

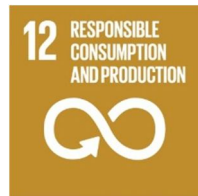
Capacity Building Module

Applying Systems thinking to achieve SDGs

India



INTRODUCTION TO SYSTEMS THINKING



WHAT ARE SYSTEMS?

"Systems are collections of actors who are engaged in a relationship that serves their common purpose". – Saraph, A. (1994)

A system could be a corporation, an economy, a living body, a city, an ecosystem. Systems are often placed within larger systems, which are embedded in even more larger systems. For example the earth's climate is a system comprised of the subsystems of our atmosphere, our oceans, the land, and human society; a market is a system of buyers and sellers who have come together in a relationship to exchange something that they have, this market a part of the economy, which is in itself a subsystem of the society. Similarly, a banking system comprises of borrowers and lenders who are engaged in exchanging credit. We participate in many different systems.

WHY THINK SYSTEMS?

It is the relationship of the actors in a system that causes the behaviour of the system to "emerge". When you change the relationship a different behaviour will emerge. The outcomes in a system, therefore, depend on this emergent property of systems. "Systems Thinking" identifies that systems often contain within them the causes of their own success and of their own failure.

The outcomes that result due to interactions between the various elements of a system can be understood and behaviours that are stable, sustainable and resilient can be accomplished. These can be brought about if the actors are able to recognise and work symbiotically to the purposes that brought them together in a system.

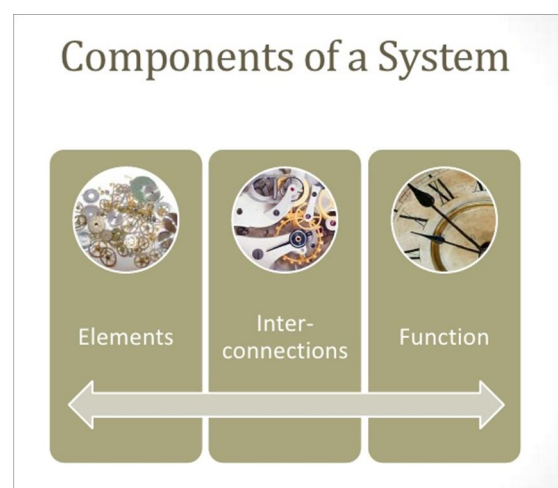


Figure 1: Source: Patrick Woessner, 2012, Introduction to Systems Thinking

Systems' thinking focuses on three essential components:

- elements of the system,
- the inter-connections between the elements, and
- the function or the purpose of the system. The purpose of the system is the least obvious, yet the strongest component impacting the health and behavior of the system.

DECISION MAKING IN SYSTEMS

A "systems thinking" approach is more promising in complex situations since it provides the decision maker(s) the opportunity to address the problematic situation in its full system context (Yurtseven and Buchanan, 2015). However, it is important to understand that in complex systems there is no direct influence on the state of the system (Meadows, 1999). The process of our action on the system has some delay and it seems as if it's making a direct influence. The reason for no direct influence is that decisions in complex systems involve the actions of other agents whose choices jointly determine the outcome desired. Additionally the result we receive at the end is only a perceived state as the real state is too complex to get as a whole.

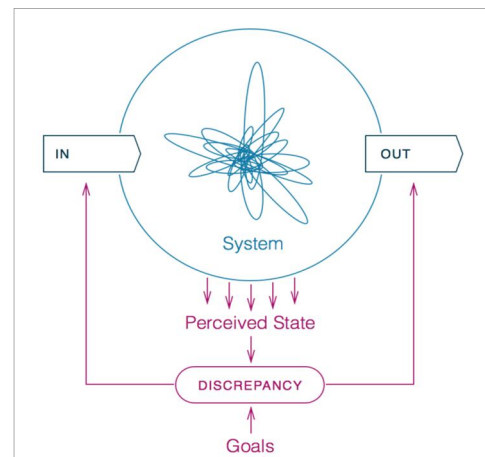
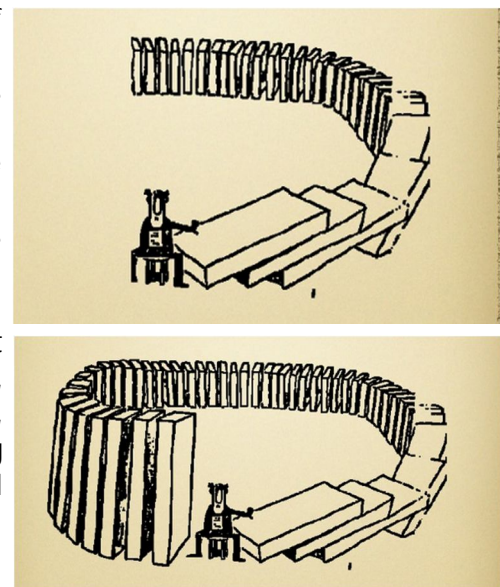


Figure 2: Source: Davide 'Folletto' Casali, 2015, Leverage Points

The info-graphic above clearly depicts that the behavior of the components of a system can't be ascertained if the entirety of the system isn't taken into consideration. This understanding, or lack thereof, is a major contributor to recurring problems in today's world. By just addressing the symptoms of a problem, and not the root cause, the next set of symptoms only gets delayed and never resolved. This is because in the complex systems that we are a part of, there are numerous feedback loops and the cause of the symptom evident to us may come from a certain different path which may stretch far back in time (Jay W. Forrester, 1994). When it comes to solving the world's problem today, a computational way of thinking is ineffective, lacking understanding that the human behavior and environmental impacts are intricately related.



SDG AS A COMPLEX SYSTEM

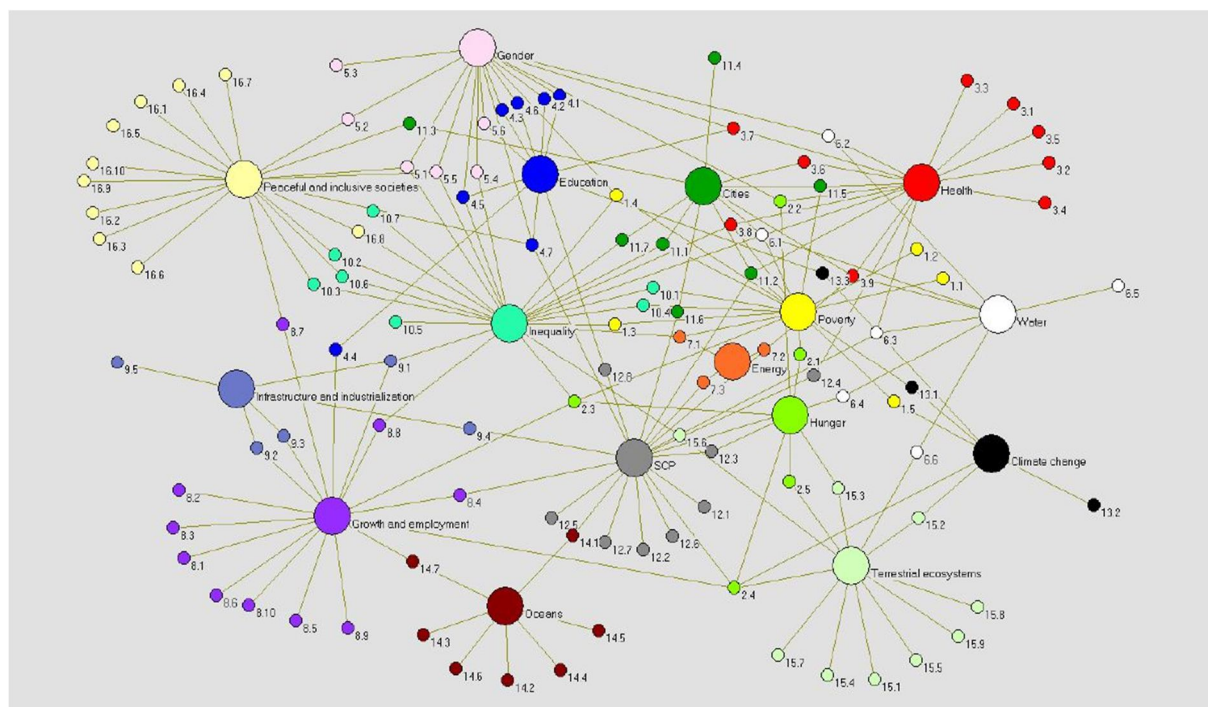


Figure 4: The SDGs as a Network of Targets (Le Blanc, 2015)

The SDGs are often referred to as an “integrated agenda”, an “indivisible whole”. There are significant interactions and inter-linkages between goals. The 17 goals of the Agenda 2030 comprises of concerns on agriculture and food security, water and energy for all, sustainable habitats, healthy terrestrial and water eco-systems. Some SDG targets on agriculture productivity, access to water and sanitation, forest will be vulnerable to climate change due to changing weather patterns and water availability. The means to achieve electricity for all, carbon emissions from the country will depend on the plans for energy (SDG 7) and economic growth (SDG 8) targets. The targets of SDG 2 on food security also stray into several other SDG areas, such as reducing food waste (12.3), health (3), sustainable business practices (12.6), conservation of marine areas (14.5) (Mans et.al., 2016; Le Blanc, 2015). It could be very well understood that it is a complex system in itself. The solutions then implementing these goals should take into account the entire system and all its complexities.

HOW CAN SYSTEMS THINKING HELP IN ACHIEVE SDGS?



Figure 5: SDG journey consist of destinations, the engine, the fuel and the driver.

- Destination is the desired future state of humanity.
- Engine is actions that need to be taken to get to the destinations.
- Fuel is inputs to the means – natural resources
- Driver is global partnerships and cooperation

Since India committed to the SDGs in September 2015, the NITI Aayog (nodal agency for SDGs in India) has designated state governments to plan, execute and report on their progress on SDGs. There are 17 Goals, 169 targets and more than 200 indicators finalized for tracking SDGs.

Principles of sustainable development and the complex inter-linkages between various social, economic, environmental components of development are critical for successful development planning. The economic goals and actions of the state drives closely their social and environmental performance by making choices on the nature of jobs created, efficiency and sustainability of resource use in production systems, nature of products, consumption behavior and market incentives. In the absence of a way to comprehend sustainable development priorities and integration of social, economic and environmental components into a seamless action plan, there is a danger of states mechanically reporting on the in-numerous indicators of the SDGs without being guided by the framework offered by SDGs in their planning. In order to promote sustainable development in line with the principles of the SDGs, the states need to:

- aim for investing in areas which provide multiple benefits, such as those that result in cleaner production, improved skills, greener jobs and have positive spill-over impacts on other avenues of development.
- aim to choose pathways that do more good than harm, keeping in perspective the limits of regenerative and absorption capacities of our natural sources and sinks, exploring technology, business and institutional options to enhance resource efficiencies.

SUSTAINABLE DEVELOPMENT GOAL 12

ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

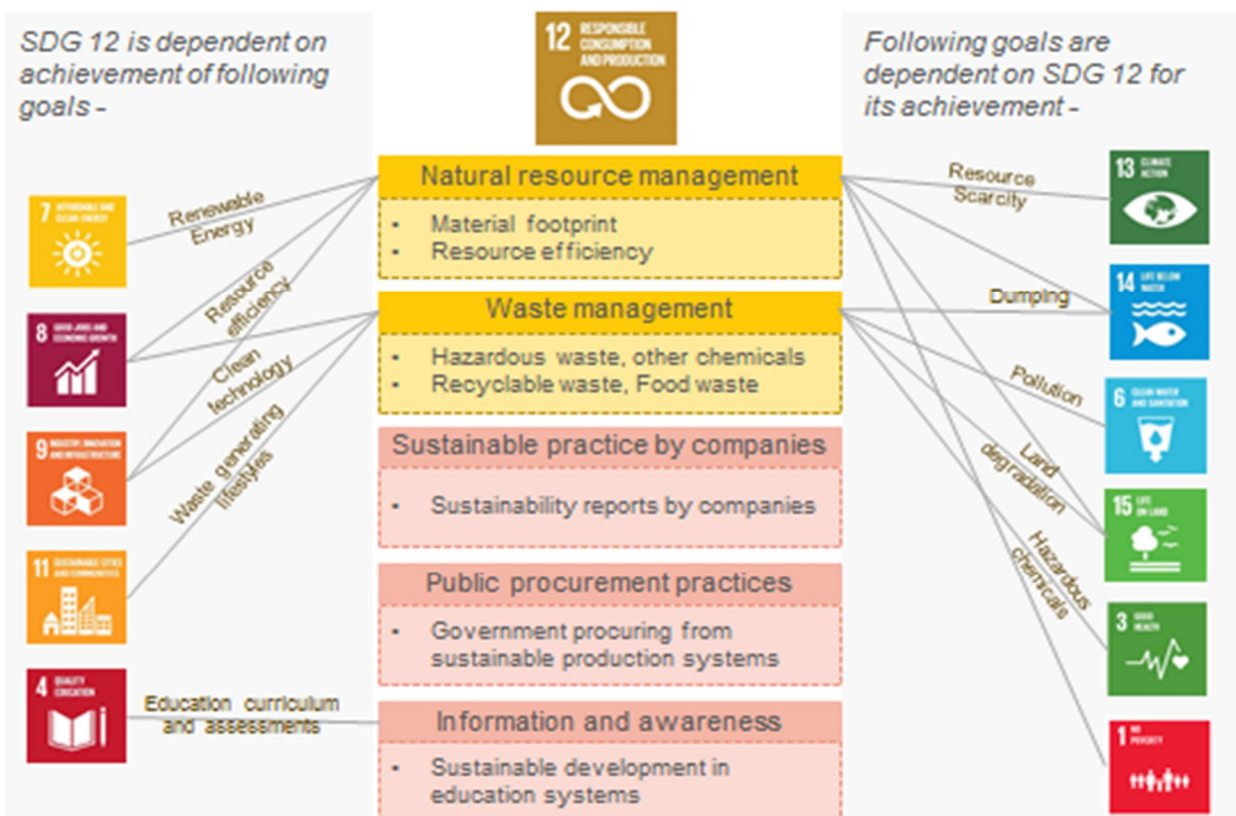


ABOUT SDG 12

Sustainable Consumption and Production (SCP) is a pre-requisite for the world's development to remain within the safe limits of growth and planetary boundaries. Decoupling economic growth from natural resource use is fundamental to sustainable development. Global figures, however, point to worsening trends: total domestic material consumption also rose during the same period — from 48.7 billion tons to 71.0 billion tons.

Countries continue to address challenges linked to air, soil and water pollution and exposure to toxic chemicals under the auspices of multilateral environmental agreements – Basel Convention on Control of Trans-boundary Movements of Hazardous Wastes; Rotterdam Convention on Hazardous Chemicals and Pesticides; Stockholm Convention on Persistent Organic Pollutants; Montreal Protocol on Substances that Deplete the Ozone Layer.

Sustainable production is dependent on the actions and decisions we take in design our economies—that includes our energy systems, production – manufacturing sector and other services. Sustainable consumption and production is also dependent on the lifestyles of the communities that are defined by the cultural & social systems of any society. Like there is dependence of SDG 12 on other goals for its achievement, it is also important to achieve SDG 12 in order to facilitate achieving of other goals, especially – combating climate change, sustainable terrestrial and marine ecosystems and poverty eradication.



Source: adapted from David Le Blanc. "Towards Integration at Last? The SDGs as a Network of Targets"

KEY SDGS TARGETS & INDICATORS

No.	SDGs TARGETS	INDICATORS
12.1	Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	Action plans or SCP mainstreamed as a priority or a target into national policies
12.2	By 2030, achieve the sustainable management and efficient use of natural resources	Material footprint, per capita, and per GDP Domestic material consumption, per capita, per GDP
12.3	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	Global food loss index
12.4	By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	Environmental agreements on hazardous waste, and other chemicals that meet their commitments Hazardous waste generated per capita, treated, by type of treatment
12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	National recycling rate, tons of material recycled
12.6	Encourage companies, especially large and transnational companies , to adopt sustainable practices and to integrate sustainability information into their reporting cycle	Number of companies publishing sustainability reports
12.7	Promote public procurement practices that are sustainable, in accordance with national policies and priorities	Number of countries implementing sustainable public procurement policies and action plans
12.8	By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	Education for sustainable development (including climate change education) are mainstreamed



WHAT ARE THE SYMPTOMS THAT TELL THERE IS A PROBLEM?

India stands at overshoot of 1.7 times its bio-capacity – High domestic material consumption

India's current resource use is 70 per cent above her bio capacity.ⁱ This is in the context that India homes 20.6% of the world's poorest in 2011ⁱⁱ; with 58% of the population lacking means to meet essential needs. If India continues its current development trajectory its resource demand in 2030 will have more than tripled to a figure equivalent to the combined current consumption of all the OECD countries.ⁱⁱⁱ In 2010, India's material demands was the third largest in the world, after China and the United States. India consumed about 7.2% of globally extracted raw materials in that year. The UNEP assessment (2016) demonstrates that it has increased from 2.1 tonnes per capita in 1970 to 4.2 tonnes per capita in 2010 – less than half of the world average.

Pollution levels are worsening!

The quality of land, water and air are showing worsening trends: 25 per cent of India's total **land** is undergoing desertification while 32 per cent is facing degradation.^{iv} An average of 135 hectares (333 acres) of forest land a day was given over to power, mining and other development projects in 2012-13.^v 70 per cent of the surface **water** is polluted and 60 per cent of the ground water resources expected to be in a critical state within the next decade.^{vi} India is world's third largest garbage generator, with 62 million tonnes of solid waste generated everyday by the 377 million people living in urban India. More than 4j5 million tonnes of **garbage** is untreated and disposed of by municipal authorities' every day in an unhygienic manner leading to health issues and environmental degradation.^{vii} India emitted 2,454 million tonnes **CO2 equivalent of GHGs** in 2015, making it the fourth largest emitter in the world, after China, USA and European Union.

DRIVERS OF DEMAND

Rising consumption based lifestyle

India has created more than 100 billionaires becoming third ranking country in this field, who are supported by some 150,000 millionaires, many of them newly minted.^{viii} An Oxfam study analyses that the richest 1% of Indians own 58% of total wealth in the country. Fifty-seven Indian billionaires have the same amount of wealth as the bottom 70% of Indians.^{ix}

By 2025, the 'affluent' consumer segment will become the largest, accounting for about 40% of all Indian consumption, up from about 26% in 2015).^x NSSO report, 2014 says the top 5 per cent of urban India spends INR 3,000 per capita per month on groceries and eating out on average. This class consumes the least amount of cereals, save for derivative cereals such as noodles and bread, and while their consumption of milk, eggs, meat and other processed foods rises. At the other end of the spectrum, the bottom 5 per cent of India spends just over INR 400 per person per month on food and a quarter of this is on cereals.^{xi}

Resource intensive production economy

Currently, around 97% of all materials, including all abiotic and non-renewable materials consumed in India are extracted domestically. The attention of resource consumption at the extraction phase is considerably high in India. Extraction of primary raw materials saw an increase by around 420% between 1970 and 2010. It is lower than the Asian average but higher than the world average. Increased extraction, imports and exports have resulted in an increase in material consumption in India. According to UNEP (2016), India consumed about 5 billion tonnes of materials in 2010, out of which about 42% are renewable biomass and 38% are non-metal minerals.^{xii}



WHAT ARE THE IDENTIFIED SYSTEMS?

Systems	Production Systems (Manufacturing)	Market/Consumption Systems
Defining the system	Production systems in an economy design the use of resources and goods and services that the system produces. The system includes 5 factors of production– labour, capital, industries, physical material resources and information resources. Choice of Technology and scale of production defines the distribution of scale of production.	Market systems include the transaction of consumable goods and services between the buyers and the end consumers.
Key Players	<ul style="list-style-type: none"> Producers – Industry Input/Material Suppliers Regulations - Government 	<ul style="list-style-type: none"> Sellers/Retailers (Industry) Consumers (Public/Government)
Vision/Goal/ Purpose of the system	Sustainable Production systems and consumption patterns: <ul style="list-style-type: none"> Sustainable management & efficient use of natural resources (SDG 12.2, 12.6) Reduce waste generation & proper waste management (SDG 12.3, 12.4, 12.5) Sustainable lifestyles (12.8) 	

TRENDS IN PRODUCTION AND CONSUMPTION SYSTEMS

Production Systems

- Make in India:* India sets itself target of expanding the manufacturing and industrial sector, to reach new and higher growth rates. India is expected to realize the target of 25% share of manufacturing in GDP at best by 2025.^{xiii} Various programmes and schemes launched to support this expansion include skill building initiatives, technology upgradation, promoting business environment, deregulation and promotion of FDI.^{xiv} Our focus on manufacturing and industrial sector is from increasing our growth rate and in providing jobs. Manufacturing and industries are highly resource intensive and polluting sectors. 23% of the carbon emissions are contributed by the industrial sector. National Productivity Council of India estimated cost of environmental damage due to manufacturing and industries at USD 32 billion.^{xv}
- Free market based economy:* The most business that Entrepreneurs and material suppliers in the country make - higher is the growth rate of the country – what India is chasing in the sector. Cost reduction and higher sales is the sole premise of the nature of entrepreneurs and material suppliers in such an economy. The common ways of cost reduction includes –externalizing the costs, cheaper input availability, cost and time efficient technology for higher productivity.

Consumption Patterns

- Urbanisation and the rising middle class:* India has approximately 222 million households, with more than 30 per cent of the population living in 5,000 cities and towns. It is expected that the urban population will increase from 30% currently to 40% by 2030. India is predicted to have the largest middle class (Middle class is defined as the one earning between USD 2-13 a day) in the world, by 2050. (Oxfam, 2014) In 2010, it was 264 million people.
- Culture of 'consumerism'* among higher income groups, who account for the greatest per capita share of consumption is a growing trend. The richest 1% now own 53% of the country's wealth. (World Bank) More Natural resources constitute an important aspect of livelihood for approximately 833 million people living in rural areas of India (Census, 2011). This attributes to high dependence of the population on biotic resources for the very sustenance.

WHY WE ARE NOT ABLE TO ACHIEVE OUR GOALS? - COUNTER-INTUTION

Sustainability is not an obvious choice of the decision makers to achieve the goal.

Production system			Consumption system	
Manufacturers/ Entrepreneurs	Input/Material Suppliers	Government	Producers & sellers businesses	Consumers/ People
Resource efficiency and waste management is seen as an additional cost with no additional incentives that manufacturers try to eliminate.	The progress of material suppliers are tracked on their business only, without keeping any accountability to the state of environmental degradation from the source of natural resource.	Government is focusing on economic growth, with primary emphasis on increasing GDP. Growth is inherently dependent on higher consumption and increasing resource use.	Increasing profit share is the primary purpose of producers and sellers. Newer markets are also created in the process. Rising production and market based economy will lead to high resource consumption use	People are poorly informed or/and unaware of the resource footprint of their lifestyle and the impact it has on global and national sustainability.
Dumping of waste in water bodies and open dumping sites.	Indiscriminate and unregulated sand-mining causing erosion of the river bank and damaging biodiversity.	India – aims for sustained GDP of 9-10% (Case A)	Uber and Ola services have created new markets with affordable cab services.	Expenditures have risen most sharply for transport and communications , food and personal care.

IS THERE AN ALTERNATIVE?

We cannot win the game unless we don't change the rules.

- Redefine you market – Case of Patagonia

Patagonia, an outdoor retailer and leader in the green apparel market, is committed to achieving the triple bottom line: being profitable as well as environmentally and socially responsible in its business practices. Patagonia has used its environmental achievements to differentiate itself in the marketplace and in doing so has received great brand recognition within the apparel industry and amongst consumers. ([UCSD, 2007](#))

- Boost positive feedback – Opportunity in Green Public Procurement

Republic of Korea has passed the Act on the Promotion of the Purchase of Environment-Friendly Products, in 2005, requires public agencies at national and local levels to publish green procurement policies and implementation plans, carry out the latter, and report results. The Environment Ministry is asked to publish guidelines, designated items and evaluation criteria. Although green public procurement is still relatively small (roughly 6% of total public procurement in 2003), it has been growing very rapidly during the last years.

- Integrating signals throughout the value chain – Extended Producer Responsibility (Case B)
- Rules of the system: Incentivise processes that reuses/recycles all the waste generated (Case C)
- Paradigm shift – People behave less selfishly than assumed in market economy (Case D)

Case A: India's GDP targets and the sand mafia

The Supreme Court in February 2011 ruled that "sand mining on either side of rivers instream or upstream is one of the causes of environmental degradation and also a threat to biodiversity."

However, if GDP predictions are pursued, then sand mining will only increase further. Construction contributed 8.9% to India's gross domestic product in 2009, up from 7.4% in 2005. According to the Planning Commission, investment in infrastructure needs to increase to 10% of GDP by the fiscal year ending March 31, 2017, from 8% five years earlier, if India is to continue to grow.

The government has called for a trillion dollars of public and private investment into infrastructure in the next five years to help revive a flagging economy by creating sorely needed roads and airports, as well as jobs.

If this investment comes through, the demand for raw materials such as sand will grow threefold, according to Priya Ranjan Swarup, director general of the government's construction industry development council. In its February 2011 judgment on mining in Haryana in northern India, the Supreme Court said that the demand for sand continues to increase day by day because of continuous demand from building and construction. "[This is] placing immense pressure on the supply of the sand resource and hence mining activities are going on legally and illegally without any restrictions," the judgment said.

(Source: [Wall Street Journal, 2013](#))

Case B: Changing the way we manage our waste

The core objective of an EPR policy is to provide an incentive for manufacturers to make design changes that reduce waste, increase recycling such products and reusability, reduce the use of materials, and streamlining product.

- **Dis-Incentivizing non-recyclable packaging: Case of Eco-Emballages** Eco-Emballages, a French packaging PRO, has modified its contribution calculation by introducing a new "Bonus/Malus" system in 2012. Under this eco-modulation model, producers can be penalized by up to 100% of the fee for non-recyclable packaging put on the market. On the contrary, they could get a reduction of up to 8% when they diminish the weight or volume of their packaging, or when they invest in broad communication campaigns.
- **Optimizing cost effectiveness: Case of Japanese Packaging Recycling Act:** This Act foresees the payment of a contributing commission to municipalities, the amount of which is relative to actual recycling costs. If the municipality provides high-quality well-sorted waste to recyclers, the costs become lower and the producers would then reimburse 50% of the difference compared to the initially estimated costs.^{xvi}
- **Take Back Requirements:** Take-back requirements, pioneered in the German Packaging Ordinance in 1991, is now being applied to a wide range of products including batteries, tires, cars, computers, used oil, oil filters and containers, refrigeration, white goods and electronic product (it takes back used pesticide containers and is being expanded to other wastes such as seed bags, fertilizer bags, bale wrap), to many OECD countries, including Australia, Canada, Japan, Korea, Norway and the European Union (EU).^{xvii}
- **Case of South Africa Waste management: Regulations or Volunteer?**

In the case of South Africa, compulsory, government regulations legislation have not been effective in stimulating improvement. Further, glass and pet bottle recycling industry has sprung up in the country on purely volunteer basis without much policy enablers and regulations from the government. However, this does not mean that voluntary initiatives are always more effective than mandatory rules. A study derives that mandatory regulations in the plastic bag industry have indirect effects to stimulate improvements in glass and PET industry.^{xviii}



Case C: General Motors: Efficient Processes save money, make money

General Motors (GM) Resource Management program preserves natural resources, reduces environmental impact, and achieves cost savings. Its first priority – reducing and eliminating waste while maintaining regulatory compliance – is delivered at each plant by a single supplier. Resource managers are rewarded for finding innovative ways to eliminate the manufacturing by-products that were formerly disposed of as wastes. As a result, the by-products that were previously sent to landfill, such as cardboard boxes, bulbs, wooden pallets, batteries, tires and plastics, are now directly reused or recycled. Now operating, where economically feasible, in all GM North American manufacturing facilities and many global locations, the program has saved over US\$ 30 million and reduced waste volume by 40% since 2000. In 2007, this program resulted in changing former wastes into valued by-products that have realized over US\$ 6 million in sales.

(Source: [WBCSD, 2008](#))

Case D: Kerala's model of Urban Sustainable Lifestyle

Kerala represents a unique cultural approach to sustainable development. Kerala is a valuable case to study because it provides a model of 'urban sustainability' that is both social and preventive.

Kerala, and societies like it, testify to the fact that against the 'culture of maxima' professed by market based west economies, there have existed other cultures, guided by such philosophies as Buddhism, Sufism, and Gandhism, that have professed frugality as an inspired way of life. What can be learnt from Kerala for 'urban sustainability' model is that planners must help society make the transition from a 'culture of maxima' to a 'culture of moderation'. Some of the ways in which this can happen:

- In **economic terms**, planners must defend full employment policies, a shorter work week, and more evenly distributed leisure hours to reform a modern economy plagued by systemic unemployment, underemployment, and overwork of the employed. This will mitigate the excessive competition that is destroying society in the developed world and remind individuals that the economy is fundamentally a societal and not an individual enterprise.
- In **social terms**, planners must organize public relations campaigns to make the 'culture of moderation' a more respectable way of life. These appeals can be patterned after the television advertisements produced by church groups urging parents to spend more time with their children. 'Social sustainability' requires a lifestyle lived as a search for 'goodness'. In terms of the urban environment, this transition implies planning that promotes public goods over private goods. Planners must recommend community parks rather than destination super-stores, public schools for the many rather than private schools for the few, public transit systems such as light rail rather than single-passenger automobile schemes, and public rather than private access to natural amenities for example, enhancement of public rather than private beaches. This transition is already emerging in public ride-sharing and recycling programs designed to reduce private energy consumption and material waste. The goal is a society in which people behave less selfishly. For 'social sustainability' to be achieved, therefore, planners must devise methods to reach people in ways that change their behavior, and do so permanently.

(Source: [Basiago, 1999](#))



What is the component?	How are we measuring it conventionally?	What else should we track?
Resource efficiency	<ul style="list-style-type: none"> Material footprint, per capita, and per GDP Domestic material consumption, per capita, per GDP Number of companies publishing sustainability reports Number of countries implementing sustainable public procurement policies and action plans Education for sustainable development (including climate change education) are mainstreamed Action plans or SCP mainstreamed as a priority or a target into national policies 	<ul style="list-style-type: none"> Resource circularity - Life of a resource during its use and reuse before decomposed back to the natural system (Case of Patagonia jackets) Tax/fiscal incentives to the industries for Reduction of material use
Waste management	<ul style="list-style-type: none"> National recycling rate, tons of material recycled Environmental agreements on hazardous waste, and other chemicals that meet their commitments Hazardous waste generated per capita, treated, by type of treatment 	<ul style="list-style-type: none"> Size of the repair and retrofit markets in different sectors indicating average life of a product (Case C – General Motors) Total products and waste recycled/reused by the industry (Case B)

SUSTAINABLE DEVELOPMENT GOAL 13

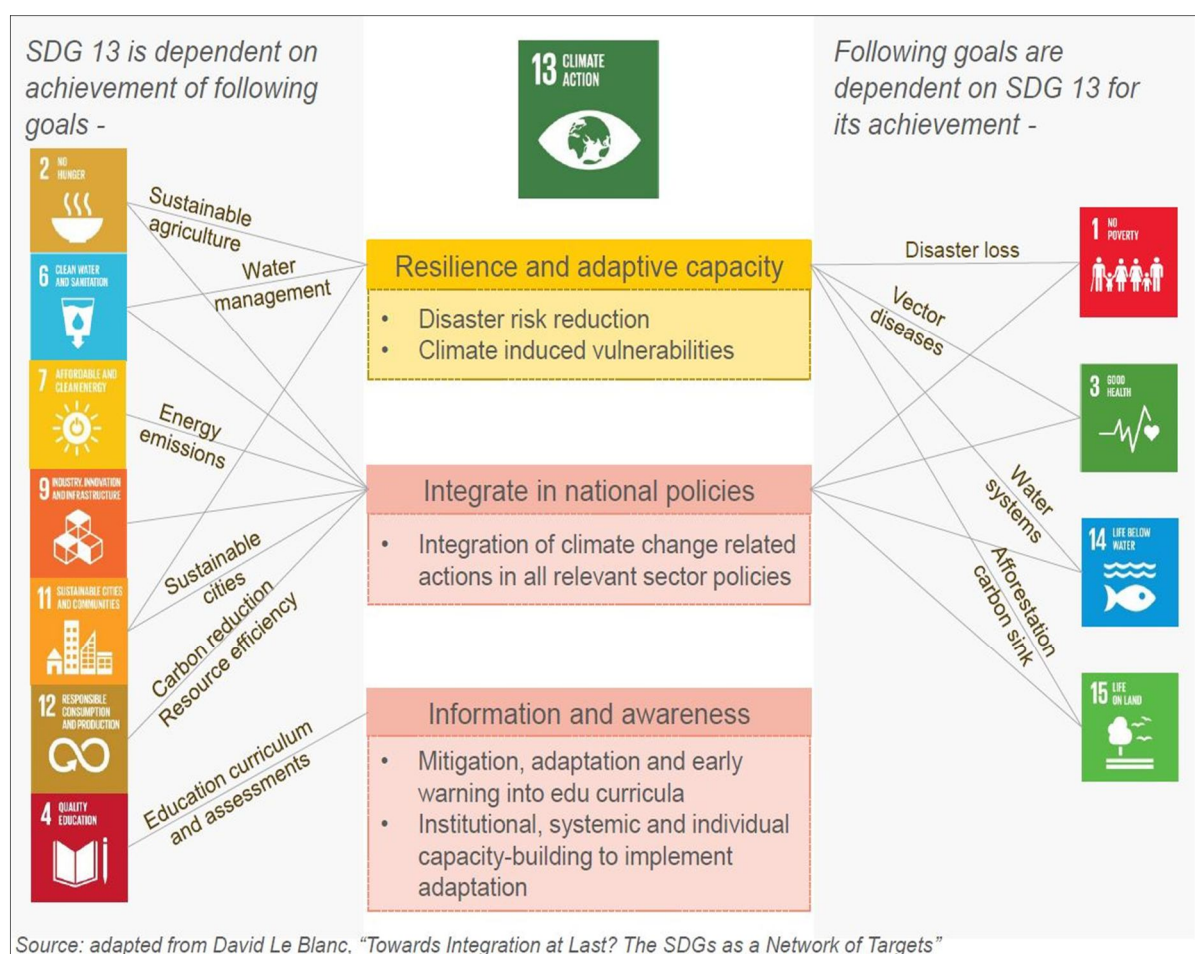
TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS



ABOUT SDG 13

Combating Climate Change and its impacts is among the most critical and interlinked SDG of all. The impacts of climate change range and affect all the other targets and achievement of other targets also impacts this goal. However, even with the Paris Agreement and SDG goals in place we are poised to breach the 1.5 degrees limit in the next 9 years.^{xix} Climate change is one of the most complex systems problem in the modern economy. Almost every human activity is linked to the use of fossil fuels or other sources of greenhouse gases.^{xx}

The target 13.2 to “integrate climate change measures into national policies, strategies and planning” is a very dynamic target that allows measuring of climate change national policies, strategies and planning. This allows the scope for measuring India’s Nationally Determined Contributions under the Paris Agreement. This target makes implicit reference to India being a party to United Nations Framework Convention on Climate Change (UNFCCC) and its submission to the same. It must also be noted that a developing country like India, climate change adaptation is of a bigger concern than most nations across the world. India also needs to make its developmental pathway resilient to climate impacts.



KEY TARGETS AND INDICATORS

	Targets	Indicators
13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	Number of countries with national and local disaster risk reduction strategies Number of deaths, missing persons and persons affected by disaster per 100,000 people
13.2	Integrate climate change measures into national policies, strategies and planning	Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production
13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions

* Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

Climate change itself as a SDG would include and interlink sustainable agriculture, food security and nutrition, health and population dynamics, education, gender equality and women's empowerment, water and sanitation, energy, promote sustainable consumption and production, sustainable cities and human settlements, conservation and sustainable use of marine resources, oceans and seas, ecosystems and biodiversity as focus areas. Achieving the climate goal itself can either give multiple mutual benefits or provide co-benefits in the SDG system. It is important to understand that we should move from single technologies to using a whole systems approach as we recognize that there is no single silver bullet solution to stopping climate change.^{xxi}

An example would be to look at Sustainable Development Goal 7 (SDG7) that focuses on universal access to modern, affordable, reliable and sustainable energy by 2030. This includes the reduction of energy-consumption, energy efficiency and renewable energy. The goal is in close relation with Sustainable Development Goal 13. The less fossil fuels are consumed, the less emissions of the greenhouse gas CO₂ are emitted, the less impact we have on the climate. Climate action could in simple terms mean insight into your carbon footprint, less energy consumption (and thus less CO₂ emissions), transition to renewable energy sources and economical handling of raw materials.



India and SDG 13

WHAT ARE THE SYMPTOMS THAT INDICATE THERE IS A PROBLEM?

India is disproportionately affected by climate change as compared to most of the developed countries in the world. India is among the most vulnerable nations to climate change, just after Bangladesh. In a list of nations considered at "extreme risk" from climate change, nearly the whole of India has a high or extreme level of sensitivity to global warming. This is exacerbated due to increasing population and further its important strain on natural assets. There is a high level of poverty, poor general wellbeing and reliance on agriculture by a significant part of the population that increases the negative impacts. Rainfall induced landslides will also increase in many regions of India especially the North-East.

India's NDC is a national climate change mitigation plan to commit itself, on a voluntary basis, to reduce their GHG emissions. Being the energy sector responsible for about two-third of global greenhouse gas emissions, the India's NDCs has partially turned out to be a concrete national energy plan. However, India has 240 million people without access to electricity.^{xxii} Electricity demand is estimated to double by 2022 nationwide, and coal production is expected to double to 1 billion metric tons by then. Much of it would be in thermal power plants to generate an additional 103 gigawatts of capacity.^{xxiii} India is already the world's fourth-largest emitter of carbon dioxide after China, the United States and the European Union, releasing more than 2 billion metric tons in 2013. Additionally, India is a net importer of energy, coupled with the GDP growth requirements in the future with population rise, the additional energy requirement will be mind boggling. By 2030, India's emissions are projected to rise to between 4 billion and 5.6 billion metric tons, according to modeling studies. India ambitiously plans to generate 175 GW of renewable energy by 2022, modeling studies show that coal would occupy more than half of its energy mix in 2030.^{xxiv} The Indian Government is focused on the access to power more than the quality of power.^{xxv} Grid connections in India are growing by 5 percent a year this coupled with rising incomes requires the power system to quadruple in size by 2040.^{xxvi}

While currently, about 50GW of coal power projects are being developed in India, the draft National Electricity Plan (2016) indicated that no new coal-fired power stations were likely to be required to meet energy needs from 2022 until at least 2027. In the 2027 forecasts, India aims to generate 275 gigawatts of total renewable energy, in addition to 72GW of hydro energy and 15GW of nuclear energy. Nearly 100GW would come from "other zero emission" sources, with advancements in energy efficiency expected to reduce the need for capacity increases by 40GW over 10 years.^{xxvii}

Studies show that even with nuclear, supercritical coal, hydro, and even solar and wind with the estimates mentioned above India is unlikely to reach the goals prescribed to meet their NDC pledge.^{xxviii} Therefore it is leading to a failure on the SDG target.



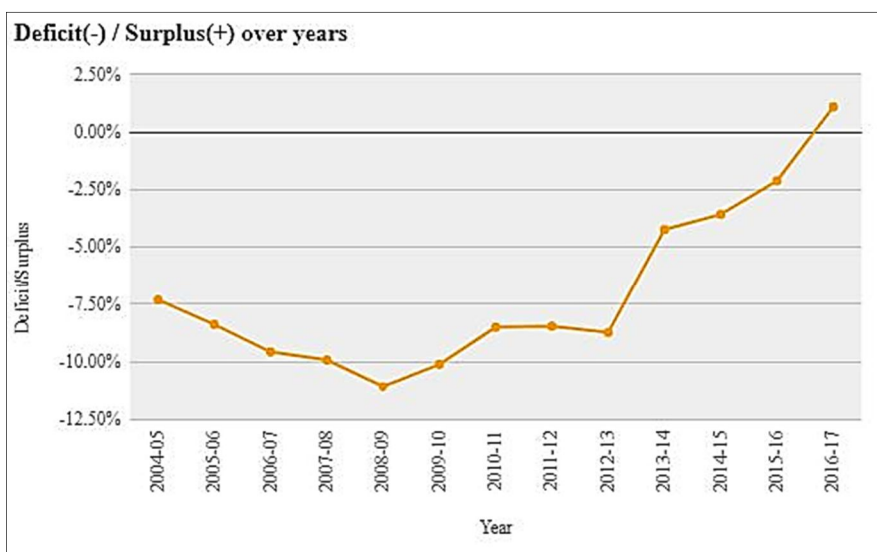
WHAT ARE THE IDENTIFIED SYSTEMS?

There are governmental stakeholders at National, state and local level in reaching this goal as most fall in the realm of renewables and energy efficiency. However, Indian businesses are also getting proactive in implementing climate-friendly initiatives as well as accelerating R&D in low carbon solutions; this is either as a part of companies' Corporate Social Responsibility (CSR), voluntary measures, core business operations, or under various government schemes. While the Paris Agreement and the Goal 13 falls under the purview of the MoEFCC, the Indian energy sector is being handled by 4 different ministries-Ministry of coal, Ministry of power, Ministry of petroleum and natural gas and Ministry of new and renewable energy. These ministries are then interacting with production companies/organizations. The government participates in a big way through various corporations such as, State Electricity Boards (SEB), NTPC Limited, NHPC Limited and Power Grid Corporation Limited (PGCL). However, these four ministries are only concerned about their own turf. There is a huge scope for synergies between different energy sources that can enhance economic efficiency as well as meet the energy needs of the country.^{xxix}

An important stakeholder in this system are also the planning departments and ministries such Urban Development, Rural Development etc. The measures that these departments take have an influence on the mitigation or adaptation pathways that have been instituted.

WHY WE ARE NOT ABLE TO ACHIEVE OUR GOALS? - COUNTER-INTUITION

As we have seen that in order to address the idea of access to energy we are unable to fulfill our commitment for our SDG targets. It is important to look at the complete system regarding energy access. The SDG targets which would address our climate targets lie within the realm of other goals. The targets of Goal 1 (End poverty), Goal 7 (Energy), Goal 9 (Infrastructure), and



Source: The Hindu, 2016

Goal 11 (Cities) all play a role if we are to tackle energy access. Additionally, in fact while addressing only energy targets we end up with conventional energy not reaching those marginalized communities to whom energy is critical for livelihood. We also do not have indicators in place to reduce or measure the over-shooting of our emission targets in our pursuit of development. The system of "energy access" adding more to the GHG emission space causing increasing climate impacts on ourselves. However it is true that in the case of combating climate change, the slow system dynamics in terms of impacts that GHG emission is creating makes it difficult to measure and stop the root cause. It is not easy to create negative feedback loops which put a price on carbon emissions, thereby helping to reduce emissions.^{xxx}

While we lose on providing energy access and reducing GHG emissions, the issue lies in our indicators and pathways to achieve our goals. In India household energy access is measured by household's primary source of lighting and cooking, or through electrification status of household. This pursuit has led us to have empty grids with no electricity in them.^{xxxii} Even as India is likely to experience the energy surplus of 1.1 per cent in 2016-17 as per the Load Generation and Balance Report (LGBR) 2016-17 of the Central Electricity Authority (CEA)^{xxxiii} we do not have complete energy supply. For example six States — Madhya Pradesh, Kerala, Odisha, Sikkim, Mizoram, Tripura — will be power-surplus in 2016-17 but the per capita availability in the States is lower than the national average.^{xxxiii} Power plants, as well as installing poles and wires for distribution, is only a small part of the challenge ensuring reliable supply to poor households. The other elements in this system are transmission and distribution companies and their constraints are also responsible for power cuts. The distribution companies have no incentive to supply power to rural areas because they don't get paid. The critical challenge for reaching ambitious renewable targets for India is that different parts of the energy system must be looked at closely and together.

The Indian government's energy access/ development agenda is based on grid extension. This will be impossible to achieve without a primary role for Decentralized Renewable Energy (DRE). Multiple research studies show that DRE will help reach the last mile while addressing the mitigation targets. These haven't been fully realized in India due lack of access to finance and adequate supportive policy. This is in addition to coal being a cheaper alternative. There has been little effort by the Ministry of New and Renewable Energy (MNRE) in the past few years to implement off-grid solutions. The decade-long Remote Village Electrification Programme (RVEP) was stopped in 2012 and it suffered from poor service delivery and corruption.^{xxxiv}

IS THERE AN ALTERNATIVE?

The key to the issue is that an energy access/GHG emission combined monitoring system needs to provide information at the right rate to enable system control. This is achievable through DRE. The effective leverage point in the energy systems would be to work around and change the goal of the system - Decentralised renewable energy can provide basic energy access to all. Rather than narrowly focusing on one approach, like grid extension, we should take a more holistic view to developing systemic solutions. This means that we should avoid continuation towards burning all available fossil fuels, either usefully or not, in a competition towards more growth. If we keep measuring access in terms of electricity grids and power plants built we may never get to actually address the issue of reaching the last mile.

It is also very interesting to note that in terms of building resilience as per Goal 13, when it comes to electricity access, centralized energy grids are often the first to fail when a disaster hits - they are vulnerable to any break in a chain which transmits large amounts of power across a wide area. A centralized system is filled with choke points. Outages during disasters hamper recovery efforts and mean whole communities can be left without power. Decentralized generation has a role to play in increasing resilience to disasters in areas with energy access challenges. Decentralization means that the entire network is not interrupted when one weak point fails. When Hurricane Matthew landed in Haiti it left 5,000 a lot of people without power, a private company Sigora working on DRE was able to restore power to its customers in 55 hours – long before the rest of the country.^{xxxv}

The current practices in our system of energy access incentivize the carbon economy. They are measured by electrification status without looking at the rate of GHG emission release. Climate change mitigation will not work if we have the wrong indicators to measure progress. Global measures to slow climate change impacts would limit or change economic activities such as mining and extraction, transportation and trade networks, deforestation, livestock, and land allocation.



Looking at SDGs as whole could help create significant, positive impact in climate change mitigation and adaptation for communities. The effective measures will have to address the entire system. Whatever we do will impact the economy, the planning institutions and the society as a subsystem of the larger global system experiencing climate change and they will also have to adapt to these global changes.

Case A: India's Private Micro-grids

In India we are seeing that new models of electricity distribution are emerging. However, rural electricity supply and service costs are high, while rural demand is low and fragmented. Furthermore, pilferage and losses are high and the tariffs are well below delivered cost. This is a huge disincentive for India's debt-plagued state-owned distribution companies. While most of the villages in Uttar Pradesh, Bihar and Jharkhand have grid availability there were electricity issues. In nearly 110 villages across Uttar Pradesh, Bihar and Jharkhand state, more than 40,000 people have access to reliable grid-quality electricity from privately operated renewable energy mini-grids supported by the Rockefeller Foundation's Smart Power India program. Private players can be attracted to scale up mini-grid deployment if the government announces a national target for mini-grids along with a package of incentives.^{xxxvi} The approach followed to set up the Community Solar Power Plant is 'Build-Own-Operate-Transfer' (BOOT), wherein the ownership of constructing and operating the solar power plants rested with the village community itself. The concept of 'Pay for Energy' was introduced to the villagers to ensure financial sustainability of the plant. The village Rampura, district Jhansi, Uttar Pradesh had no electricity till 2008. Development Alternatives partnered with Scatec Solar to set up a Community Solar Power Plant (CSPP) to electrify Rampura. DD Solar 23 India, which works under the banner of Bergen Group, provided the technical support by donating one television and a computer to Rampura.^{xxxvii} This pilot project of decentralized energy generation has been successful at the community level and is now capable of being replicated in other areas and context as well.

Case B: Bangladesh's Solar Home Systems

Bangladesh as an example underlines the tremendous potential for value creation in the expansion of electricity access in rural areas not served by power grids. The government has approached electricity access through hybrid renewable mini-grid approach as a possible solution in the country.^{xxxviii} Currently, more than 50,000 rural households access electricity through the solar home systems (SHS) program of the government every month. This program was supported by the World Bank (WB). Implemented by the government-owned Infrastructure Development Company Limited (IDCOL) through a partnership with the non-government organizations (NGOs), Bangladesh's SHS program is a successful example of public-private partnership (PPP). The project named the Rural Electrification and Renewable Energy Development II (RERED II) is continuing to provide access to electricity in rural areas of Bangladesh through renewable energy sources. The project has provided access to electricity to over 377,000 households in remote rural areas where grid electricity cannot reach easily. It is also supporting renewable energy-based mini-grids in remote rural areas to provide electricity.^{xxxix}



SUSTAINABLE DEVELOPMENT GOAL 15

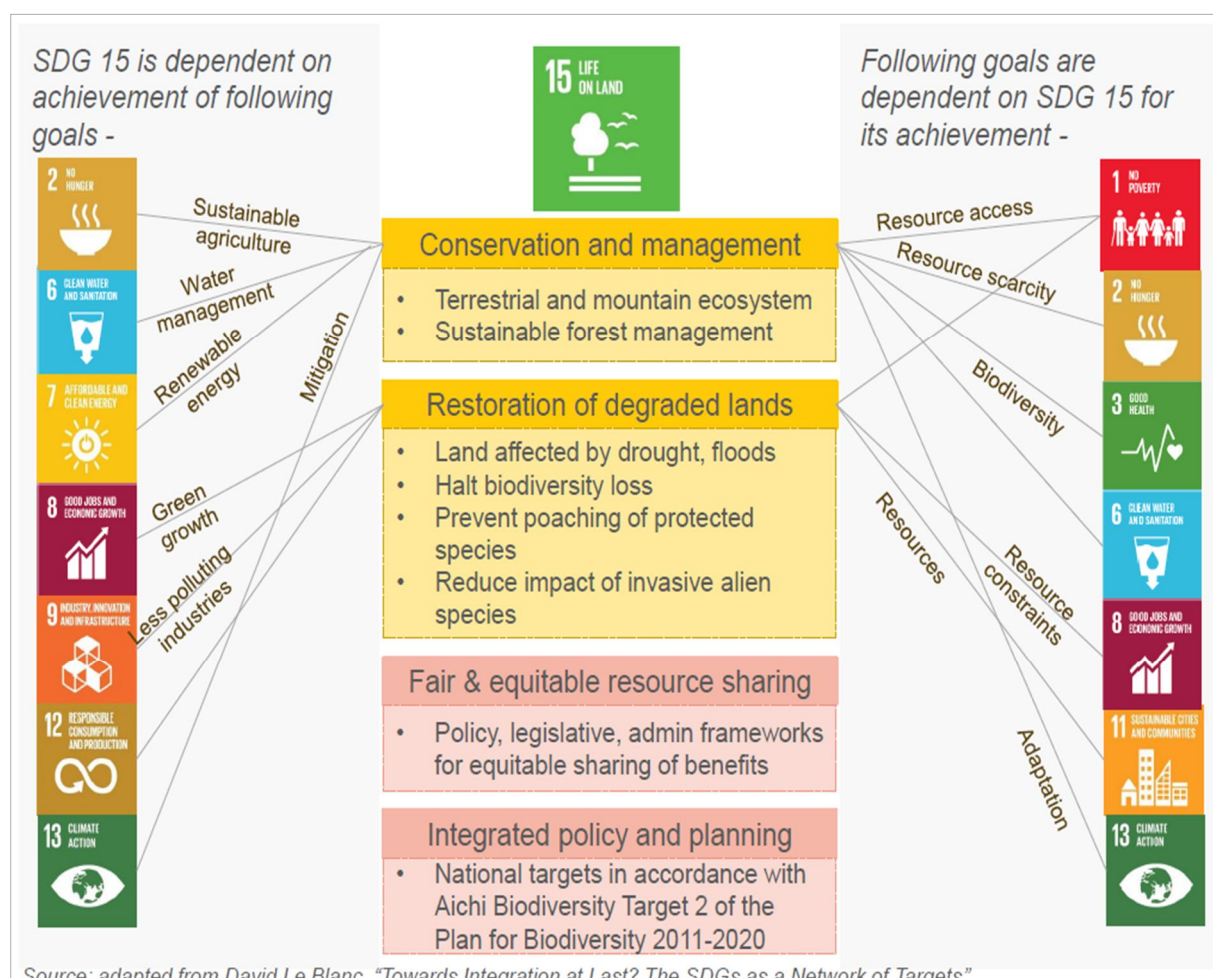
PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS



ABOUT SDG 15

Land ecosystems and the ecosystem services they provide are essential to human survival. 58%^{xi} of India's rural population depends on agriculture as the main source of livelihood, and nearly 200 million depend on forest produce for sustenance and livelihood. 32%^{xii} of our total geographical area is undergoing degradation currently, and we have lost 2,510 square kilometers of the country's very dense forests since 2013^{xiii}. Multi-stakeholder alliances such as the Convention for Biological Diversity, Bonn Challenge, Collaborative Partnership on Forests and the Mountain Partnership were constituted to promote sustainable approaches to natural resource management, and thus contribute to achieve SDG 15.

Inter-linkages between all SDGs indicate that feedback from different goals may be essential for achieving the targets specified in one, as illustrated below.



KEY SDGS TARGETS AND INDICATORS

	SDGs TARGETS	INDICATORS
15.1	Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services	<ul style="list-style-type: none"> Forest area as a proportion of total land area Proportion of important sites for biodiversity that are covered by protected areas
15.2	Promote the implementation of sustainable management of forests, and substantially increase afforestation and reforestation globally	<ul style="list-style-type: none"> Progress towards sustainable forest management
15.3	Combat desertification, restore degraded land & soil , including land affected by drought, floods, strive for- land degradation-neutral world.	<ul style="list-style-type: none"> Proportion of land that is degraded over total land area
15.4	Ensure the conservation of mountain ecosystems , including their biodiversity.	<ul style="list-style-type: none"> Coverage by protected areas of important sites for mountain biodiversity Mountain Green Cover Index
15.5	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity .	<ul style="list-style-type: none"> Red List Index
15.6	Promote fair, equitable sharing of the benefits from the utilization of genetic resources and promote access to such resources.	<ul style="list-style-type: none"> Number of countries that have adopted policy frameworks for equitable sharing of benefits
15.7	Take urgent action to end poaching and trafficking of protected species of flora & fauna.	<ul style="list-style-type: none"> Proportion of traded wildlife that was poached or illicitly trafficked
15.8	Introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on ecosystems.	<ul style="list-style-type: none"> Proportion of countries adequately resourcing the control of invasive alien species
15.9	Integrate ecosystem and biodiversity values into national and local planning , development processes and accounts	<ul style="list-style-type: none"> Progress towards national targets established in accordance with Aichi Biodiversity Targets

INDIA AND SDG 15

WHAT ARE THE SYMPTOMS THAT INDICATE THERE IS A PROBLEM?

Land degradation and loss of forests

Land degradation is characterized by loss of natural fertility of soil, loss of vegetation cover and changes in soil characteristics. 32% of India's total land area is undergoing degradation, and 5.16 per cent of our forest land is under high fragmentation which is one cause of land degradation.^{xliii} An average of 135 hectares (333 acres) of forest land a day was given over to power, mining and other development projects in 2012-13.^{xliv} Agricultural systems, ecosystem services and industries dependent on raw material from nature will be hugely impacted as a consequence.

Biodiversity loss

Terrestrial biodiversity as a component of biological integrity of our planet is priceless. As per the planetary boundary concept, we are already in the high risk zone with respect to biodiversity loss and extinctions.^{xlv} As per the IUCN Red List 2016, 341 Indian faunal species are 'near threatened' in addition to 665 threatened species in the country. 387 plant species are also listed in the threatened category which includes species that are critically-endangered, endangered and vulnerable. Major causes of these symptoms include overexploitation and unsustainable use of components of biological diversity, land and water pollution from anthropogenic activities, and diversion of forest land citing developmental needs, economic growth prospects and encroachment activities.

What is my System?	<ul style="list-style-type: none"> The system includes processes and design of decision making for forest land diversion. This system may be intended for catering to developmental needs.
Players	<ul style="list-style-type: none"> Government: It may have regulatory functions (as the Ministry of Environment, Forest and Climate Change) and the other functions at the programmatic level (Ministry of Coal, Ministry of Mines, Ministry of Power etc.). Private Players: Those undertaking developmental and economic activities on the diverted land (private businesses, NTPC, CIL etc.) Communities having rights over the forest and its resources.
Vision/Goal/ Purpose of the system	<p>To reduce diversion of forest land for non-forest purposes</p> <ul style="list-style-type: none"> Ensure the conservation and sustainable use of terrestrial ecosystems and their services, in particular, forests (SDG 15.1)
Norm	<p>The strongest policy for conservation of forests in India is the Forest (Conservation) Act 1980. According to the Act, for diversion of any forest land, the government ensures submission and compliance of the following:</p> <ul style="list-style-type: none"> Species-wise and enumeration data of the trees being felled Environmental clearance for the project intending use of the land Plan of the Compensatory Afforestation Scheme, with a condition of transferring the land (to be afforested) to the Forest Department. Information on legal status of the land being diverted and whether it's a protected area.

WHAT IS THE CHALLENGE IN ACHIEVING THE GOAL?

- **Remediation measures for the end result and not the core cause of the issue:** Diversion of Forest land results from developmental needs of business and societies, whilst reforms and policies are continuously directed at the consequence of the action, which may end up being ineffective.

This is evident in the case of Compensatory Afforestation in India, which is an essential requirement to allow diversion of forest land for non-forest purposes. In many cases, suitable equivalent non-forest land is unavailable for afforestation, and where it is, studies show that a new forest takes 50 years to deliver a similar level of services as a fully established forest. The loss, thus, is insurmountable.

- **No internalization of natural capital costs by businesses:** Annual environmental costs from global human activity amounted to US\$ 6.6 trillion in 2008, equivalent to 11% of GDP. Assuming all environmental costs were internalized for each company in a study by UNPRI, it is estimated to equate to between 0.34% and over 100% of revenue, making it a huge barrier to companies accepting such propositions of internalizing costs of natural capital^{xlvi}. There are no widely accepted mechanisms to combat the issue.
- **Absence of correct and essential information:** As per the CAG Report on Administration of National Parks and Wildlife Sanctuaries in Karnataka^{xlvii}, there's inadequate recording and utilization of research for management of species in the areas. The report also notes that there's absence of information about lesser known species of amphibians, insects etc. This could be a hindrance in drawing efficient management and conservation plans for the forest/protected area create strong diversion to prohibit diversion.
- **Prioritization of development over environmental protection:** 13386.19 hectares of forest land was diverted in 2013-14, whilst the figures increased to 16141 hectares in 2015-16. The country has also witnessed environmental clearances being granted to projects in eco-sensitive areas. For example: The construction and operation of Demwe Lower in Arunachal Pradesh is likely to have serious impacts on ecologically sensitive areas in both Arunachal Pradesh and downstream Assam. These include protected areas such as Kamlang Wildlife Sanctuary and Dibru-Saikhowa National Park, important bird areas, potential Ramsar and downstream habitat of Gangetic dolphin, the national aquatic animal.



WHAT ARE THE ALTERNATIVES?

- Increase the size of buffers by promoting green businesses, such that in cases of inevitable use of natural resources, there's minimal damage. (Case Study 1)

Wood products certified by Forest Stewardship Council indicate that the manufacturer is following stringent guidelines in the harvesting, planting and protection of the forest they obtain their wood from, indicating sustainable management of the forest resources.

- Interventions to change the rules of the system- such as increasing taxes for businesses on diverted forest land acquisition and rehabilitation costs paid to native communities. Inclusion of environmental degradation costs in the final services and products to reduce consumption and dependence. (Case Study 2)
- Interventions to modify the structure of information flows, such as to ensure creation of a feedback loop where information reaches the right stakeholder, who wasn't receiving it earlier.

In the Silent Valley movement in Kerala, a proposition to build a hydroelectric dam across the Kunthipuzha River was estimated to submerge 8.3 sq. km of untouched moist evergreen forest. Approvals to divert the forest land for the project were given a green signal by the Planning Commission and the National Committee on Environment Planning and Coordination task force. It was only after tremendous pressure and uproar from conservationists, Nature Clubs, global media and NGOs, that the project was called off and Silent Valley was declared a National Park.^{xlviii}

- Interventions to change the mindset or paradigm that the system — its goals, structure, rules, delays, parameters — arises from.

For a mountainous state that has limited availability of land, clearing forests becomes the only resort to make land available for setting up industries. Adopting an unusual mindset, the state of Sikkim has limited tax advantages for businesses and encourages mostly knowledge-driven and IT-driven industries to ensure conservation of the environment. This makes the industrial atmosphere non-conducive to resource driven, polluting enterprises.^{xlix}

What else can we track?

- Tracking indicators and feedback loops from other SDGs: When land is diverted for real estate, a feedback loop should help us ascertain whether affordable housing projects developed on that land (SDG 1, 11) or it was redirected for boosting the market for rental and luxury services.
- Formalized tracking of impacts for justifying large developmental projects: Construction of large dams to be linked to better access of electricity to deprived populations.



CASE STUDY 1: How adoption of sustainable practices helps reduce deforestation

In Central Vietnam hundreds of smallholders are joining forces to produce FSC-certified acacia used in outdoor furniture around the world, expanding the approach and making the business case for sustainability may be the best chance for saving forests in the Greater Mekong.

Reforestation degraded areas with natural species and enriching plantations with natural 'buffer zones' is part of the solution and can provide vital corridors for wildlife.

Reducing dependence on foreign imports that drive deforestation is also critical. Ultimately, tackling deforestation relies on making the business case for sustainability – especially for Vietnam's 1.5 million smallholders who own most of its plantations.

"We realised that small forest owners could help shape a sustainable forest sector – but only if they could supply the international market", says Vu Nguyen, Sustainable Acacia Manager, WWF Vietnam. "That means helping them improve the quality of their product."

In collaboration with WWF corporate partner IKEA, the project promotes FSC certification as one way of driving sustainable production and drawing smallholders into the international market.

Source: Forest Stewardship Council and WWF International.

CASE STUDY 2: Making Diversion of Forest Land expensive for businesses

The Ministry of Environment, Forests and Climate Change (MoEF&CC) has come up with new guidelines for diversion of forest land, with newly added costs, which is likely to make the process more costly.

The guidelines add 30 per cent of the net present value (NPV) of forests to the cost of diversion for "possession of forest land", and 50 per cent of NPV cost as "habitat fragmentation cost". Another 10 per cent of the forest's net value is added as compensation for loss of animal husbandry productivity and soil moisture conservation costs.

The guideline submitted to the National Green Tribunal, will come into effect once the NPV of forests is revised. NPV is the amount paid by the project proponent for diverting land for non-forest use to compensate the loss in ecosystem services.

The Indian Institute of Forest Management (IIFM) was assigned the responsibility of reassessing the value of forests. Its report in 2014 said that NPV was grossly underestimated and proposed NPV rate ranges from Rs 9.87 lakh to Rs 55.55 lakh per hectare.

Source: [Down to Earth, 2017](#)

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