Connecting the Dots

Evolving Practical Strategies for Adaptation to Climate Change

Energy, Development and Climate Change: Striking a Balance

WOTR

Energy, Development and Climate Change: Striking a Balance

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Foreword

Climate change is already happening and its effects, especially on rural communities in India, are particularly adverse. The need is to highlight the key issues and understand the practical challenges that must be addressed if India is to build the capacities of rural communities to robustly adapt to climate change and realize the National and State Action Plans on Climate Change (NAPCC and SAPCC).

Since the last 4 years, WOTR has been implementing a large scale integrated project on climate change adaptation in rural Maharashtra, Andhra Pradesh and Madhya Pradesh in collaboration with NABARD, the Swiss Development Cooperation (SDC), the Indian Meteorological Department (IMD), the Central Research Institute for Dryland Agriculture (CRIDA), the World Agro-Forestry Council (ICRAF) and the State Agricultural University (MPKV).

This experience has catalyzed insights, learnings and experiences from multiple stakeholders which we have formulated as Position Papers across 12 thematic areas: Watershed Development, Water , Food and Nutrition Security, Agriculture, Livestock, Bio Diversity and Eco System Services, Disaster Risk Reduction and Risk Prevention, Alternate Energy, Economics and Livelihoods, Health , Gender and Governance.

These papers assess and analyse the key policy and operational challenges faced in building adaptive capacities across sectors, from the perspective of different key stakeholders; aim to contribute towards formulation of an enabling policy and operational framework that would facilitate effective implementation of the NAPCC and SAPCCs in rural India; and hope to trigger creative dialogues between key stakeholders with a view to providing effective support to efforts that seek to build the adaptive capacities and resilience of rural communities.

The paper, "Energy, Development and Climate Change: Striking a Balance", examines the energy scenario – availability, access, influence of markets and government policies – in rural India, especially in the areas where WOTR has been working. It highlights the successful partnership between local communities, with their innate grounded wisdom and local knowledge, and modern researchers and scientists willing to position their learning and experience on community science. It roots for a positioning and policy framework that broadens the scope of work from cooking fuel and lighting, to energy needs for irrigation, for trade, business, manufacturing, infrastructure, transportation and construction.

Key Messages

- Whenever we discuss rural energy needs, we tend to limit our discourse to subsistence levels for cooking fuel and lighting; and rarely ever include energy for livelihoods, mobility or infrastructure. Moreover, even this infrequent discourse does not envision a fulfilling life of comfort, dignity and well-being.

- In charting out a developmental pathway which is ecologically sustainable, India has a wider spectrum of choices precisely because it is at an early stage of development.

- Adaptation and mitigation go hand-in-hand and cannot really be separated. As communities adapt to the degraded natural resource base and chart out a development pathway that is ecologically sustainable, the resulting scenario is what we call **mitigation through adaptation.**

- Our experience of over 20 years of rural development work has thrown up various insights and perspectives from the grassroots. Critical amongst these are:
  - Opportunities exist for enhancing energy efficiency in all sectors.
  - A focus on research & development and immediate tangible benefits are key to community acceptance – product development often falls short of quality, service and user friendliness, especially in rural markets.
  - Post-project management is essential to ensure sustainability. Building capacities of communities to handle new products and motivating them towards their continued maintenance and up-gradation is very critical.

- Tools and methodologies to enable a bottom-up process of planning that would integrate (i) local knowledge, wisdom and good practices existing within eco-system based communities, and (ii) modern science, technology that incorporates local wisdom, are essential.

- Access to energy should be recognized as a universal right, to be enabled by all governments and the global community. Based on this philosophy, as well as insights from field experiences and the application of our participatory tools and methodologies, WOTR has included in its mandate the following four action areas.
  - Decentralized energy systems
  - Improving efficiency and incentivizing energy savings
  - Research and Development
  - Policy advocacy

These action areas and a set of policy recommendations arising out of them are discussed in more detail in the paper that follows.

1. Introduction

Progress today is synonymous with energy use. However much one may complain about the ills of modern development, there seems to be no other broadly acceptable development pathway in sight. We use energy for cooking, to power our industries, to run our hospitals, to keep us warm in the winter and cool in the summer. Turning on a light switch rarely requires conscious thought for most of the industrialized world.

Yet, over 1.4 billion people do not have access to modern energy services today and this number is not expected to change significantly even in 2030[1]. Access to basic, clean energy is essential for sustainable development and poverty eradication. Water for irrigation, drinking and other domestic uses will not be pumped or treated without energy. Energy for critical medical services, like vaccinations and maternity services, are essential for lowering death rates and improving health.

Around 40% of the global population, 2.7 billion people, relies on biomass – wood, dung, crop waste, etc. for their basic energy needs like cooking and heating[2]. Burning this fuel in poorly ventilated homes is primarily responsible for the premature deaths of 2 million people a year, mainly children and women[3]. Lower respiratory tract infections, one of the leading causes of child mortality, cannot be tackled unless we reduce smoke from cooking fires in the homes.

Energy and climate change

While access to energy might appear to be a silver bullet in dealing with developmental issues, the unbridled use of fossil fuels has been leading to an increase in CO_2 and other GHGs. The effect of these gases on global temperatures is now one of the biggest areas of concern for all countries. Since the early 20th century, mean global temperatures have risen by 0.76°C, with 2/3rds of this increase happening since 1980[4]. Today the debate has moved on from whether global temperatures are being influenced by anthropogenic actions, to one about the quantum of influence and how best to tackle it.

If global temperatures increase by 4°C, the limits for human adaptation are likely to be exceeded in many parts of the world[5]. In addition, the limits for adaptation of natural systems would largely be exceeded throughout the world. While scientists continue to debate on whether the panic button needs to be hit at 1.5°C or 2°C, the challenge for people relying on climate-linked-livelihoods is how to insulate themselves from the vagaries of the monsoons, temperatures and other climatic conditions.

Developing countries generally dismiss purported solutions as being unfair and/or unrealistic by asserting that its people are frugal. People in developing countries emit less than one-twentieth the CO_2 of an average American[6]. Fingers are often pointed towards the 'west' for its carbon intensive growth stories of the past that made such wealth creation possible.

Considering the early stage of development of the 2nd and 3rd world nations it would perhaps be relevant to focus on the alternatives available to ensure quality of life, health and well-being similar to the industrialised 1st world countries as also the development pathways that would be ecologically sustainable and not lock them into enduring vulnerabilities.

[1] Rio+20 Media Brief, June 2012
[2] Energy for all: financing access for the poor, International Energy Agency, 2011
[3] Indoor air pollution and health factsheet, World Health Organisation, 2011
[4] http://www.ipcc.ch/publications_and_data/ar4/wg1/en/tssts-3-1-1.html, accessed on 30-05-12
[5] http://www.guardian.co.uk/environment/2010/nov/29/climate-change-scientists-4c-temperature, accessed on 30-05-12
[6] Big Ideas for India 2050, http://articles.timesofindia.indiatimes.com/2012-07-22/all-that-matters/32788101_1_wealth-creation-gdp-gatekeepers, accessed 22nd July 2012.

In the context of India, the additional challenge while we attempt to address the energy needs of 'today' and prepare for tomorrow's requirements, is to ensure that ecosystems as also ecosystems services upon which the sustainability of future generations depend, are not harmed.

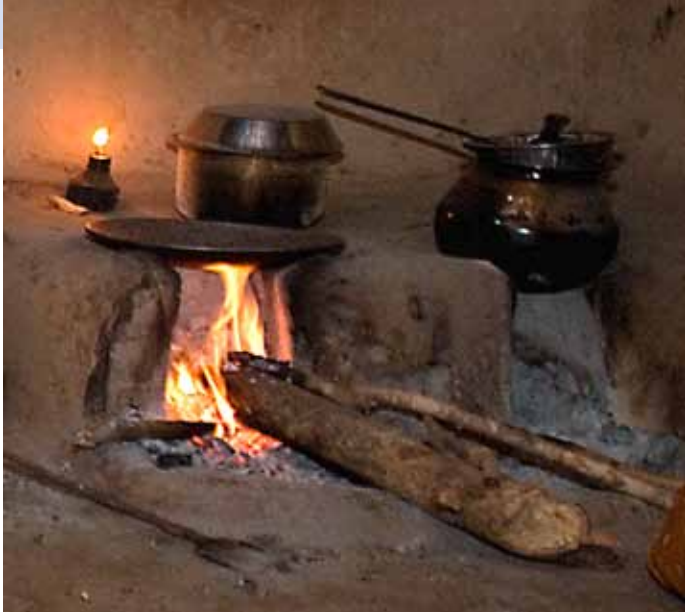
2. The Indian Energy scenario

According to the GoI's own reckoning, 33%[7] of India's population has no access to grid-based electricity. The Planning Commission envisages a fourfold increase in power generation capacity in the next 20 years from 200,000 MW to nearly 800,000 MW (business as usual case). This is based on an extrapolation of a growth rate of 8% over the next few decades. Most (74%) of this increase would be made-up of thermal power. Apart from a large chunk (12%) from hydropower, a bulk of the remaining is, unrealistically, expected to be nuclear (13%)[8,9].

Rural Energy

Nearly 70% of India's population (approximately 830 million) lives in rural areas. Over 85% of these rural households use biomass – dung, agricultural waste and fuel wood – as the primary cooking fuel[10]. Thermal efficiencies of these traditional cooking fuels are very low (15%), in comparison to LPG (60%)[11].

Smoke emitted in these rural homes exposes women to pollution levels 10–20 times higher than the maximum standards considered safe in developed countries[11]. According to the WHO, indoor pollution from solid household fuels ranks as the fourth greatest health risk in low-income countries, including India[12].



Traditional cook stove in a typical Indian rural household

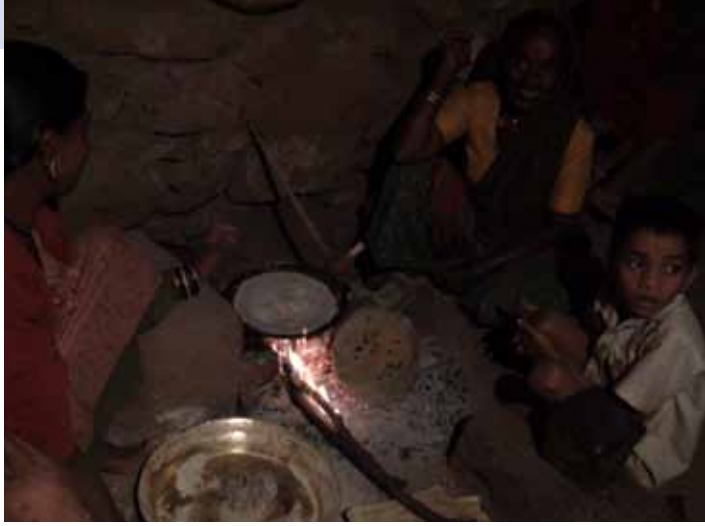
Although records tell us that around 94%[13] of the villages in India have been electrified, only about 44% of the rural homes actually have access to electricity[14]. Except in a few states, rural households receive on an average six to eight hours of supply from the grid and that too mostly during the off-peak period i.e. afternoons and nights (made worse by the poor quality of service)[15].

Whenever we discuss rural energy needs, we tend to limit our discourse to subsistence levels for fuel and lighting; and rarely include energy for livelihoods, mobility or infrastructure. Moreover, even this infrequent discourse does not envision a fulfilling life of comfortable dignity and well-being.

Considering that access to energy remains the core issue in the Indian Energy scenario,

[7] 2011 National Census: http://censusindia.gov.in/2011census/hlo/hlo_highlights.html
[8] Integrated Energy Policy, GOI Planning Commission 2006
[9] Low Carbon Report, GOI Planning Commission, 2011
[10] Preliminary Estimates, Census of India Report, 2011
[11] Cleaner Hearths, Better Homes: New stoves for India and the Developing World. Douglas F. Barnes, Priti Kumar, Keith Openshaw. Oxford University Press, April 2012
[12] Indoor Air Pollution: National Burden of Disease Estimates. World Health Organization (WHO). 2007
[13] CEA monthly report, July 2012: http://www.cea.nic.in/reports/monthly/executive_rep/jul12/16.pdf
[14] Preliminary Estimates, Census of India Report, 2011
[15] Empowering Rural India: Expanding electricity access by mobilizing local resources. SE Asia unit, World Bank Report, 2010.

we review below recent government policies that address this issue and analyse the extent to which they conform with national and international strategies on sustainable development, climate change adaptation and mitigation.



3. Government policies and schemes on rural energy

3.1 Improving access to energy

The Rajiv Gandhi Grameen Vidhyutikaran Yojana, a Government of India scheme which came about in April 2005 has as its core objective the electrification of all villages and habitations, providing access to electricity to all households and electricity connections to below-poverty-line families free of charge[16]. While there has been considerable progress, an increase in electrification of villages to 94%, more than 300 million people still do not have access to electricity. In villages, access to electricity, is most often limited to just the main settlement(s), with its hamlets, where the poor and marginalized live, remaining in darkness.

A key challenge in the implementation of the RGGVY is the availability of power to rural areas. Distribution companies make a loss of about 4 rupees per unit for supplying power to rural households, leading to a structural disincentive for them[17]. Hence, there is an urgent need to revisit and restructure the RGGVY if the objective of 'electricity for all' of the National Electricity Policy[18] is to be achieved.

With conventional energy supply struggling to keep pace with growing demands across both urban and rural areas, continued emphasis has to be placed on renewable resources, especially on expanding wind-power generation and in the emerging area of solar thermal and solar photovoltaic. While C-WET[19] estimates a technically feasible wind potential of 103,000 MW for India, experts from The Energy Resource Institute (TERI) estimate the potential to be $>$ 1,000,000 MW[20]. The estimate from the Lawrence Berkeley National laboratories is even higher - at about 2,000,000 MW[21]. Thus, to assess the true potential of renewable energy across the country and make policy decisions to realize this potential, a realistic review of our national targets and plans based on objective and inclusive norms is required at the earliest.

3.2 Incentivizing energy efficiency

In a paper discussing the approach to the 12th five year plan, (2012-2017), the Government of India discusses that increased energy efficiency is perhaps the only way to contain the energy demand without jeopardizing growth and it must therefore receive high priority[22].

To push the economy towards greater energy efficiency, a review of the country's energy pricing mechanisms and taking certain key non-price initiatives are urgently needed. An

[16] Rajiv Gandhi Grameen Vidyutikaran Yojana scheme brochure, Ministry of Power April 2005
[17] Ensuring Electricity for All: Overcoming Structural Disincentive
[18] National Electricity Policy, Ministry of Power, 2005. http://powermin.nic.in/whats_new/national_electricity_policy.htm
[19] C-WET: Centre for Wind Energy Technology, autonomous R&D institute under the MNRE, Government of India
[20] Hossain J, et al., 2011. A GIS based Assessment of Potential for Wind Farms in India, Renewable Energy (2011)
[21] Amol Phadke, et al., 2012 Reassessing Wind Potential Estimates for India: Economic and Policy Implications
[22] Faster, Sustainable and More Inclusive Growth – An approach to the Twelfth Five Year Plan, October 2011

integrated energy policy was approved by the cabinet in late December 2008, and one of the recommendations was a rationalization of fuel prices to reflect free market prices that promote efficient fuel choice and substitution. However, this rationalization is yet to take place due to its linkages with complex issues like inflation, taxes, access to clean energy, populist pressure from political parties etc[23].

In any case, even in market economies where energy prices are de-regulated, prices do not accurately reflect the supply costs as they cover none or just a few environmental externalities[24]. Hence, clear price signals alone are not enough to achieve a rationalization of energy use. Certain pre-conditions should exist to remove the barriers to energy efficiency, and develop and structure a market for efficient equipment and devices.

Non-price initiatives

Energy efficiency policies and measures ("non-price initiatives") are necessary to compliment the role of prices. The main objective of such measures is to create the necessary conditions to speed up the development and the deployment of energy efficient equipment. The National Mission on Enhanced Energy Efficiency (NMEEE), under the NAPCC - National Action Plan on Climate Change, is the principal policy document directing energy efficiency measures in the country. The Bureau of Energy Efficiency (BEE) has been designated as the implementing agency of the NMEEE.

As compared with the European Union (EU), the regulatory scenario in India for promoting energy efficiency or renewable energy is at the stage of infancy. Even in the EU, it was only in 2007 that national targets for member states were specified[25].

3.3 National and State Action Plans on Climate Change

In charting out a developmental pathway which is ecologically sustainable, India has a wider spectrum of choices precisely because it is at an early-stage of development. Strong political and economic support is essential for shaping the alternate energy market and while there are valuable lessons to be learnt from the experiences of the west, the viability of each strategy and option will have to be evaluated keeping in mind the complexity of the geo-political scenario in India.

The National Action Plan on Climate Change[26] identifies eight core 'national missions' and directs ministries to implement plans that would promote the country's development objectives while also yielding co-benefits for addressing climate change. Apart from the NMEEE mentioned in the previous section, the key mission dealing with energy is the National Solar Mission, and is listed first among the eight missions; the NMEEE follows in 2nd place. This has given great impetus to the states to come out with their own action plans.

WOTR's own Climate Change Adaptation programme echoes some of these objectives[27]. In addition, WOTR firmly believes that adaptation and mitigation cannot be separated. An effective response to climate change must combine both mitigation—to avoid the unmanageable—and adaptation, to manage the unavoidable.

[23] Mid-term assessment of the 11th plan, Planning Commission report, http://planningcommission.nic.in/plans/mta/11th_mta/chapterwise/chap15_energy.pdf
[24] Energy Efficiency Policies around the World: Review and Evaluation World Energy Council 2008
[25] Anuradha R.V., Yadava, S. (2012), India: Implementing incentives focused on energy, Challenges for climate policy and governance in key emerging countries Series, Working Papers N°06/12, IDDRI, Paris, France, 2012
[26] National Action Plan on Climate Change, GoI, PM's Council on Climate Change, 2008
[27] Meeting the Challenges of Globalization and Climate Change: A roadmap for the coming decade, 2011

4. Insights from grassroots experiences

Essentially WOTR sees itself as the link between the complexity of climate science, the top-down policy frameworks of the governments and the bottom-up context-specific needs and vulnerabilities of the communities. Our experience of over 20 years in rural development, engaging with communities, local administration and policy makers has thrown up various insights and perspectives from the grassroots that are discussed below.

4.1 Opportunities for enhancing energy efficiency and switching fuels

The baseline data collected in 2009 from 25 villages in the Sangamner and Akole blocks of Ahmednagar district threw up the following information in terms of energy use:

Stove used	No of HHs	Fuel used	Total quantity annually*
Cooking Chulha	3791	Fuel wood gathered (common areas, forests etc)	45,67,722 kgs (equivalent of over 5000 trees**)
	80	Fuel wood purchased	65,480 kgs (equivalent of over 80 trees**)
	2251	Dung cakes	8,22,157 kgs
	42	Coal	19,917 kgs
LPG	695	LPG	2,953 cylinders
Kerosene stove	4041	Kerosene	1,64,139 litres

* Primary data collected in the survey by WOTR

**Estimated using an assumption that a full grown tree weighs roughly 800 kg

While access to energy remains the primary concern, what one also notes from the above data is that the opportunities for improving efficiency are plentiful. Almost all (4350) households use the traditional stoves (chulha) and between them each year 4,574,262 kg of fuel wood is used for cooking. This is either obtained from the forest, common or private lands or is purchased. Besides, these households also utilize 822,157 kg of dung cakes and 19,917 kg of coal.

While 16% of HHs use LPG, there was not a single biogas plant in these 25 villages as of 2009. Approximately 900,000 kg of dry farmyard manure gets used for agriculture per annum. The total availability of dung in the villages - 1,721,419 kg - could potentially provide dual tangible benefits to farmers of (i) being used in biogas plants to extract a clean cooking fuel i.e. methane, and (ii) the slurry remaining in the biogas plants being an excellent source of manure, which can help lower the amount of chemical fertilizer required/used.

Consumers of large amounts of cooking fuel in rural areas are the Ashram Schools (boarding) and to an extent, the government programmes that support mid-day meals at schools and Anganwadis. A typical school of about 50 students uses about one cylinder a month. However, meals are also cooked on fuel wood, especially in the Ashram schools. In Khadki Budruk village, the Ashram school consumes about 400 kgs of wood each day for approximately 480 students. In these 25 villages there are 5 Ashram Schools and 97 schools and Anganwadis. Access to more efficient and clean cooking fuels is urgently required to prevent the government schemes continuing to have an adverse impact on the local eco-system.

4.2 Focus on R&D and immediate tangible benefits are key to acceptance

The experiences gained in the implementation of energy related projects by WOTR have helped us reflect on what kind of interventions work and how they need to be 'pitched' to gain a better acceptance with the community involved.

Equally essential to the overall sustainability of any product is a strong focus on Research & Development to improve upon existing

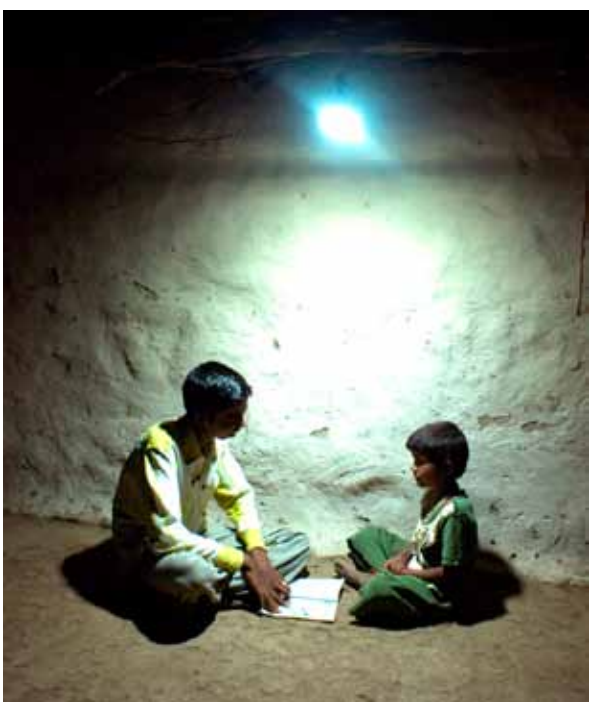
WOTR's hot water chullah

technology in the light of changing needs and life-styles of the communities.

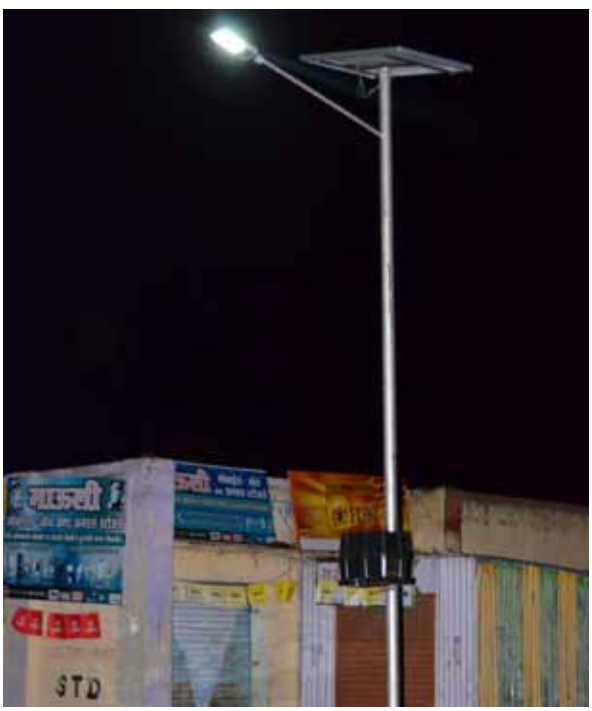
To protect the tree cover restored as part of the watershed development activity, between 1996 and 1997 WOTR had installed about 1100 *'nirdhul' chulhas* which were selected through discussions and field trials involving active participation and feedback from women. A few years down the line, it emerged that the design needed changes to make it more efficient and user friendly. WOTR also designed and experimented with an agro-waste pellet stove where procurement of the raw stock was an issue since it competed with fodder.

The continuous process of participatory R&D led to the development of the Hot-Water *Chulhas* (HWC), which in addition to all the benefits of a smokeless, energy efficient cooking stove, can heat water in a jacket that surrounds the stove by utilizing any waste, residual heat produced. This has been very popular, especially with women[28].

Besides these, WOTR has also installed biogas plants in 560 households, and 23 parabolic solar cookers in rural schools[29]. Household and community lighting through alternate energy means (solar) was gradually included. Solar home-light systems finds application in 3,478 households and 13 villages also have solar street lighting.



Homelighting system at Sattechiwadi village



Street light at Karjule Pathar village

[28] A comparative study on the Energy Efficiency of the Smokeless Chulha and the Traditional Chulha, J.R.Pawar 2009
[29] WOTR Research Data

An important learning for WOTR in all its interventions was that community acceptance was the most critical factor that determined the success or failure of the project. The community's acceptance came from immediate tangible benefits (reduction in fuel used, ease of use, reduction of drudgery and cooking time, additionally, hot water available without extra cost etc) and user-friendliness of the designs. Long term benefits of improved health and sustainable resource utilization are much less appealing as compared to the immediate conveniences and familiarity with regular practices. Hence, it is very important that these considerations are factored in during the product design stage itself.

Table 1 below lists some of the interventions that WOTR has implemented in the field of energy, and the motivations that made people adopt or

Table 1: Reflections on the Energy related interventions at WOTR

Intervention	Motivation for people to adopt	Climate Change/Eco-system Impact	The Gap / Limitations
Biogas[α]	• Convenience – time saved in cooking and collecting fuel-wood • Quick lighting of stove • Easy cleaning of vessels (All these lead to women having time to participate in other activities) • Clean air in kitchen • Readily available organic fertilizer in the form of slurry from the bio-gas tank	Clean burning fuel, reduction in use of firewood which helps reduce GHGs and in turn helps in carbon sequestration	• Lower gas production ◆ in summer due to reduced quantity of dung (less fodder & water) and ◆ in winter because of lower temperatures • Managing the plant can be tedious and adds to burden for women • Information and plan for regular maintenance needed. • An appropriate back-up stove to be installed simultaneously
Hot Water Chulhas	• Convenience and cost saving– hot water easily available at no extra cost • time saving • drudgery reduction • Less smoke	More efficient and hence results in forest protection (carbon sequestration), GHG reduction	The initial effort and cost of the stove are the only real limitations
Solar Parabolics for cooking[β]	• Fuel-wood saved – leading to drudgery reduction in collecting fuel • Cleaning of vessels easier as no soot is generated	Reduced tree cutting, hence forest protection (carbon sequestration), GHG reduction	• Not useable for certain months of the year (rainy, cloudy days) • Need to overcome traditional cooking style and habit • Can only be used during the brightest part of the day
Solar homelights and street lights	• Ease of doing domestic chores after dark; helps children study, also contributes to a feeling a safety, especially among women and children	Much lower carbon footprint as compared to conventional lighting[30]. Just replacing incandescent bulbs with LEDs/CFLs can also improve lighting efficiencies considerably	• limited life of batteries, need for frequent repairs and replacements • initial cost of the set-up can be prohibitively expensive

[α] For further details refer: 'A case study of Narlewadi', Sujaya Dangwar, Sunil Agarwal, 2009
[β] For further details refer: 'A Report on deployment of Parabolic Community Solar Cookers', Arjuna Srinidhi, 2012
[30] Latest studies indicate that the EROEI of Solar PV is greater than 10

reject them. The longer-term beneficial impacts on the climate and the eco-systems and the limitations /gaps have also been listed.

While it could be argued that many of the above activities appear to be targeting mitigation rather than adaptation, we would like to emphasize the point that adaptation and mitigation go hand-in-hand and cannot really be separated. As communities adapt to the degraded natural resource base, and chart out a development pathway that is ecologically sustainable, the resulting scenario is what we call **mitigation through adaptation.**

Biogas plant being used at Gunjalwadi village

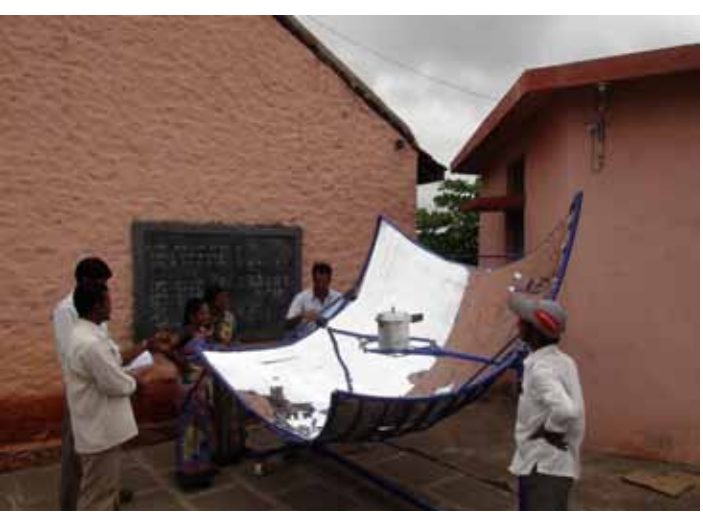
4.3 Post-project management and sustainability

Successful implementation of a project is actually observed a number of years after its completion. Success lies as much in improving the initial acceptance of a new idea/activity as in its post-project management and sustainability, especially in the medium and long term.

A large part of project activities should therefore be directed towards building the capacities of communities to handle the new products and to motivate them towards continued maintenance and up-gradation. Therefore, long after a project is completed, WOTR re-visits projects to understand the sustainability of the activities, the maintenance requirements as well as the current demands and to find responses to these.

Whether it was with the implementation of biogas plants or with the solar parabolic cookers, revisiting the project brought up a number of insights and learnings for WOTR. One of the key insights has been that there are cultural contexts and/or habits that need to be considered particularly when older people are involved. Longer term benefits of improved health and sustainable resource utilization are not as compelling as immediate conveniences, financial savings and familiarity with regular practices. Hence, it is very important to begin from the perspective of people's immediate tangible benefits while we look at the longer term and climatic impacts.

For instance, in the case of the Solar Parabolic cookers for mid-day meals in schools, a buy-in from the prospective stakeholders – the women's groups/SHGs – would throw more light and spark interest to also start using these cookers for income generating activities. This would bring in the immediate benefit as well as serve the purpose of increasing the utilization of the cooker that is often lying idle on Sundays and during the long summer months when the schools are closed for vacations.



Parabolic cooker installed at Sarole Pathar village

5. Looking ahead: WOTR's position and areas of action

Access to energy should be recognized as a universal right, to be enabled by all, governments and the global community. Overall, the focus needs to be on the right to energy of every citizen, even in slum and rural communities; it is the right not just to subsistence energy for single bulb and small community TVs and milling machines, but for a dignified, comfortable lifestyle that enables them to work, play, study and develop as human beings.

While awaiting this level of access, even in remote rural parts of the country, meeting the energy needs during the interim period is necessary. WOTR has therefore included in its mandate the following 4 action areas, to address the right to energy while keeping in mind the strategy of mitigation through adaptation.

I. Decentralized energy systems: Many of the initiatives undertaken by WOTR to date, such as the solar parabolic cookers, solar home and street lights and biogas plants, fall into the category of decentralized energy systems. This has an immediate and significant impact on reducing women's drudgery and making a positive difference to the quality of their lives. Decentralized energy systems give the end-user control over the energy source and also significantly reduce losses in transmission, distribution and theft. In India, these losses are estimated to be over 30%![31]

II. Improving efficiency and incentivizing energy savings: An immediate way to incentivize energy savings would be to support efficient, alternate energy sources rather than subsidize mainstream energy, especially for industries and urban communities. As discussed in section 3, this can be achieved through a rationalization of the energy pricing system in the country, suitable energy policies and other non-price initiatives to speed up the development and the deployment of market efficient equipment.

In this regard, WOTR has been and will continue to promote efficient use of water for irrigation through activities such as water-budgeting, promoting drip irrigation and sprinkler systems, promote energy efficient cooking stoves, replacing incandescent lamps with CFLs, LEDs etc.

III. Research & Development: As discussed earlier in section 4, a very important part of WOTR's mandate is to keep improving on existing technology to make them better suited to the changing needs and life-styles of the rural communities.

With agricultural planning, efficient water management, designing of energy efficient cooking stoves, etc., WOTR has been using the expertise available in-house in suggesting modifications to existing designs with the objective of making the devices more energy efficient, robust, cost-effective and user friendly. In other cases such as with the solar parabolic cookers, solar home-lighting systems, WOTR has been working with professional fabrication units to come up with improved designs by providing very critical grassroots level user feedback.

Our current focus is on renewable, decentralized energy options for irrigation and promoting livelihoods linked to the distribution and maintenance of energy products (critical for ensuring last-mile connectivity); further challenges lie ahead - energy for non-farm livelihoods, rural transportation, building and construction etc.

IV. Policy advocacy: As mentioned before, WOTR sees itself as the link between – the complexity of climate science, the top-down policy frameworks of the governments and

[31] India Energy Handbook, 2011

the bottom-up context specific needs and vulnerabilities of the communities. Engagement with policy makers in particular is critical for replication of successful projects and upscaling.

In this regard, WOTR does engage with policy makers at various levels from the regional and state levels to the national level. WOTR is a regular invitee to the various Government of India advisory committees for consultations on Agriculture and watershed development. WOTR was present at the Doha round of climate talks in 2012 and also hosted an event titled "Making Policy work for the grassroots". It has also participated as a special invitee at MNRE workshops discussing the prospects and strategies for mainstreaming solar cooking in India.

WOTR is also engaged in designing tools and methodologies that would enable a bottom-up process of planning that would integrate (i) local knowledge, wisdom and good practices existing within eco-system based communities, and (ii) modern science and technology that incorporates local wisdom. We believe that such a bottom-up process of planning and policy advocacy is critical to ensuring that India is on a development pathway that is acceptable to its masses and ecologically sustainable.

6. Policy recommendations

Based on the insights gained from grassroots experiences of working with rural communities, we have listed below a few points that clarify our own positions on the nexus of energy, development and climate change.

We also hope that these points serve as recommendations to state and national policy makers as these are a result of working with communities in an integrated manner across a wide range of subjects from watershed development and agriculture to biodiversity conservation and disaster risk reduction.

Policy recommendation 1: All Watershed Development and Natural Resources Management projects should include the promotion of alternatives for cooking (stoves and fuel source), as it contributes to sustainable management of tree cover, as also to better health and lesser drudgery for women.

Policy recommendation 2: Promote decentralized energy generation by instituting mechanisms for payments to small scale decentralized renewable energy systems. (We understand that a guideline to this effect is being discussed by the Forum of Regulators. Operationalizing the guidelines would be the next challenge).

Policy recommendation 3: Subsidies for conventional energy should be phased out (especially for industry and urban communities) and strong incentives should be created for encouraging improvements in efficiencies and energy savings.

Policy recommendation 4: Promoting entrepreneurship and innovation in rural technologies that improve access to clean energy, promote energy efficiency and fuel cost savings for the user to be incentivized. A key component of this would be to incentivize and build capacities of local communities to manage and maintain the new infrastructure being set-up.

Decentralised Energy system at WOTR's Darewadi training centre.

About WOTR

Aware of the fragility of ecosystems and our symbiotic link with it, WOTR has since 1993 applied a systems-based approach to watershed development, focusing on people-centric participatory interventions. With more-than-normal weather variations now being experienced, WOTR has moved into an Ecosystem-Based Adaptation (EBA) approach that helps vulnerable communities build resilience of their degraded ecosystems and livelihoods threatened by climate change impacts. This approach generates significant benefits, social, economic and cultural.

WOTR is now oriented and equipped to specifically address the challenges (and opportunities) posed by climate change to vulnerable communities. In the process, WOTR has introduced a bottom-up, holistic and integrated approach towards Adaptation and Resilience Building.

Constantly learning from experience, WOTR has been revisiting conventional development. Systems Thinking and Complexity Analysis have been incorporated in program design leading to formulation of new tools and frameworks while adapting the existing ones. This helps us shift to a Framework-Based Management, in contrast to activity focused project.

At WOTR, Applied Research is a constant companion. Our team, guided by experts, helps local communities become researchers - observing, measuring, and assessing for themselves problems as also improvements that a project brings about. Having tested methodologies, WOTR disseminates the learning through Capacity Building Events to implementers and donors, far and wide, so as to benefit rural communities across India and to countries in the South.

WOTR has carried out developmental work in over 2,500 villages in six states. Its program on Climate Change Adaptation project is currently being implemented in over 70 villages in Maharashtra, Madhya Pradesh and Andhra Pradesh.

For more information visit us at www.wotr.org

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