to afford solar energy, with the further benefit of increased efficiency of the system, however subsidisation is not a long-term solution, and if start-up costs are not repaid, it is possible that the solar energy system may experience similar problems of limited funds.

In terms of employment, the solar power plant project illustrates both an increase in employment and in unemployment. For the construction of the power plants and of the infrastructure in rural areas, a large amount of employment opportunities would be created. However, after construction, the general maintenance of the power plants requires a much smaller level of personnel. Specialist waste disposal, engineers and cleaning crews are needed for the up-keep of the power plants, and with these positions come opportunities for education and training; conversely the widespread use of solar energy equals a lower demand for coal, increasing unemployment in the coal industry.

Although the urban population will benefit from the lower levels of CO_2 emissions, the focus of government funding on rural electrification means a decrease in funding for energy provision and upkeep in the urban areas. Although there is widespread access to electricity in the urban areas, there is excess demand for energy, leading to severe blackouts and electricity shortages (World Bank 2010). Though there are health benefits, the blackouts are likely to be more obvious to the urban population, possibly causing them to feel more as dis-beneficiaries than beneficiaries. Data gathering and information dissemination could aid in including the urban population in the rural initiative.

Solar energy engineers will also experience advantages and disadvantages from the Indian initiative. Firstly, there will be increased demand for the solar panels, and increased demand for engineers and training to construct the power plants. However, India, in reference to the Kyoto protocol (UN 1998), have requested that the developed countries provide the relevant technology and an affordable, fair price, meaning that the solar panels and so on will be sold at a much lower value than usual,

reducing profits. However, solar energy engineers are not especially important or influential in the project, so the project would hope that by gaining a good reputation for aiding development at an affordable price and helping further rural access to renewable energy, the monetary loss would be offset.

It is an obvious pattern that with increased access to energy and electricity, there will be an increase in the demand for electrical appliances and utilities. Refrigerators enable food, especially perishables, to be kept for longer, milk and meat for example. This is clearly beneficial for the homes and businesses that will have increased access to utilise fridges. On the other hand, older refrigerators especially contain chlorofluorocarbons (CFCs) which have the potential to destroy parts of the ozone layer, contributing greatly to climate change. Without the proper disposal of these refrigerators and development and widespread use of refrigerators which do not use CFCs, the efforts to reduce climate change will be seriously hampered.

A final secondary stakeholder is the collective of various local NGOs. Animal rights NGOs for example have an interest in the solar power plant construction as the area used for the site will undoubtedly be the natural habitat for a certain animal population. Moreover, birds can be injured and burnt by the concentrated reflections of the sun's rays from the solar panels. On the other hand, the movement away from a reliance on coal positively affects the animals in India, creating cleaner air and reducing environmental degradation.

Stakeholder Influence and Importance Table

	RURAL ELECTRIFICATION BY SOLAR POWER IN INDIA		
	Stakeholder	**Influence**	**Importance**
A	United Nations	5	5
B	Indian government	5	5
C	Energy companies	4	3
D	Rural population	1	5
E	Rural businesses	2	5
F	Rural schools and hospitals	2	5
G	Rural agricultural workers	2	4
H	Population local to power plant site	2	2
I	Global population	1	1
J	Indian population	2	3
K	Indian hospitals and staff	1	2
L	Indian energy consumer	2	3
M	Electrical appliance retailers	1	1
N	Indian workers	2	2
O	Urban population	1	1
P	Solar power designers and engineers	2	1
Q	NGOs	2	2
R	Coal miners and workers	1	1
S	Coal industry	1	1
T	Other developed nations	1	1

The second stakeholder table, following the DFID model, illustrates the different influence and importance each stakeholder has over the programme. The influence rating, with 1 as lowest and 5 as highest, reflects the power over the project that each stakeholder has, and their ability to hinder or support its implementation and efficacy. The importance rating, again with 1 as low, 5 as high, demonstrates the different priority levels given in the project to fulfil their needs. As key stakeholders, the UN and the Indian government are both high influence and high importance. Conversely, although the global, Indian and Indian urban population benefit from the solar energy initiative, they have neither high influence nor high importance.

The rural population, businesses, schools and hospitals and agricultural workers are the key important stakeholders, the project is specifically aiming to improve energy access to this group. However, their influence rating is low as they are most likely poor, with limited education, and therefore unlikely to be paid much attention in the scheme. This could prove to be a key failing of the Indian project. Without taking into account the say and opinions of such important stakeholders, ideas and opportunities may be overlooked. I would suggest ensuring that the project planning and

implementation utilised participatory approaches throughout. Through the use of focus groups, problem and objective trees and other participatory methods, key stakeholders can be empowered and increase their ownership of the project.

Stakeholder Influence and Importance Matrix

	LOW IMPORTANCE	HIGH IMPORTANCE
LOW INFLUENCE	H, I, K, M, N, O, P, Q, R, S, T	D, E, F, G, J, L
HIGH INFLUENCE		A, B, C

The influence and importance matrix shows where each stakeholder is placed in relation to the potential success of the project. The low influence and high importance box contains the rural population, businesses, schools and hospitals, agricultural workers and the Indian energy consumer. This matrix is a reflection of the policy and the different levels of influence and importance if it were implemented in a top-down manner. However, if the project utilised participatory methods, the influence of the low influence, high importance stakeholders would be greatly increased. Below is a second influence and importance table and matrix which reflects the high position of influence and power the rural population would have through the implementation of participatory approaches.

	With a Participatory Approach		
	Stakeholder	**Influence**	**Importance**
D	Rural population	4	5
E	Rural businesses	4	5
F	Rural schools and hospitals	4	5
G	Rural agricultural workers	4	4

	LOW IMPORTANCE	HIGH IMPORTANCE
LOW INFLUENCE	H, I, K, M, N, O, P, Q, R, S, T	L
HIGH INFLUENCE		A, B, C, **D, E, F, G**

Participatory methods increase ownership of the project, but also increase understanding and knowledge. Those who are important to the solar power initiative should also be influential; participation is vital to understand the different needs and issues of those affected, and is a good opportunity to think of new ideas from varying perspectives (DFID 2003).

An issue which may affect the success of the participatory stakeholder analysis is the existence of several different languages in the country. The main languages spoken in India are Hindi (41%), Bengali (8%), Telugu (7%), Tamil and Urdu (5% each), Gujurati (4%), Kannada, Malayalam and Oriya (3% each), Punjabi (2%), Assamese and Maithili (1% each) as well as other languages which contribute up to a further 6% (CIA World Factbook n.d.). With such a variation of languages throughout the 28 Indian states, communication and understanding could be a real issue; in 2006 just over 60% of the Indian population was literate (World Bank n.d.). Illiteracy can further distance

rural groups from the project. Focus groups with people who speak or understand a certain language is an option, but in rural areas there may be a wide disparity in languages and understanding. All stakeholders should be involved in the project planning and evaluation at the least, and failing this, the individuals or groups must be provided with information in a language or manner they can understand.

Summary Participation Matrix

A	United Nations
B	Indian government
C	Energy companies
D	Rural population, businesses, school and hospitals and agricultural workers
E	Population local to power plant site
F	NGOs
G	Indian workers
H	Indian energy consumer

Action	Inform	Consult	Partnership	Control
Project Stage: Identification		D, F, G, H, C, E	A	B
Planning		D, F, G, H, C, E	A	B
Implementation	C, G, H		D, B, A, F	
Monitoring and Evaluation	C	A, B, C, D, E, F, G, H	D, B, A, F	

The summary participation matrix illustrates the different types of participation and action taken with different stakeholders throughout the Indian solar power project. I have filled out the matrix assuming there is a high level of participation throughout the project life. Participatory methodologies such as focus groups are essential in identification, planning and monitoring and evaluation, especially with the high importance stakeholders such as the rural population and agricultural workers. However, in the monitoring and evaluation stage the participatory analysis should include all stakeholders where possible to gain a clear and broad view of the efficiency of the project and its' ownership and sustainability.

A partnership is vital throughout the programme with the UN and Indian government to ensure that the project can be implemented and continue to run, but in the other high importance rural population stakeholders and NGOs should also be in partnership with the project, to ensure all factors and issues are dealt with, and to ensure it is a project implemented both from top-down and roots-up, and to increase project ownership by the rural populations. The government must be controlled in the first two stages of the solar energy initiative, to ensure that money is not diverted, that there is no corruption in the project and that the initiative is not co-opted. Furthermore, the process of control of the government and the participatory approaches combined increases government accountability, which will again increase ownership and belief in the programme.

As mentioned previously, a risk assessment can also aid in a stakeholder analysis. Moreover, a risk assessment can highlight which stakeholders should be involved in the project in a participatory manner to avoid certain risks. For example, a risk may be that the rural populations continue to use coal and biomass fuels for cooking and their other energy needs, instead of using the newly-supplied solar power. Up to 90% of rural households in developing countries rely on biomass fuels for cooking and light; these fuels are collected by hand or home-grown. Whilst biomass fuels are accessible and there is ample labour available, technology may be neglected or even resisted (Avakian et al. 2002; Shukla 1996). Nevertheless, through the use of participatory methods, the rural population receiving increased access to solar energy increase their ownership and understanding of the project, and are more likely to accept the changes, perhaps by creating a discourse through which the new power source can be traditionally understood. The utilisation of risk analysis throughout the project and in conjunction with the stakeholder analysis, risks can be avoided and solutions highlighted before the implementation of a project.

Stakeholder Analysis as a Tool of Development

Stakeholder analysis is a very useful tool used throughout the project cycle. By identifying the different stakeholders and interests in the solar energy project, potential conflicts and problems are also raised, for example, with the necessity to relocate the rural population that lives on the chosen site for the power plant. Partaking in a risk assessment, during the design period of the programme, alongside stakeholder analysis will raise further issues that can be dealt with or minimised before implementation.

As well as highlighting the negative effects that may arise during a project, stakeholder analysis creates a way in which to reduce or eradicate these impacts, and to protect the more vulnerable and disadvantaged groups and individuals. This process can be furthered by combining participatory methods into the stakeholder analysis. The participatory approach can create relationships and opportunities that can be developed to support the success of the project, as well as identifying the different stakeholders that should be encouraged to participate throughout its' implementation, and to gain sustainability of the project, such as the rural, local populations (DFID 2003).

However, in practice stakeholder analysis does have some disadvantages. Stakeholder analysis is a very subjective tool, for example with deciding the importance and influence rating of different stakeholders. Furthermore, matrices may over simplify the myriad of relationships and power controls over a project. This is another reason why participatory approaches in stakeholder analysis are vital; by including different groups and individuals in the creation of a stakeholder analysis, more information and opinions can be incorporated into the tool. The issue was illustrated in the influence and importance matrix where there were two separate matrices, one relating to the project without a participatory approach, and one relating to the project with the incorporation of participation. Different approaches and different stakeholders have widely varying ideas of others' influence and importance in a project, and this subjectivity can be a difficult issue to overcome.

A further concern of stakeholder analysis is associated with the categorisation of key, primary and secondary stakeholders, and with the winners (those positively affected) and losers (negatively affected) of a project. This differentiation can lead to alienation and increased animosity between stakeholders. In a participatory stakeholder analysis, it may be better to not categorise stakeholders into key, primary and secondary groups, nor too designate the overall beneficiaries or dis-beneficiaries of each project, so as to keep all stakeholders interested and open to the project. However, it is also vital that the project is clear, and all stakeholders involved understand their roles and the different affects the project will have on their lives.

Rural Electrification by Solar Energy in India

The solar energy project proposed by the Indian government to increase access to energy to 20 million rural homes is ambitious. A large amount of funding from the UN, developed nations and India itself would be needed to implement the programme, and an extensive amount of land would have to be vacated to construct the power plants. However, the increased access to energy in rural areas would increase health, standard of living and livelihood options, as well as the reduced dependence on coal creating global, national and local benefits.

- **Overlooking Development**

The first main problem of the solar energy initiative is both theoretical and practical. The Indian government and the requested funding must take into account India's developing country context. It is imperative that the programme is implemented in a way which is relevant to India, and not based on a developed country's model of energy supply. The Indian government are aiming to build several solar energy power plants and increase access to energy in rural areas, but the development process must not be overlooked, a developed country model will not translate to the Indian context (Shukla 1996).

Energy infrastructure in rural areas is lacking or inefficient. Furthermore, it is often seen as financially unviable to extend the grid and energy access to remote rural areas. The rural electrification project is ambitious enough without the added solar power project, and without the pre-existing infrastructure, development is a key factor in the policies. It is important for developing countries to pursue renewable energy for development, and rural electrification by solar energy is a positive step to a greener future. Developed countries must play their part in aiding the renewable development.

A further barrier is restricted power and budget of energy companies. Presently, energy in rural areas is subsidised, meaning the energy industry has low financial health. With the high start-up costs of solar power, again the energy would have to be subsidised, thus reproducing the issue (Ohja 2010). Funding from the UN and developed countries needs to be supplied at a low interest-rate, so that India is able to create and sustain a lower-costing solar power system without having to pass on high start-up costs to the energy consumer.

Furthermore, with the solar power plants situated in the rural areas, there will be a need for proper and specific maintenance and cleaning and other staff roles, and with the lack of education and training in rural areas, the up-keep of the power plants may be neglected (World Bank 1999). The project should work with other local NGOs to provide education and training for the local populations in order to increase employment and ensure sustainability of the power plants.

Developing renewable power in India will help the country reduce its energy dependence on coal and other sources and countries, reduce the adverse impacts of carbon emissions, and develop the country's reputation as a leader in high-technology industry (World Bank 2010). Despite this, the solar energy initiative cannot simply be implemented and expected to function perfectly. The stakeholder analysis has highlighted the problematic relationship between the loss of employment in the coal industry and increased health gains, and the provision of more efficient solar power in place of traditional, home-grown biomass fuels. There are several problems to be overcome in the solar energy project other than the primary construction and maintenance, however, by utilising stakeholder analysis continuously throughout the programme, initiatives and solutions can be found and implemented.

- **Alternative Approaches**

India has already begun to pursue other renewable energy options, wind farms for example. A World Bank report (2010) stated that small hydropower was the most economically viable renewable energy approach that should be implemented in India, with solar power as the least economically viable (World Bank 2010). Avakian et al. (2002) suggest that washing coal thoroughly reduces the impurities that are then combined in carbon emissions when the coal is burned (Avakian et al. 2002). India should invest time and planning into the creation of a broad renewable energy plan, taking into account the various different energy production options, to achieve a holistic and expansive policy. India should focus both on renewable energy, as well as reducing the effects of coal use.

India, as a developing country, is a dual economy, harnessing both highly-developed technical knowledge, as well as traditional and informal knowledge (Shukla 1996). Through a development focused and participatory programme, traditional knowledge can be utilised to increase understanding and support for the increased access of energy in rural areas, as well as to increase ownership and sustainability. It is imperative that local knowledge is harnessed in the solar power initiative.

A final issue with the project in terms of the Indian government is corruption. India has a fairly high level of government corruption and bureaucratic barriers. This will in no way aid the solar energy project, and the effects and impacts must be attacked and minimised before the project implementation begins. Governments must be accountable to the people, if the government is not so, then the policies and projects it implements will not be supported. For full support of the solar power initiative the whole process must be completely transparent, and results and reports must be published regularly, in a manner understandable to the entire Indian population.

As demonstrated with the case of refrigerators, along with increased access to energy there should also be awareness raising campaigns and information in the country about the varying electrical appliances available. An increase in the use of fridges has both positive and negative outcomes, and the issue should be fully explored, along with other issues that may arise from different appliances or utilities bought.

Conclusion

Stakeholder analysis is a useful tool to be used in any project. By identifying the different stakeholders in an initiative and analysing the different role and implications of each stakeholder, many risks, opportunities and improvements arise. The incorporation of participatory methodologies is intrinsic in the stakeholder analysis to get a clear understand of the different groups and individuals, and to see the project from every angle possible.

The Indian rural electrification by solar power programme is a positive step towards a green future. However, the Indian government and project writers must not forget the development aspect which is vital in the country. I think the best progression of this solar energy project would be to design the initiative, fully integrated the participatory methodologies, but also to involve other renewable energies as well. Furthermore, information and awareness raising is imperative in order to improve the Indian population's understanding of carbon emissions, and the best way to utilise the solar power. It is vital that this programme is sustainable, and after the initial construction of the power plants the energy provision system will continue in an efficient manner. This must include the participation of the local and national population, as well as a clear and accurate technical and financial bid, taking into account all outside factors as well as direct stakeholders.

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