Landscape Study of Potential Investment Funds for Fecal Sludge and Resource Recovery in India

COMMISSIONED FOR THE BILL & MELINDA GATES FOUNDATION

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EXECUTIVE SUMMARY

India has among the worst sanitation outcomes in the world and faces serious energy shortages that threaten its economic development, yet the area of energy recovery from fecal sludge has received little attention from government, sanitation implementers and funders. While this is largely due to the stigma attached to applications involving the use of fecal waste and the complexities related to its handling, the low salience is also due in part to the relative lack of development in India's waste to energy (W2E) sector. This is reflected in the low levels of interest among commercial and social impact investors – with waste to energy projects comprising less than 3 percent of overall investments since 2010.

The sources of investor caution can be traced to a combination of factors like regulatory and policy challenges (for instance, the heavy subsidies for solar energy and the variability of tariffs for renewable energy projects across states); logistical issues (for example, the significant constraints to reliable and predictable availability of feedstock for waste to energy plants); and the near absence of business models that lend themselves to scale and sustainability – particularly models that combine revenue streams from power sales, renewable energy credits and bio-waste applications like fertilizers. Consequently, there is limited interest even in technology research and development for waste to energy as the business applications are unclear. All these factors are further compounded for fecal sludge to energy (FS2E), which is a marginal topic even for those currently invested in the W2E sector.

However, recent macro-events in India might portend a positive shift in the enabling environment for the waste to energy space, which could have trickle down benefits for fecal sludge to energy as well. The Government of India is showing signs of raising the priority (and funding) accorded to improving the coverage and quality of sanitation services in urban and rural areas, which could potentially improve the supply chain issue for fecal sludge. Further, the Central Electricity Regulator Commission has notified the issuance and trading of renewal energy certificates[1] on energy exchanges to promote renewable energy generation and also notified rules on subsidies and tariffs for renewable energy technologies. At least a couple of organizations are working on demonstration projects for off-grid power solutions for rural and urban slums using fecal sludge as the primary feedstock. Finally, at least one company is in advanced negotiations with 1-2 urban local bodies to use sewage and fecal sludge as potential inputs for waste to energy projects that will also use municipal solid waste and food waste as inputs.

To be sure, none of these developments will translate into immediate transformative action but a survey of potential funders and investors with existing or potential links to the waste to energy sector indicates real opportunities for an interested organization to catalyze the sector and also

[1] See https://www.recregistryindia.in/

[2] For the purpose of this report fecal sludge is defined as "the sludge of variable consistency collected from on-site sanitation systems and consisting of varying concentrations of settleable or settled solids" (Heinss et

highlight the relevance and potential of energy recovery from fecal sludge – an area that is unlikely to receive much attention without such intervention. In-depth interviews with a set of commercial, social impact and philanthropic investors pointed to five broad areas of potential intervention – 1) advocacy to elevating salience of the FS2E sector; 2) analytics for market feasibility and sizing; 3) technology evaluation and benchmarking in domestic conditions; 4) develop and incubate scalable business models (supply, demand and revenues) and 5) support flexible financing options for the FS2E value chain. In addition, cross-sharing of business approaches and technology deployments with related efforts in other geographies, such as Africa, would likely advance the end objective, which would be to demonstrate one or more proof of concept business models with scalable technology options that can spur investor interest.

Most respondents feel that the Bill & Melinda Gates Foundation is well placed to serve as a catalyst in partnership with select funding agencies, private donors and social investors who might be interested in promoting the W2E and FS2E sectors in India. These partnerships will also be crucial for productive engagement with the Central and State governments. Clearly the Gates Foundation's plans will be contingent on alignment with its global strategies and objectives and also on forging the appropriate partnerships at the country level. However, as this study indicates (see the Recommendations section) there are some actionable ideas that might be explored in the near term to foster growth of the FS2E space.

The public version of this report does not contain confidential information disclosed by respondents during interviews including strategies, details of investments and speculative statements about market dynamics and direction. The information contained herein is largely available in the public domain, either through the websites of respective organizations, news articles or the Venture Intelligence database (www.ventureintelligence.in) on venture capital and private equity investors. This report contains findings largely gathered during the study phase from January to April 2012. Developments subsequent to this period might be missing from this report and will be updated in forthcoming versions.

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PROJECT SCOPE AND METHODOLOGY

This project was commissioned by the Water, Sanitation and Hygiene initiative of the Bill & Melinda Gates Foundation (referred to as "the foundation" in this report). The specified objective of this project was to "landscape investment funds capable/willing to invest in fecal sludge[2] to energy projects in India". The approach consisted of the following steps:

1. Develop an analytical framework based on foundation objectives and limitations
2. Develop a comparative evaluation of identified funding entities based on a set of benchmark criteria including strengths, weaknesses, regions of focus, capacity to provide technical assistance, expertise in either sanitation or alternative energy, size and in-country presence/experience
3. Conduct interviews with staff from select funding entities to identify interest, conditions for developing a sanitation (and/or explicitly a waste to energy sanitation fund), their risks and limitations
4. Make recommendations to the foundation for potential next steps.

In consultation with foundation program staff a long list of candidate funding entities was drawn up and indicative benchmark criteria identified to filter potential candidates for in-depth interviews. The long list included funds across the spectrum from pure philanthropic funders to social impact investors and commercial private equity funds. Further, given the nascent state of fecal sludge to energy (FS2E) investments, the catchment was expanded to include funds investing in sanitation and / or renewable energy.

BACKGROUND

Renewable energy scenario in India

On the surface, fecal sludge to energy conversion seems to have great relevance for India – with its dual potential to improve dismal sanitation outcomes and bridge the widening energy gap. India's sanitation woes are well documented – despite 250 million people having gained access to sanitation since 1990, it is estimated that well over 600 million Indians continue to lack access to even the most basic of sanitation facilities forcing them to defecate in the open[3]. This constitutes over half of the global burden (an estimated 1.1 billion) and is a major factor why the global MDG target for sanitation appears unlikely to be met.

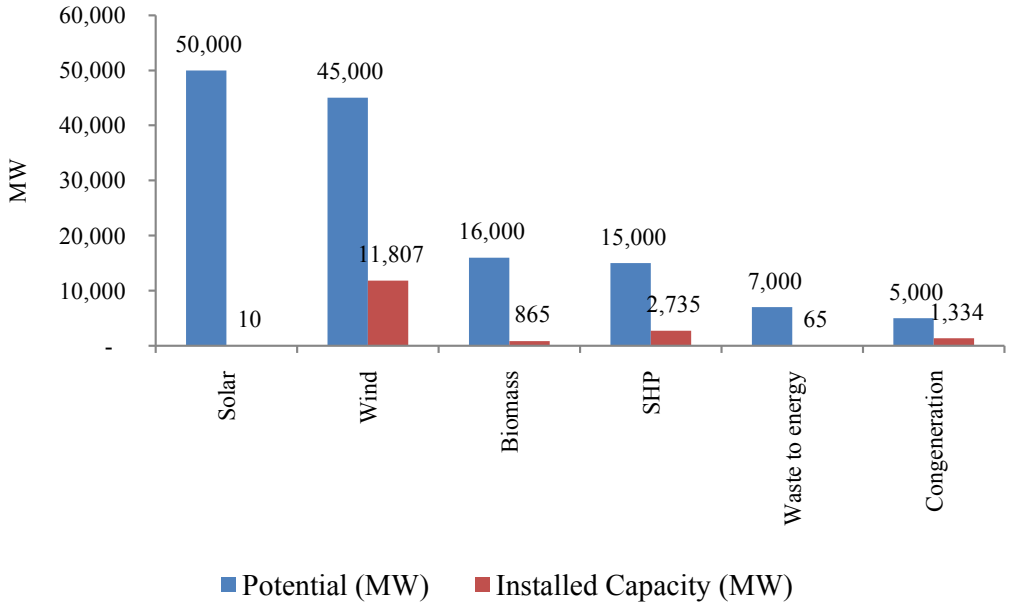
India is also facing an energy crisis – during 2011-12 the power deficit stood at nearly 8 percent whereas peak load deficit was almost 11 percent[4]. Further, the

[2] For the purpose of this report fecal sludge is defined as "the sludge of variable consistency collected from on-site sanitation systems and consisting of varying concentrations of settleable or settled solids" (Heinss et al 1998). Fecal sludge is therefore distinct from sewage sludge that consists of domestic and industrial wastewater discharged into sewers and might also include fecal matter.
[3] Progress on Drinking Water and Sanitation – 2012 Update, WHO and UNICEF, March 2012.
[4] "Economic Survey of India 2011-12", Ministry of Finance, Government of India, March 2012.

capacity addition in power generation during India's 11th Five Year Plan (2007-12) is likely to fall short by nearly a third against the target (52,000 MW vs. 78,700 MW targeted).

Of course, India remains dependent primarily on thermal power generation (coal and natural gas constitute nearly 70 percent of installed capacity) and renewable energy sources are unlikely to significantly bridge the overall deficits in the near term. However, India relies on imports for nearly 80% of its oil needs and has at most 45 years of coal reserves left, the inefficient exploitation of which have contributed to an increasing import burden. India is, therefore, cognizant of the need to move towards a low carbon economy. Accordingly, the Ministry of New and Renewably Energy (MNRE) of the Government of India is increasing its emphasis on exploiting India's full renewable energy potential through supportive regulation and increased financial investment. A 2010 World Bank study[5] estimates that India has renewable energy potential of 150 GW of which roughly a tenth has been realized – mainly through wind power (see figure below).

Figure 1: India' renewable energy potential vs. realization

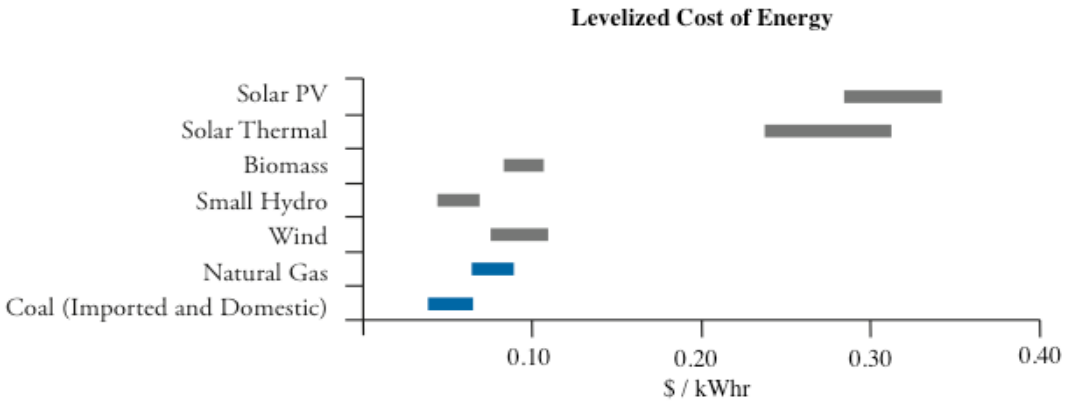


Source: World Bank (2010)

Renewable energy generation has been growing at a rapid clip, albeit from a small base. During the period 2003-10, installed renewable energy capacity grew at an annualized rate of 30 percent from 2.5 GW to about 17.5 GW. About 97 percent of this is grid connected. Wind accounts for nearly 70 percent of installed capacity but biomass also offers a potentially very cost effective energy source (see figure overleaf), particularly for regions of India that do not have perennial rivers or the topography for wind power.

[5] Unleashing the Potential of Renewable Energy in India", South Asia Energy Unit, The World Bank, 2010

Figure 2: Levelized Cost of Energy for different energy sources



Source: India Infrastructure Report 2010, IDFC, December 2010.

In addition, the Government of India's Electricity Act, 2003 makes it mandatory for State Electricity Regulatory Commissions (SERCs) to notify mandatory levels of renewable energy power purchased, while also allowing the Central Energy Regulatory Commission (CERC) to set preferential tariff levels for power generated from renewable sources. This has been reinforced by subsequent policy notifications culminating in the CERC notifying the terms of tradable Renewable Energy Certificates (REC), which can be traded to meet renewable purchase options (RPOs). Trading in RECs started in April 2011 and volumes have picked up to cross over $ 10 million monthly. Over 300 renewable energy projects have received REC certification as of Feb 2012. REC trading is expected to spur the market for renewable energy as states enforce RPOs in years ahead, though the timeline for this remains uncertain.

The Biomass and Waste to Energy Situation

India's biomass surplus available for power generation is estimated at around 189 million tons, which could yield 25 GW of installed capacity[6]. A Gates Foundation-commissioned report[7] estimates that energy recovery from fecal sludge has the potential to yield a further 3 GW. However, actual generation at present is just a fraction of this. The contribution of energy from biomass and waste to energy towards overall renewable energy generation is significantly higher for off-grid projects (see Table 1).

[6] "Indian Renewable Energy Status Report – Background Report for DIREC 2010", National Renewable Energy Laboratory, US Department of Energy, 2010
[7] "Sustainable Recovery of Energy from Fecal Sludge in India", Energy Alternatives India report commissioned by the Bill & Melinda Gates Foundation, October 2011

Table 1: Biomass and Waste to Energy Generation in India

Source	Grid-connected	%	Off-grid	%
Biomass co-generation (bagasse / agro residues)	2313 MW	13.5%	238	56.7%
Biogas	-		125	29.8%
Waste to energy	72	0.4 %	53	12.6%
Overall generation from all RE sources	17174	100%	420	100%

Source: "Indian Renewable Energy Status Report – Background Report for DIREC 2010", National Renewable Energy Laboratory, US Department of Energy, 2010

Biomass projects have primarily used bagasse (particularly at sugarcane plants) or agro residue (for example, in the farming belts of Andhra Pradesh, Bihar, Madhya Pradesh and Tamil Nadu). Waste to energy (W2E) projects have mainly focused on municipal solid waste – a few demonstration sewage sludge projects exist, but their viability and sustainability remains unproven. The main reasons for failure[8] include – 1) non-availability of acceptable waste (low biodegradable content); 2) mismatch in quality of waste received and the plant design; and 3) poor availability of regular inputs mainly due to lack of accountability of the urban local bodies involved.

Business models for W2E in the Indian context are few. Some well-known examples include Husk Power Systems and Desi Power – both Bihar-based social businesses that have set up off-grid power plants (with up to 32 KVe capacity) in rural areas of Bihar. While these businesses continue to refine technical and operational elements of their model to improve viability, their degree of success is likely to have significant implications for a country where nearly 400 million people still don't have access to electricity – while electrification rates in urban areas have reached 93% they are only around 52% in rural areas – and geographical dispersion and weaknesses in the transmission infrastructure make grid-connectivity for all a long-term goal, at best. Further, the rising costs of environmental pollution and land pressures for disposal of waste generated in urban and industrial areas might lend some urgency to the scale up of W2E solutions.

Accordingly, the MNRE has several schemes for providing financial subsidies and incentives for the set up of such projects both in urban and rural settings. The EAI report[9] provides details of available incentives and some examples of projects established.

There are a few pilots at sewage treatment plants in cities like Surat (3.5 MW being generated) and Chennai (3 MW being generated) that use sewage sludge as

[8] "India Infrastructure Report 2010", IDFC, Dec 2010.
[9] "Sustainable Recovery of Energy from Fecal Sludge in India", Energy Alternatives India report commissioned by the Bill & Melinda Gates Foundation, October 2011

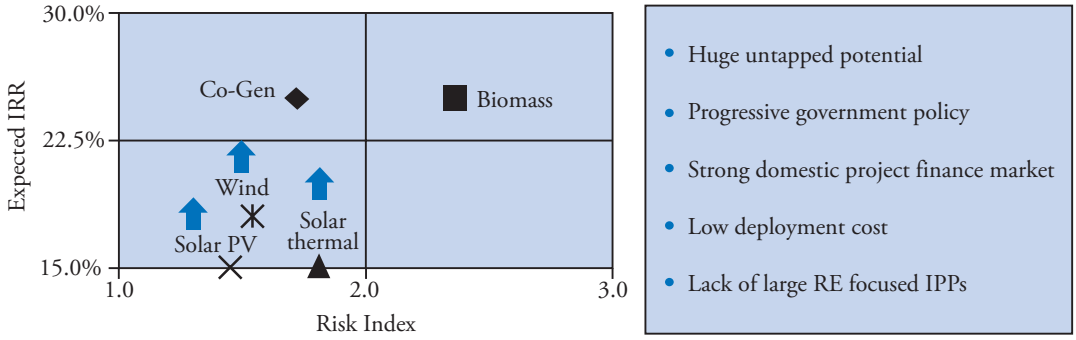
input. However, there are almost no examples of sizable projects that incorporate fecal sludge as a primary input. While the availability of proven technologies to handle fecal sludge is one part of the problem, a bigger hindrance is the absence of a feedstock supply chain. Not surprisingly, investor interest, which generally has been cautious about renewable energy in India, has largely skirted the W2E space. In the last year, a couple of small scale projects which aim to address the challenges associated with fecal sludge supply chains and energy distribution have been funded through challenge funds from philanthropic agencies – Samagra Off-Grid in Delhi, which received funding from the Gates Foundation under the Grand Challenges Explorations Round 7[10] and the Humanure Power Project in Supaul district of Bihar, which received funding from the Dell Social Innovation Challenge[11].

Investments in Renewable Energy Projects in India

This section documents recent publicly announced investments in renewable energy made by different categories of investors.

Commercial investors: The huge untapped potential of India's renewable energy resources has interested commercial investors for much of the last decade. Starting with Citigroup Venture Capital's investment in wind power major, Suzlon Energy, investments in this space have grown at roughly 25 percent CAGR to over $1 billion annually by 2010. However, during Jan-Dec 2011 investments slowed down considerably primarily due to policy and financial uncertainties. Most investments have been in Independent Power Providers (IPP) with technology and development expertise driven by strong management teams, which offer better economies of scale than small single project developers. In line with the overall capacity profile of the sector most of the $ 1.43 billion[12] invested in the last two years went towards solar and wind power with less than 3 percent for biomass and waste to energy projects. This skew is due to the risk perception associated with the availability of assured quality feedstock supply for biomass projects for any large-scale project (Figure 3).

Figure 3: Renewable Energy Segments - Risk and Return



Renewable energy segments – risk, returns and attractiveness of India

Source: India Infrastructure Report, IDFC, December 2010.

[10] http://www.gatesfoundation.org/watersanitationhygiene/Documents/wsh-gce-summary.pdf

[11] http://www.dellchallenge.org/projects/humanure-power-project

[12] Venture Intelligence PE/VC deals database

Social impact investors: The clean energy sector has also got the attention of impact investors who seek to support social entrepreneurs servicing the base of pyramid (BoP) market. This energy market is sizable at an estimated $ 500 billion[13] (in PPP terms) per a 2009 study by Hystra Consulting and Ashoka. The same study suggests that in India BoP household spending might constitute up to 87% of the national household energy market. Further, a 2010 IFMR / World Resource Institute study[14] puts the market size for BoP decentralized renewable energy services in India at $ 2 billion annually. However, investments have not kept pace with the apparent potential – since Jan 2010 investments in energy have been just well under 5 percent of all social investments made in India. Paucity of viable business models, regulatory challenges and immature technologies are cited as major reasons behind the lack of investment.

Philanthropic grants and competition funding: Apart from commercial investors and impact investors, a third segment of investors comprise purely philanthropic investors who provide grant funding either directly or through competitions that seek to catalyze project ideas. There are no reliable sources available to quantify funding from such sources but a number of donors have supported clean-tech work in India including the Shell Foundation, GIZ, SIDA and JICA. The Gates Foundation and Dell Foundation challenges mentioned previously have also sought to identify and fund innovative concepts. Competitions aimed at unearthing innovative business models have been attempted recently by the Indian Institute of Technology – Kharagpur and in a more structured way by MNRE and the Indian Institute of Management – Ahmedabad and separately by the Sankalp Conference supported by Intellecap that brings together social businesses and investors. Renewable energy and specifically waste to energy has not figured prominently in these competitions.

In summary, the waste to energy sector despite its potential to address the energy needs of small-scale industry and BoP populations while advancing environment and social development goals has not yet attracted much investor attention for a variety of reasons. Fecal sludge to energy recovery in particular has elicited very limited interest from serious investors. However, latent interest remains and as this study found, there might be potential for catalytic engagement to bring together different players – government, technology partners and entrepreneurs – to accelerate investment interest.

Organizations included in the study

The findings and subsequent recommendations in this report are based on conversations with 23 organizations covering a mix of commercial investors, impact investors and philanthropic donors.

[13] *Access to Energy for the Base of the Pyramid*, Hystra Consulting and Ashoka, October 2009
[14] *Power to the People: Investing in Clean Energy for the Base of the Pyramid in India*, IFMR Research-Centre for Development Finance and the World Resource Institute, October 2010

STUDY FINDINGS

Opportunities and enablers

Several investors were quite interested in learning about cost-effective technology solutions and viable business models if proofs of concept were demonstrated. Most respondents agreed that India must continue ramping up investments in renewable energy as it attempts to balance economic development with the imperative of minimizing the associated carbon footprint. There was also a sense that such projects at reasonable scale (3-5 MW) if backed by government power purchase agreements (to insulate entrepreneurs from the uncertainty of domestic tariff collections) could provide a viable solution for household energy needs in peri-urban and select rural areas apart from feeding the needs of small and medium-scale industry which have no access to captive power.

There was a sense that viable FS2E recovery models might ameliorate the abysmal open defecation situation particularly in peri-urban settlements and rural areas with high population density (for example parts of UP, West Bengal and Bihar). Some specific points mentioned around FS2E included:

- Urban areas, particularly Tier 1 and Tier 2 cities, with large slums and mushrooming apartment complexes, might provide the best setting for FS2E pilots
- Large industrial townships or government departments like the railways (with reference to the railways' stated aim of moving away from open disposal of fecal matter on railway tracks to containment and safe disposal) and the defense services (in the context of large cantonment areas) might also prove useful partners.
- Partnerships with supportive urban local bodies would be crucial to address the unorganized nature of septic tank / pit emptying services
- Any FS2E business model would need communications support to address the stigma around fecal matter handling and disposal
- Technology options should ideally allow FS as a combination feedstock for economies of scale – possibly with municipal solid waste or sewage sludge in urban areas and with animal waste or agro-waste in rural areas.

Barriers and constraints

There are several barriers to higher investor interest and participation in the waste to energy sector. Common concerns cited included:

1) Shortage of innovative or scalable business models and particularly of strong entrepreneurs in this space
2) Weak supply chains for reliable feedstock availability
3) Lack of transparency in contracting procedures (for municipal solid waste and sanitation services)

4) Uncertainty over evacuation infrastructure for grid connected solutions (due to weak financial condition of state transmission and distribution companies)
5) Nervousness about direct revenue realization and collections from the BoP segment (particularly in the aftermath of the microfinance crisis in India)

All these issues apply to FS2E as well, but fecal sludge was viewed as presenting some additional barriers including – social stigma around energy or other end products derived from fecal material; the risks associated with collection, handling and storage given the controversies around scavenging; and the absence of fecal sludge as a potential source of energy in MNRE and CERC documents and guidelines for renewable energy subsidies and tariffs.

In terms of technology, most respondents felt options that combine FS with other organic feedstock might prove most viable.

Role for the Gates Foundation / other philanthropic capital

Most respondents viewed philanthropic funds for FS2E as potential risk capital that could catalyze action in the following areas of need:

1) Technology development / refinement for use of fecal sludge as part feedstock in combination with MSW, animal waste, biomass etc.
2) Catalyze business models and approaches for deploying these projects for different settings (urban/rural; BoP coverage – either exclusively or in combination with mid-segment consumers)
3) Demonstrate projects at reasonable scale (1 MW or more ideally) to prove the business and techno-feasibility
4) Advocacy with government and others to foster an enabling regulatory and contractual environment for W2E projects involving fecal sludge
5) Forge funding platforms / vehicles to focus on scale up of successful demonstration projects

Organization Profiles

Of the 23 organizations surveyed about half had existing investments or plans in the W2E space, and indicated some preliminary interest in learning more about FS2E though none of them are actively considering any prospects in this space. These organizations are profiled in subsequent pages.

Profile 1 - Aavishkar	
Overview[15]	Aavishkaar is an Indian venture fund that promotes enterprises that have social impact. The firm provides micro-equity funding and operational and strategic support to commercially viable companies increasing income in or providing goods and services to rural or semi-urban India. Aavishkaar was an early funder of the micro-finance sector but has diversified into other areas. • Investment philosophy guided by finding strong entrepreneurs with credible if unproven business models that will benefit BoP significantly • Just closing Round 2 fund – targeting $ 120 million • Interested in partnerships and co-investing subject to strategic alignment
Sector Focus	Agriculture and Dairy, Education, Energy, Handicrafts, Health, Water and Sanitation, Technology for Development and Microfinance and Financial Inclusion
Fund size	Aavishkaar I $ 80 million impact investment fund (Aavishkaar II being raised with target of $ 120 million, first closing at $70 million in December 2011). Also have two funds focused on support to the microfinance sector
Investments relevant to W2E or sanitation	Shramik Sanitation Services (www.3sindia.com) - portable sanitation and liquid waste management business with stated aim of servicing slum communities and other un-served populations Servals (http://servalsgroup.blogspot.in) – sustainable energy products for rural markets including energy efficient cooking stoves and water conservation
Other sample investments	Waterlife (water purification services); Tide Technocrats (energy); Vaatsalya Healthcare (healthcare)

Profile 2 - Acumen Fund	
Overview	Acumen Fund founded in 2001 is a pioneering global non-profit venture fund. Its investments focus on delivering affordable, critical goods and services to BoP consumers (those living on less that four dollars a day). Acumen invests

[15] The overview statements and other investment statistics for most organizations are sourced from www.ventureintelligence.in

	what it terms "patient capital" via equity, debt, guarantee, loyalty and seed/lab capital for companies and test projects. Acumen has been investing in India since 2001 and supports innovative business models addressing critical challenges in the health, water, energy and agriculture sectors. • Investment decision making not guided purely by valuation multipliers – employ a growth capital model for businesses emerging out of the start up phase • Open to partnerships for co-investment • Usually do not invest in technology development alone unless linked to an innovative business model • Interested in innovative W2E business models to add to existing portfolio
Sector Focus	Health, water, energy and agriculture
Fund size	Over $ 22 million invested till date in India
Investments relevant to W2E or sanitation	Guardian – www.guardianmfi.org (water and sanitation MFI); Husk Power Systems – www.huskpowersystems.com (off-grid biomass energy plants for rural areas)
Other sample investments	SBA Hydro (micro-hydroelectric plants); D Light Design (solar lamps); Orb Energy (energy);

Profile 3 - Bamboo Finance	
Overview	Bamboo Finance is a Swiss-based, commercial global investment advisory firm financing enterprises serving people at the Base of the Pyramid. Bamboo Finance manages three funds – one focused on microfinance, another on solar power and a third, the Oasis Fund focuses on essential goods and services that benefit BoP communities. It funds companies using market-based approaches that can fill gaps where philanthropy and government may not be equipped to serve fully or effectively and where profitability can be a driving force. Bamboo Finance seeks to multiply its impact by investing in women. • India is a priority county – have existing investments in energy, education, healthcare and financial services • Preferred mode is to make direct investments usually as a minority shareholder but with an active engagement model • Invested in Husk Power Systems so interested in the W2E models that are commercially viable

Sector Focus	Affordable housing, healthcare, education, energy, livelihood opportunities, water, and sanitation
Fund size	$ 250 million under management globally
Investments relevant to W2E or sanitation	Husk Power Systems (off-grid biomass energy plants for rural areas),
Other sample investments	Vaatsalya (healthcare), Vienova (education), Greenlight Planet (solar LED lamps)

Profile 4 - Center for Innovation Incubation & Entrepreneurship (INFUSE)	
Overview	CIIE is an autonomous investment entity set up at the Indian Institute of Management, Ahmedabad with additional support from the Government of India and the Government of Gujarat. It aims to provide mentoring, financing and knowledge inputs to selected entrepreneurs during the seed and start up phase. The CIIE is has raised a dedicated fund for sustainable energy called INFUSE Capital with investments from the Government of India and private capital from India and overseas. INFUSE provides equity funding and mentoring to sustainable energy and clean-tech focused early-stage ventures in India. The fund seeks to find solutions to India's energy needs by • Incubating and mentoring scalable ideas and business models with infrastructural support, active mentoring and incubation funds of up to $0.2 million • Supporting existing entrepreneurs to scale up their solutions through equity investments and mentoring. Typical investments usually do not exceed $1.5 million.
Sector Focus	CIIE - ICT, Cleantech and Healthcare; INFUSE will focus entirely on renewable energy
Fund size	Not available
Investments relevant to W2E or sanitation	Infuse yet to make any investments so these are from the CIIE portfolio Visviva – www.vvenergy.com (biomass supply chain to realize the potential of energy from biomass fuel)
Other sample investments	Insolare (Solar energy); Save the Environment (water filtration); iStar (continuing education)

Profile 5 - IDFC Private Equity	
Overview	IDFC Private Equity is one of the largest PE firms focused on the infrastructure sector (including social infrastructure) and allied services and enablers. IDFC PE has made over 30 investments since its inception in 2002 and had 16 liquidity events. IDFC PE manages three funds – India Development Fund, IDFC Private Equity II, IDFC Private Equity III. IDFC PE has an active engagement model with portfolio companies defining and enhancing business strategy to professionalizing management teams, assisting with business development and advising on financial structuring. They also facilitate debt and acquisition finance support from their parent organization, IDFC, for portfolio companies. W2E projects are an area of interest if based on scalable technologies and business models.
Sector Focus	Agri-business, Education, Energy, Engineering & Construction, Healthcare & Life Sciences, Hotels & Resorts, Media & Entertainment, Shipping & Logistics, Telecom, Travel & Transport
Fund size	$ 1.3Billion across three funds
Investments relevant to W2E or sanitation	Green Infra – www.greeninfralimited.in (renewable energy from wind, solar, hydro and biomass); Emergent Ventures India – www.emergent-ventures.com (renewable energy advisory)
Other sample investments	Manipal Universal Learning (education); Moser Baer Solar (energy)

Profile 6 - IFC South Asia	
Overview	The International Finance Corporation is the private sector arm of the World Bank Group. IFC coordinates its activities with the other institutions of the World Bank Group but is legally and financially independent. IFC finances private sector investments in the developing world, mobilizes capital in the international financial markets, helps clients improve social and environmental sustainability, and provides technical assistance and advice to governments and businesses. IFC has been present in India for over 50 years and has invested in over 260 companies. To grow opportunities for the underserved, IFC concentrates on low-income, rural, and fragile regions while • Building infrastructure and assisting public-private-partnerships; • Facilitating renewable energy generation; promoting

	cleaner production, energy and water efficiency; • Supporting agriculture for improved food security; • Creating growth opportunities for small businesses; • Reforming investment climate; • Developing public-private partnerships; • Encouraging low-income housing; and • Making affordable healthcare efficient and accessible. IFC has interests in off-grid energy solutions, including W2E and has a sizable portfolio across India and Bangladesh in South Asia.
Sector Focus	Health, housing, infrastructure, renewable energy and agriculture
Fund size	$ 3.6 billion invested in India (till Jan 2011)
Investments relevant to renewable energy or sanitation	Husk Power Systems (off-grid biomass energy plants for rural areas); Vishwa – www.vishwainfra.in (water supply and wastewater management); AuroMira Energy – www.auromiraenergy.in (renewable energy from biomass, small hydro and wind; also developing energy plantations)
Other sample investments	Tata Cleantech Capital (for renewable energy investments); FINO (ICT for financial inclusion); Jain Irrigation Systems (agriculture and food processing); Zulekha Hospitals (healthcare)

Profile 7 - India Innovation Fund	
Overview	The India Innovation Fund is a venture fund for early stage India companies with innovative models in a range of sectors. The fund was set up by NASSCOM (an industry organization of Indian software companies) and IKP Knowledge Park (an arm of the IKP Trust headed by Mr. N. Vaghul, the former Chairman of the ICICI financial group – India's largest private sector financial services company). The fund has a set of strategic investors from across sectors including the Government of India, TCS (India's largest software company), Airtel (India's largest mobile services provider) and SIDBI (a public sector bank for promoting small scale industry). In addition to providing start-up capital, the India Innovation Fund also provides support in areas like mentoring (through market experts) and market access through global and domestic corporates. • Interested in the W2E sector but still exploring

	different models to understand scalability and commercial viability • Also interested in exploring the commercial potential of water recovery from sewage
Sector Focus	ICT, Life Sciences, Pharmaceuticals, Medical Devices but open to innovations in other sectors as well
Fund size	~$ 12 million
Investments relevant to renewable energy or sanitation	None thus far
Other sample investments	SEDEMAC (power control and energy efficiency); Mitra Biotech (translational oncology); Surewaves (digital media-technology)

Profile 8 - Intellecap	
Overview	Intellecap is a social-sector advisory firm that provides investment banking, consulting and knowledge building services for sustainable development initiatives. Intellecap, in partnership with the Shell Foundation, has floated Intellegrow a debt-fund for early stage social businesses, which face difficulty in attracting bank financing. Intellegrow is a distinct entity that makes investment decisions independent of Intellecap. Intellecap is also setting up a fund for social businesses (the Intellecap Impact Investment Network) with investments from high-net worth individuals. • Intellecap provides consulting and investment advisory services to social businesses – have intermediated over $100 million in social business investments since 2002 • They also work with social businesses to develop financial and operating models that are commercially viable and scalable • Delivered market analysis and feasibility studies in various sectors including water management (not worked on W2E yet) • They also conduct the annual Sankalp Conference to showcase innovative social businesses and connect them with investor networks – has become a well-established event and provides them access to a pipeline of social entrepreneurs across sectors like energy, water and sanitation, healthcare and financial services.

Sector Focus	Cross-sectoral
Fund size	Social fund size not available
Investments relevant to renewable energy or sanitation	None in the energy segment yet
Other sample investments	Details not available

Profile 9 - Khosla Impact	
Overview	Khosla Impact's mission is to assist great entrepreneurs developing market-based solutions to poverty. Their focus is on for-profit enterprises serving people at the bottom half of the world's economic pyramid: low-income laborers, farmers and families, as well as small businesses in emerging markets. They seek to fund entrepreneurs focused on developing scalable and self-financing solutions for poverty, healthcare, education and other intractable problems. • Focus on innovative social business in developing countries – initial focus on India and East Africa • Not keen to fund pure technology or product development per se, but interested in innovative applications and deployment situations
Sector Focus	Agriculture, water, energy, healthcare, education, housing but open to looking at others as well
Fund size	Not available
Investments relevant to renewable energy or sanitation	None thus far in energy
Other sample investments	DripTech (irrigation); Embrace (medical devices); Mokshayug (rural supply chains); Kopo Kopo,(financial services)

Profile 10 - LGT Venture Partners	
Overview	LGT Venture Partners is an impact investor that supports organizations with outstanding social and environmental impact. LGT VP supports organizations working for the BoP community in three ways – a) financial capital as equity, debt

	or grants; b) intellectual capital through close mentoring and the iCats program that places top-notch business professionals at needy social businesses temporarily; c) social capital by connecting organizations to wider global networks. LGT VP gets funding mainly from the Royal Family of Liechtenstein. Key criteria considered for funding include: • A clear mission and values which are compatible with the principles of LGT Venture Philanthropy • An effective solution to a social and/or environmental problem which is efficiently implemented • A dedicated and professional management team with an excellent track record • A proven model that can be scaled or replicated • Strong financial discipline • Effective methods to evaluate results • The goal to significantly increase social and/or environmental impact
Sector Focus	Health, Education, Resources, Nutrition, Water, Energy, Social Markets
Fund size	Not available
Investments relevant to renewable energy or sanitation	Green Oil Energy Solutions (power generation and organic fertilizer from biomass – mainly Jatropha); Husk Power Systems (off-grid biomass energy plants for rural areas)
Other sample investments	Aangan Trust (education); Driptech (irrigation); Mann Deshi (markets for social investments); Operation Asha (health)

Profile 11 - Matrix Partners	
Overview	Matrix Partners India is an investment fund with about $600 million under management. The fund targets the Indian market and is sector-independent in its investment strategy. In terms of investments, Matrix seeks companies that address a large and growing market with a viable business model that has long-term and sustainable differentiators. The India investment fund is run in partnership with Matrix Partners US, which has a 30-year record with investments in firms such as Apple Computer, FedEx, Sycamore Networks and Veritas. In India, the firm invests up to $30 million in each new investment and tends to build long-term relationships. Apart from financial investments, the firm actively partners with portfolio companies to define strategies that will generate exceptional market returns and create shareholder value.

Sector Focus	Sector independent but current portfolio covers consumer products and services; education; financial services; internet and mobile technologies; healthcare and an "emerging areas" space which includes water and hospitality presently
Fund size	~$600 million
Investments relevant to renewable energy or sanitation	None as yet
Other sample investments	Waterlife (water purification); Tree House (education); Quikr (internet commerce)

Profile 12 - Michael & Susan Dell Foundation	
Overview	The Michael & Susan Dell Foundation focuses on funding opportunities with the greatest potential to transform the life of impoverished urban children across the world. The foundation has committed over $700 million towards such opportunities in urban areas across the United States, Africa and India. The foundation uses metrics-based methodologies and analysis to identify where resources can be applied to maximize impact in a systemic, sustainable way. The foundation applies funding flexibly and can provide grant funding, debt or equity depending on the requirements of each investment opportunity. In India their work is focused on urban slums in the Tier 1 and Tier 2 cities. The foundation does not have an explicit renewable energy focus but urban sanitation is a priority area, hence its intersection with W2E is of interest, though not an investment priority presently.
Sector Focus	Education, Childhood health (including water and sanitation), community strengthening, family economic stability
Fund size	$ 726 million committed to date; over $ 100 million in India
Investments relevant to renewable energy or sanitation	Shramik Sanitation /Saraplast (portable toilets pilot for urban areas). The Dell Social Innovation Challenge fund has also invested in Humanure Power Project in Bihar
Other sample investments	Waterlife (water purification); Invest India Micro Pension Services, Akshaya Patra (school feeding), Kaivalya Education Foundation

Profile 13 - Sage Capital	
Overview	Sage Capital is an advisory company for SAGE NPE Fund I, which invests in private, mid-market Indian companies with high growth and profit potential across sectors like infrastructure and science and technology. The firm looks for fast growing, profitable private companies.
Sector Focus	Energy, engineering, construction
Fund size	Not available
Investments relevant to renewable energy or sanitation	Concord Enviro Systems (waste to energy solutions, waste water treatment)
Other sample investments	John Energy (oil & gas sector service provider)

Profile 14 - Shell Foundation	
Overview	Shell Foundation was established in 2000 as an independent charity operating with a global mandate to develop, scale-up and promote enterprise-based solutions to address issues around poverty and the environment, particularly those arising from the impact of energy and globalization. It received an endowment of $250 million from the Shell Group when it was established and provides on average $16 million a year of funding support. Shell Foundation's enterprise-based approach focuses on developing sustainable solutions that are financially viable and replicable. To this end the foundation works with strategic partners, commits its own funds and where appropriate, leverages the infrastructure, brand and knowledge of the Shell Group. The foundation also seeks to set up new organizational entities – often innovative hybrids comprising of NGO and business sector elements with the capability to eventually function independently and sustainably. In India, the Shell Foundation presently has the following lines of work: • Breathing Space – which seeks to tackle indoor air pollution by designing and market a new range of stoves for cooking and heating • Trading UP – creating sustainable supply-chains for developing country producers to access markets profitably

	• Embarq – developing and implementing sustainable transport solutions to address pollution and congestion in large urban centers • Excelerate – supporting small businesses that provide modern energy services to low-income communities • Climate change – developing initiatives to reduce greenhouse gases to add to the impact of the other lines of work; includes work on bioenergy drawn from agricultural waste feedstock (both animal and plant)
Sector Focus	Energy, Livelihoods, Climate Change, Access to Markets, Infrastructure (including water and sanitation), Urban Transportation
Fund size	Not available
Investments relevant to renewable energy or sanitation	Husk Power Systems - (off-grid biomass energy plants for rural areas), Organizational entities set up include – • First Light India Accelerator (in partnership with Gray Ghost Ventures) to provide seed-stage funding to Indian enterprises with a social or environmental mission, • IntelleGrow Finance Company (with Intellecap), a non-banking finance company (NBFC) designed to provide growth finance, particularly unsecured short-term debt, to small businesses in the energy and infrastructure sectors.
Other sample investments	EnviroFit (indoor air pollution control); Agrocel (rural market access);

RECOMMENDATIONS FOR FURTHER ACTION

As highlighted in previous sections the FS2E sector is constrained by several structural barriers which have served to limit interest among investors and entrepreneurs / implementers, while also hindering institutional engagement in FS2E from government, donors and other stakeholders working on sanitation. These barriers must be addressed in order to catalyze interest and action in this sector. A number of options are available for agencies seeking to play a facilitating role to develop this space. The options can be bucketed into five broad categories:

1) Advocacy to elevate salience of the FS2E sector
2) Analytics for market feasibility and sizing
3) Technology evaluation and benchmarking in domestic conditions
4) Develop and incubate scalable business models (supply, demand and revenues)
5) Financing options for the FS2E value chain

These options are listed in Table 5 below.

Table 2: Potential opportunities to develop the FS2E in India

Potential opportunity	Gap addressed	Desirable attributes for partner organization
1) Commission a study to estimate market demand and business potential for FS2E (possibly in combination with other biomass feedstock)	No reliable data exists. Would serve as resource material for entrepreneurs, government and funders	• Deep understanding of the energy market in India, including regulations, pricing, subsidies • Knowledge of the sanitation sector • Understanding of W2E / FS2E technology options and feasibility to Indian conditions • Strong government connections at center and state level
2) Benchmarking study of globally available W2E / FS2E technologies to determine applicability and financial viability for implementation in India	Sparse understanding of technology options with little information on project development costs, technical requirements etc.	• Deep understanding of renewable energy technology options for W2E and FS2E, including global R&D and emerging proofs of concept • Ability to partner with local research partners and private sector as appropriate • Understanding of project financing, funding options and business plans
3) Establish a platform (competitive or otherwise) to bring together entrepreneurs and technology partners (local and international) to	To establish an enabling ecosystem across technology firms, entrepreneurs and funders	• Convening power with social entrepreneurs and technology firms locally (and internationally, especially in Africa) • Access to network of business and technology mentors (individuals / firms)

Potential opportunity	Gap addressed	Desirable attributes for partner organization
develop business ideas and models in FS2E		• Connections with funder networks (particularly seed / early stage investors and philanthropic donors)
4) Develop and implement a pilot to demonstrate a reliable supply chain for fecal sludge in 1-2 urban settings tied to an FS2E project	Significant reservations among most stakeholders on the dynamics of running a supply chain to provide fecal sludge as feedstock	• Strong understanding of local business and government relationships (including at urban local body level); • Existing urban services delivery in solid waste / sanitation • Experience with community engagement in urban neighborhoods and slums • Risk-taking ability to implement FS2E proof of concept
5) Foster creation of a W2E themed investment fund (could be housed within an existing renewable energy fund) with an explicit FS2E component	No existing fund in India has any FS2E element; there is particularly a need for risk capital to support proof of concept implementations, which could be provided through philanthropic capital	• Funds who privilege social impact over financial return • Focused on market-based solutions for the base of the pyramid • Interest in supporting some technology development linked to FS2E business models

Some additional recommendations for consideration include:

- **Support regional convenings to raise the salience and potential of FS2E in the context of India / South Asia and Sub-Saharan Africa's sanitation and energy challenges**: The current discourse around W2E does not usually extend to FS2E, hence such thematic convenings that bring together policy makers, government, entrepreneurs, technologists and funders might serve as triggers for more constructive dialogue around the scope and potential of FS2E. These could also serve as platforms for technology transfer discussions and cross-pollination of business models.
- **Advocacy with the government to consider fecal sludge as potential component for renewable energy projects and to deploy a portion of National Clean Energy Fund resources towards FS2E projects**: As mentioned previously CERC guidelines do not currently indicate fecal sludge as an approved renewable energy source. This largely due to the absence of viable examples and reliable data. By investing in suitable pilots, documenting results around project setup expenses, costs for operation including feedstock supply, maintenance and related heads, a knowledge base could be developed to support advocacy with government institutions. Further, since 2010-11 the Government of India

has been collecting a cess on coal sales towards a National Clean Energy Fund. While the size of this fund has swelled to nearly $ 700 million (as of February 2012) and is expected to grow to $ 2 billion by 2015, the Government has not announced plans to deploy these funds. In the medium to long-term this Fund could emerge as an important domestic funding source for clean energy and it would be important to establish FS2E as a viable option.

Clearly, all the opportunities mentioned above have associated risks because of – a) low levels of salience on this topics among stakeholders; b) the stigma associated with anything around fecal waste and its handling; c) the long timespans likely associated with realizing such action. Further, the payoffs are by no means guaranteed because regulation and financing would need to provide an enabling environment for the development of this sector.

Almost all the options presented above could fall in the "market creation" category. Given the early stage of the FS2E space it might be strategically important for the Gates Foundation and its partners to consider playing a substantial role in creating a "coalition of willing" geared to advance the FS2E space.