POLICY BRIEF III

DECOUPLING ENERGY AND RESOURCE USE FROM GROWTH IN THE INDIAN CONSTRUCTION SECTOR

POLICY RECOMMENDATIONS

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POLICY RECOMMENDATIONS

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LIST OF ABBREVIATIONS

ABBREVIATION	FULL FORM
BEE	Bureau of Energy Efficiency
bigEE	bridging the information gap on Energy Efficiency in buildings
BIS	Bureau of Indian Standards
BMTPC	Building Materials and Technology Promotion Council
BPL	Below the poverty line
C&D	Construction and demolition
CAGR	Compound annual growth rate
CBRI	Central Building Research Institute
CEEF	Cost-effective environment-friendly
CERC	Central Electricity Regulatory Commission
CHCP	Combined heating, cooling and power
CPWD	Central Public Works Department
CREDAI	Confederation of Real Estate Developers' Associations of India
CSE	Centre for Science and Environment
DISCOM	Distribution company
DMC	Direct material consumption
DSM	Demand-side management
ECBC	Energy Conservation Building Code
ECM	Energy conservation measure
EMC	Environmentally weighted material consumption
EPI	Energy performance index
ESCOs	Energy service companies
GDP	Gross domestic product
GRIHA	Green Rating for Integrated Habitat Assessment
INDC	Intended Nationally Determined Contributions
KSNK	Kerala State Nirmithi Kendra
LED	Light-emitting diode
LEED	Leadership in Energy and Environmental Design
MFA	Material flow accounting
MNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
NSDC	National Skill Development Corporation
PV	Solar photovoltaics

REC	Renewable Energy Certificate Regulation
SDA	State-Designated Agency
SERC	State Electricity Regulatory Commission
SMATS	Sand Mining Approval and Tracking System
SME	Small and medium enterprises
TNN	Times News Network
ULB	Urban local body
VSBK	Vertical shaft brick kiln
WRI	World Resources Institute

THE POLICY BRIEFS

CONTEXT OF THE POLICY BRIEF SERIES

India is currently at a crucial juncture where it is aiming for economic growth to meet the basic needs of its 1.2 billion people. However, so far this growth has resulted in energy shortages and the increasing use of limited resources. This policy brief series is about decoupling, i.e. improving efficiency to reduce the resources and energy needed for this growth and meet the country's increasing development needs.

The construction sector is highly resource and energy intensive; it is therefore imperative that it moves towards a path of environmental sustainability. This transition is likely to be achieved by decoupling both resource and energy use from the sector's growth. Decision-makers in the sector will play a crucial role in achieving this. The aim of this policy brief series is to inform decision-makers in India at central government and state level about the current status of research, policy and institutions in the Indian construction sector and to identify key drivers and barriers. Finally, practical recommendations will be made for decision-makers about how to promote decoupling of resource and energy use from growth in the construction sector.

The series comprises three policy briefs:

Policy brief 1 focuses on the baseline for decoupling in the Indian construction sector. The study draws attention to the existing scenario in terms of key policies, research and institutions linked to resources and energy in the sector.

Policy brief 2 focuses on analysing the potential for decoupling in the Indian buildings and construction sector. Primary and secondary research was conducted to identify the factors that influence decoupling. Subsequently, a framework was established to make it possible to measure the nature and extent of decoupling that is possible within the existing policy environment. Furthermore, gaps, drivers and barriers have been identified which could enable a potential analysis study on decoupling to be carried out. In addition, examples of good practice from Germany and other European countries have been studied with a view to learning lessons that can help to bridge the current gaps in India.

Policy brief 3 focuses on recommendations both at national and state level on the possible interventions that could result in resource and energy use being decoupled from growth in the Indian construction sector. Lack of a comprehensive policy on resource efficiency and the possibility of using secondary raw materials to obtain resource and impact decoupling continue to be the key issues that India will have to grapple with in the years to come.

The policy briefs are a follow-up of the Policy Paper "Decoupling Economic Growth from Resource Consumption. A Transformation Strategy with Manifold Socio-Economic Benefits for India and Germany" by Peter Hennicke and Ashok Khosla with contributions from Chitrangna Dewan, Kriti Negrath, Zeenat Niazi, Meghan O'Brien, Mandira Singh Thakur, Henning Witts, published in November 2014. The Policy Paper was elaborated by members of the Indo-German Expert Group on Green and Inclusive Economy. The group is supported by the German Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and facilitated by the GIZ Environmental Policy Programme in Berlin and the Indo-German Environment Partnership in Delhi.

KEY MESSAGES

POLICY BRIEF 3 – POLICY RECOMMENDATIONS

DECOUPLING ENERGY AND RESOURCE USE FROM GROWTH IN THE INDIAN CONSTRUCTION SECTOR

- The key indicator for positive trends in sustainability and resource and energy efficiency is decoupling. It can be considered a sustainability objective in that it de-links economic growth and activity from environmental impacts.
- New directives on resource efficiency are needed to create an enabling environment in which small businesses as well as large-scale industries can work towards ensuring resource use is decoupled from overall growth in output.
- Getting the price of resources right: the markets must correctly price the externalities associated with sourcing and use of resources. An accounting system such as material flow accounting (MFA) can support correct pricing of resources.
- Capacity building for state regulatory authorities, as well as developers and the workforce at all levels, is essential for decoupling energy and resource use. This includes revising the Schedule of Rates of the Central Public Works Department (CPWD) to include various alternative materials that can promote a greater linkage between research, development and market acceptance of alternative materials.
- Green building centres should be established at state level.
- Deconstruction rather than demolition of buildings should be promoted.

KEY MESSAGES

POLICY BRIEF 3 – POLICY RECOMMENDATIONS

- Quantifiable and time-bound targets which are as stringent as possible should be developed for energy efficiency in buildings in order to reduce the risk of a lock-in effect of energy-inefficient buildings.
- Domestic and small to medium commercial customers with sufficient rooftop space should be seen as potential electricity generators rather than just customers. This can be enabled by providing net metering systems.
- Building energy labelling and performance certification should become mandatory.
- As a long-term planning strategy, and based on economic, social and environmental benefits, energy subsidies should be first reformed and ultimately phased out. Using at least part of the budget expenditure saved in this way to fund energy efficiency programmes, particularly for housing and low-income consumers, will multiply the benefits and facilitate acceptance.
- Greater emphasis on establishing and funding research and development institutions is required as the country moves towards finding more efficient alternatives.

1 WHY DECOUPLING OF ENERGY AND RESOURCE USE IN THE CONSTRUCTION SECTOR: THE INDIAN SCENARIO

India has reached a crucial juncture in its development, where it has to carefully strategize its development pathways to meet the increasing demands of a population of 1.2 billion that is growing at an annual rate of 1.2 % (Census of India, 2011). Having signed the Paris Climate Agreement and resolved to achieve the targets it set for itself in its Nationally Determined Contributions (NDCs), India has now agreed to take measures to combat climate change. While these may aim to reduce carbon emissions, development growth will continue to depend on natural resources. This means that India needs to adopt a low-carbon, resource-efficient growth pathway.

As a consequence of population growth and economic development, which has increased wealth and reduced poverty, the country's housing demand is on the rise. The current affordable housing shortage in urban India (2012–2017) stands at around 19 million households (Ministry of Housing and Urban Poverty Alleviation, 2012). Additional 28 million units are required by 2022 (KPMG, 2014). While rural housing shortage stands at about 44 million (2012–2017) (Ministry of Rural Development, 2011) and additional 51 million units are required by 2022 (KPMG, 2014). If the number of vacant houses is factored in, core demand for urban housing in 2022 will stand at 37 million units and 90 million units for rural. Apart from the housing shortage, reconstruction due to disasters and extreme weather events, refurbishment and upward expansion of buildings will result in increased demand for materials as well as energy use in the construction sector.[1] A number of government programmes, such as Housing for All (urban and rural), Indira Awas Yojana, the Smart Cities Mission and the Atal Mission for Urban Rejuvenation and Urban Transformation, have been launched to meet this housing demand and are likely to give a further boost to the construction sector.

The construction sector is considered to be one of the major contributors to economic growth, and therefore a measure of a country's development. According to the Global Construction 2020 Report, the sector will account for 13.2 % of the world's GDP by 2020, and is estimated to grow by 67 % from USD 7.2 trillion in 2010 to USD 12 trillion in 2020 (Global Construction Perspectives and Oxford Economics, 2011). However, this sector is highly resource and energy intensive. Bricks, cement and steel are the three most commonly used materials in the construction sector. While India's cement production has increased at a compounded annual growth rate (CAGR) of 8.3 % over the last ten years (1999–2009), the CAGR in production has been particularly high during the last five years (9.2 %), which reflects the increase in demand from the construction sector and high exports. Of the total cement production in India, 50 % is consumed by the housing sector, 25 % by infrastructure and another 25 % by the industrial and commercial sector (NSDC, 2012). The cement industry is classified in the RED[2] category because of its demand for natural resources, combustion process, the calcination process that produces clinker, the energy demand (fuel and electricity) and the emissions released. It has been estimated that one tonne of cement produced releases close to 0.85 to 1.15 tonnes of CO2 (Kumar, 2013). Similarly, demand for steel is on the rise with the real estate sector having consumed approximately

1 This demand would be required during both the construction and the operational phases of buildings.

2 These are industries identified by the Ministry of Environment, Forests and Climate Change, Government of India as being heavily polluting.

22 million tonnes of steel in 2013 (CREDAI, 2013). It is a resource-intensive sector: to produce 70 million tonnes of steel in 2010–2011, the industry consumed about 60 million tonnes of coking coal equivalent, 111 million tonnes of iron and 700 million tonnes of water (CSE, 2012). Similarly, India is estimated to be the second largest producer of bricks with a total production of 240–260 billion bricks a year (CSE, 2015). Furthermore, this sector is considered one of the most polluting since it generates 24 million tonnes of CO2 annually and uses 20–30 million tonnes of coal and 350 million tonnes of topsoil (Development Alternatives, 2012).

Furthermore, in the specific case of the buildings sector, domestic consumption accounted for 22.5 % of total electricity consumption in the country in the year 2013–2014, commercial sector for 8.7 %, industry for 43.83 %, agriculture for 18 %, railways and traction for 2 % and all other for the remaining 5 % (Central Statistics Office, 2015).

In view of the above trends, worldwide research has now focused on studying the effects of decoupling energy and greenhouse gas intensity from growth on gross domestic product (GDP) in various countries. The extent and intensity of decoupling varies depending on the intensity of use of energy and materials and total energy and material resource use in relation to GDP growth. As described in policy brief 1 decoupling can be defined as weak (relative) decoupling and strong (absolute) decoupling.

To present a more nuanced explanation: the key indicator for positive trends in sustainability and resource efficiency is decoupling. This involves separating impacts from an activity to remove the link and interrelationship between variables. Thus, decoupling is an objective for sustainability in the sense that it de-links economic growth and activity from environmental impacts (Rademaekers, Zaki & Smith, 2011). This policy brief series has analysed the existing mechanisms through which the Indian buildings and construction sector has initiated a process to de-link growth in the sector from environmental impacts, and has carried out a specific analysis on ways it can decouple resource (e.g. soil and sand) and energy (particularly for lighting and cooling) consumption.

2 GAP ANALYSIS

Through its analysis, the policy brief series has been able to contextualise decoupling within the Indian policy framework. In the case of India, decoupling natural resources from economic growth has largely been driven by two parameters: increasing productivity and dematerialisation, which is achieved through technological means (innovation, efficiency, substitution, product durability etc.), and reducing demand, which requires behavioural change on the part of individuals and societies (lifestyles, waste minimisation, sharing underutilised infrastructure and assets etc.).

Based on the above parameters, the policy brief series has analysed the existing R&D institutions, government policies and institutional frameworks that have tackled the question of decoupling energy and resource use from growth in the Indian buildings and construction sector. The main gaps identified in this analysis are,

- While the R&D institutes have made considerable progress in identifying innovative technologies – both non-disruptive (vertical shaft brick kilns, star-rated fans, air conditioners, hollow bricks) and disruptive technologies (fly-ash bricks, M-sand, combined heating, cooling and power (CHCP), and solar PV) and also overall low-energy/ resource design – there continues to be a lack of promotion of these technologies in the mainstream construction market and little dissemination of the technical know-how associated with them. These technologies fail to enter the market due to a lack of conducive policies (incentives, finance, capacity building etc.). Of crucial importance in the policy framework is the link between innovation and market incubation and final dissemination of these technologies and materials in the buildings and construction sector as a whole.
- Research has shown that there is a range of different policy instruments targeted towards ensuring resource and energy efficiency and that some address the construction phase of a building, others the operational phase. The Energy Conservation Building Code (ECBC) formulated by the Bureau of Energy Efficiency has been instrumental in setting the standards and guidelines for energy-efficient building design, which includes the building components like envelope, lighting, heating, air-conditioning and electrical systems.
- Several green rating systems, such as the Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED), have been established. They rate buildings against several criteria, including energy efficiency, materials and resources, water efficiency, sustainable site selection etc. However, it should be noted that they rate overall performance, which includes components such as water conservation, handling of consumer waste, reduced dependency on virgin materials etc. The rating schemes offer possibilities of acquiring points from a range of criteria, which can result in a building achieving a high green

building rating (waste water management, rain water harvesting, use of renewable energy, conservation and efficient utilisation of resources etc.). There are number of incentives that developers are provided by the central and state governments, and financial institutions for constructing green rated buildings under GRIHA or LEED certifications. Some of the incentives include priority in environmental clearances, extra Floor Area Ratio (FAR), easy access to loans by banks etc. However, these green building rating systems are voluntary and there is a lack of awareness of these rating systems and the associated incentives among developers and builders, especially in small towns.

- Furthermore, the majority of the building projects that apply for a green rating are commercial and office buildings. A review of GRIHA-rated residential buildings revealed that they were mainly residential complexes owned by large developers. However, the reality in India remains that the majority of residential projects are still constructed by small builders, developers and local masons, who are not highly literate and are not yet aware of green buildings.
- Alternative materials and technology interventions, classified into non-disruptive (e.g. bricks from efficient kilns, star-rated fans and ACs) and disruptive (e.g. low-energy/material design, fly-ash brick, M-sand, CHCP and solar PV) categories, have the potential to achieve impact and resource decoupling in India. However, there is a clear lack of regulations, and transparency and information policies to ensure that these materials and technologies achieve compliance. Regulatory policies appear to be the front-runner when it comes to resources. For example, the Sustainable Sand Mining Management Guidelines, Karnataka Sand Policy, 2011, and Fly Ash Notification (S.O. 763 (E)), have been commendable in placing restrictions on the extraction of soil and sand. However, despite stringent legislation being in place, there continues to be a strong nexus between local politicians or people's representatives and contractors. In addition to this, a mafia-like situation has developed throughout the sand mining sector, resulting in illegal, indiscriminate sand mining (DownToEarth, 2013). Furthermore, a focus on research and development, promoting best available technology and capacity building (including scaling-up measures, involvement of SMEs and skills development initiatives) appears to be severely underrepresented in existing policies.
- In the case of energy-efficient technologies, incentives and financial instruments have led the way in this sector, with state governments and municipalities providing financial and non-financial incentives under the National Domestic Efficient Lighting Programme, especially for the distribution of LED bulbs (pmindia, 2015). Renewable energy capacity has increased considerably in the past few years, from 34,351 MW in

March 2015 to 42,849 MW in April 2016, as an assessment of the Central Electricity Authority (ETBureau, 2016) shows. But, despite state governments' policies on capital subsidies and feed-in tariffs for renewable energy, factors such as a lack of net metering and provision of battery less systems within the schemes have discouraged domestic users from taking advantage of their full benefits.

- It is absolutely crucial that energy (cost) savings derived from dedicated energy conservation measures (ECMs), demand-side management (DSM) programmes and energy service company (ESCO) contracts translate into long-term bonds and are not converted into short-term monetary savings, which risk getting lost in the rebound effects. However, for lower and middle-income consumers, energy cost savings can be spent for urgently needed purposes. This motivates policy-makers and consumers alike to implement energy efficiency measures. This benefit will, of course, stimulate growth and to some extent also cause direct rebound effects.

3 RECOMMENDATIONS

Based on the gap analysis conducted in the previous two policy briefs, a number of recommendations have been suggested below. While we have looked at economic growth at country-level (i.e. India), it is critical to point out that environmental impacts are felt both at the regional as well as national level. With this in mind, recommendations about addressing decoupling of both energy and resources in the construction sector would require a reduction in energy and resource use and an increase in efficiency at every level of intervention. Hence, the recommendations below have been divided into two separate categories: material resource use (specifically sand and soil) and energy intensity and efficiency in the Indian buildings and construction sector.

Furthermore, the country's federal structure means that state and regional systems have greater power to influence decision-making, despite the fact that directives come from the central government. With this in mind, the recommendations have been formulated to address different levels of governance: national, state and local. The following recommendations are addressed to policy-makers and stakeholders within the buildings and construction sector in India to ensure decoupling of resource and energy use in that sector.

3.1 RECOMMENDATIONS FOR DECOUPLING MATERIALS

3.1.1 NATIONAL LEVEL

- Resource Efficiency Directive: More often than not, a directive in India is based on an act that is passed in Parliament. For example, the 2001 Energy Conservation Act created the legal framework, institutional arrangements and a regulatory mechanism at central and state level to embark upon an energy efficiency drive in the country (WRI, 2016). In the same way, we recommend a directive on transitioning to a resource efficiency economy. Enforcement of this directive would ensure that favourable policies are formulated to encourage resource efficiency and use of secondary raw materials.

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- There is a need for a central policy governing resource efficiency in India. This should be driven by the concept of decoupling resources and economic growth.
- The environmental costs of using natural resources should be incorporated into the cost of products.
- An environmental impact assessment of extracting these materials highlights the true value of their cost. Accounting systems such as material flow accounting and economic valuation of ecosystem services need to be in place to permit robust data acquisition and analysis.

Enforcement could lie with the Ministry of Environment, Forests and Climate Change with insights being contributed by the newly formed Indian Resource Panel.

- Resource pricing policies: In the case of most natural resources used in construction (for example, soil, sand, limestone and iron ore), capital markets have failed to correctly price the externalities associated with environmental degradation. Alternative resources and products are priced relatively higher because of the higher cost of processing. Thus, the cost of any externalities that may be caused needs to be factored into the pricing of these natural resource-based products. For example, an economic valuation of ecosystem services will make it possible to correctly price the use of natural resources, hence making alternative resources and products more competitive.
- Establishment of a material flow accounting (MFA) system: A material flow accounting (MFA) system for resource materials (sand and soil) needs to be established to account for direct material consumption (DMC) and environmental impacts. Environmentally weighted material consumption (EMC) is a comprehensive indicative measure for analysing the environmental impact of resource use. The main advantage is that it provides information on the environmental impact, from cradle to grave, of resource consumption. It is useful for analysing[3] i) the upstream effects of resource consumption that are not visible in the final product stage, ii) the environmental impacts from material substitution and recycling. A time series analysis of the derived indicator will show whether the economy has achieved a decoupling of the environmental impact of the resource use from economic growth.
- Sustainable Soil Management Guidelines: Regulation of soil extraction is the need of the hour and should take the form of Sustainable Soil Management Guidelines similar to the newly formulated Sustainable Sand Management Guidelines, 2015. The guidelines should focus on the use of alternative materials for bricks and ensure regulatory mechanisms for enforcement at district level.
- Indian Standard Codes to be developed for construction & demolition waste products: The Ministry of Environment, Forest and Climate Change has for the first time notified Construction and Demolition Waste Management Rules, 2016, which has created a legal framework for recycling and reusing C&D waste in the construction industry. However, the Bureau of Indian Standards (BIS) has still not developed standards for these products.
- Revise the CPWD Schedule of Rates to include products made from recycled C&D waste: Scientific studies from research institutes such as the National Council on Cement and Building Materials, the Indian Institute of Technology – Madras, the Building Materials & Technology Promotion Council etc., and pilot interventions by IL&FS Environment Infrastructure Services Ltd., Technology and

3 Adapted from Policy Review on Decoupling: Development of indicators to assess decoupling of economic development and environmental pressure in the EU-25 and AC-3 countries (Voet, et al., 2005).

Action for Rural Advancement, for example, indicate that the Central Public Works Department (CPWD) should revise its Schedule of Rates to allow the use of building materials made from recycled C&D waste. This will ensure market development of these recycled products, thus making them economically viable. It will promote not only procurement and processing of C&D waste, but also the sale and use of these products by developers.

- Need for greater linkage between research and development and market acceptance of alternative materials: Research has revealed that while scientific studies have been conducted on the technical viability of alternative building materials, there continues to be a lack of significant research on the market development of these products, i.e. economic viability and awareness of the products, plus ease of accessibility. Thus, greater promotion efforts are needed and there has to be a focus on market assessment of these products.
- Need for an integrated national policy framework on sustainable public procurement: This policy framework is essential to give legitimacy and impetus to various ongoing interventions in developing resource-efficient materials and technology in the construction sector. This will clearly communicate the government priority of ensuring decoupling of natural resource use and will thus expedite the implementation of sustainable public procurement.
- Creating a conducive environment by introducing tax incentives and disincentives to encourage alternative technology and material use in the buildings and construction industry: Promoting alternative technology and materials through tax incentives such as tax holidays, rebate mechanisms etc. and disincentives like fee charges applicable to both building product manufacturers and property developers, combined with a sustainable public procurement policy, will enable the creation of markets for these products and technologies.
- Creating a technology upgradation fund scheme: A Technology Upgradation Fund Scheme will provide assistance to building material manufacturers to upgrade their machinery to facilitate more efficient processes and resource-efficient products,

- Standardisation and green certification for alternative resource efficient building materials.
- Government-sponsored infrastructure projects should act as innovation hubs for procurement of alternative, resource-efficient materials. They should also develop a conducive environment for uptake and market acceptance of new alternative materials.
- A Technology Upgradation Fund should be set up to support modernisation and upgrading to more resource-efficient construction materials and technologies.

and provide support for modernisation and upgrading of construction technology in the form of interest reimbursement, tax rebates and capital subsidies. A similar funding scheme has been developed by the Ministry of Textiles in 2011 to modernise the textile industry.

- Demand for more reliable data on extraction of raw materials: The Indian brick industry is currently based on decentralised production activity that is energy intensive, resource depleting and uses highly polluting technologies and production methods. While there has been a transition to more efficient technologies such as vertical shaft brick kilns[4] (VSBK) and fly-ash brick plants, the use of soil (in VSBK) and sand (fly-ash bricks) persists. Hence, in cases where the use of soil and sand is calculated indirectly on the basis of production figures for building products like cement, clay-bricks, fly-ash bricks etc. there is no reliable data on the extraction of these materials. This makes environmental assessment very difficult and contributes to a lack of awareness of the detrimental impacts of over-extraction. To fill this data gap, the Ministry of Mines, in conjunction with the Ministry of Environment, Forests and Climate (MoEF&CC), could take an initiative to inventorize minor minerals, such as soil and stone, in the country. The initiative could be developed on the lines of the sustainable sand management guidelines developed by MoEF&CC in 2016.

- Need for robust monitoring and evaluation based on an analysis of reliable data: While acquisition of reliable data is the need of the hour, it is also necessary to analyse this data and assess carrying capacity. Monitoring and evaluation thus not only tracks the amount of raw material extracted, but also allows for identification of options for scientific and systematic mining of these materials. The Indian Bureau of Mines could become the nodal government body for monitoring and sustainable extraction and use of these minor minerals that are used for construction activities.

- Need for development of a robust system for accurate and reliable data acquisition on natural resources extracted.
- Stringent monitoring and evaluation systems should be put in place – not only to penalise illegal extraction activities but also to prevent such activities from occurring.

4 As of January 2003, there were 27 VSBK plants with a typical annual production capacity of approximately 0.5-4.0 million bricks (Maithel, Vasudevan, & Johri, 2003).

Sand Mining Approval and Tracking System (SMATS) in Maharashtra

With the demand for sand for construction activities in urban areas on the rise, illegal sand mining, more commonly known as the 'sand mafia,' is also on the rise. Illegal mining activities have been monitored, vehicles impounded and penalties imposed, but they still continue.

Under the Bombay High Court's directive to check illegal sand mining, the Maharashtra Government's information technology wing, Mahaonline, has come up with a new app-based system called the Sand Mining Approval and Tracking System (SMATS) to check illegal sand mining. Under this tracking system, each sand mining ghat contractor must register their mobile phone numbers with the district collectorate and send a text message notifying the volume of sand being carried in a particular truck, along with other details such as its starting point and destination. On receipt of the text message, a token number is issued. If a truck is found carrying sand without this token number, it will be considered a case of illegal sand mining and penal action will be taken against the driver and the contractor (TNN, 2015).

Box 1: Example of a mechanism for monitoring illegal sand mining

3.1.2 STATE LEVEL

- Deconstruction rather than demolition of buildings: In the recently notified Construction and Demolition Rules, 2016, the term deconstruction has been defined as 'planned selective demolition in which salvage, re-use and recycling of the demolished structure is maximized.' While this term is critical to the procedures that are followed for recovering materials from construction and demolition waste, the rules do not explicitly mention the process of deconstruction as being part of the duties of the service providers and their contractors. The state building by-laws formulated by the designated development authorities should therefore specify the process of deconstruction rather than demolition, in order to ensure proper recovery of construction and demolition waste.
- Inclusion and regular update of state Schedule of Rates to include alternative materials: The state Schedule of Rates for buildings is established through an extensive analysis of data on building materials and market trends. However, there remains a considerable time lag between the development of an alternative material or technology and its certification and inclusion in the Schedule of Rates. Thus, it is crucial that these processes be strengthened, while ensuring the state Schedules of Rates are upgraded promptly.
- Preferential procurement of alternative materials and technologies: In order to boost market uptake of more resource-efficient materials and technologies, preferential procurement of such items is essential in state government tenders.

- Promotion of efficient construction management practices to encourage innovative use of alternative technology and material:
  While innovative approaches to decoupling material resources in the buildings and construction industry continue to be developed in research institutions such as the Building Materials and Technology Promotion Council (BMTPC) or the Central Building Research Institute (CBRI), little is showcased as exemplary practice for states or industry to adopt. To decouple resources significant emphasis needs to be placed on research and development of materials and technologies and how they might be incorporated into the state machinery. Another crucial element that needs to be highlighted is capacity building and raising awareness of these materials and technologies through best practices.

- Systematic recovery of materials from waste products. For example, systematic dismantling of demolition and construction waste to enable materials to be recovered.
- Uptake and market acceptance of new and alternative materials by including them in the state Schedules of Rates.
- Green building centres to be one-stop innovation hubs, providing construction services, cost-efficient environment-friendly building materials and masonry.

- Green building rating systems should mandate the use of alternative materials:
  The current green rating systems have placed little emphasis on the use of alternative building materials. The present GRIHA/LEED rating criteria mandate the use of fly-ash for reinforced cement concrete structures in in-fill walls and load-bearing structures, mortar and binders. However, these rating systems fail to mandate the use of alternative building materials like fly-ash bricks and other locally available building materials. The criteria for green buildings should stipulate that at least 50 % of building materials are alternative materials or that products made from secondary raw materials (i.e. fly-ash and C&D waste aggregates) must be used. The selection of alternative materials is, however, subject to regional availability.
- Establishment of green building centres:
  Green building centres will be established at state level and will act as one-stop nodal centres, ensuring that locally available materials and construction technologies are given preference and made easily accessible to both developers and home-owners. Furthermore, they can act as centres of excellence for masonry skills development, thus enhancing the skills and capacities of small contractors and developers to adopt more resource and energy-efficient construction methods. This can also be integrated into the flagship skill development campaigns such as skill India initiative by the GOI.

Kerala State Nirmithi Kendra

The aim of these centres is to act as knowledge banks to generate innovative ideas in the construction sector and to interact with research institutions, governments, and NGOs so as to ensure research on the housing sector is used in practice. Furthermore, these centres work on designing training programmes and upgrading traditional housing technologies. The Kerala State Nirmithi Kendras (KSNK) have been successful in the use of cost-effective, environment-friendly (CEEF) construction options like hollow concrete blocks, ferrocement slabs etc. that not only ensure cost savings but also prevent excessive use of wood, concrete and steel.

The Kerala State Nirmithi Kendra is engaged in several activities that range from consultancy services for mass housing schemes for different income groups, setting up production centres for CEEF and selling these building materials at subsidized rates to below the poverty line (BPL) beneficiaries to organising training for artisans and other institutions. The KSNK has set up 14 regional kendras in almost all districts of Kerala, which provide the above-mentioned construction services as well as training unemployed youth in building material production, masonry, landscaping and horticulture, carpentry etc.

Box 2: Examples of green building centres

3.1.3 LOCAL GOVERNMENTS – MUNICIPAL BODIES/URBAN AUTHORITIES/STATE DESIGNATED AGENCIES

- Robust tendering documents by urban development authorities: When drafting tendering documents for urban infrastructure (roads, public buildings etc.) urban development authorities should make special mention of the use of secondary raw materials such as C&D waste-based products/fly-ash bricks. Furthermore, specific percentages of these materials/products should be stipulated for particular infrastructure projects. This would indirectly encourage entrepreneurs working on producing alternative building materials to scale up their activity in line with the market demand for these materials/products.
- Preferential procurement of alternative materials: The preferential procurement mechanism stimulates economic activity, improving the competitiveness of industrial sectors involved in sustainable consumption and production encouraging greater use of particular alternate materials/products and improving environmental quality. Following on from the tendering documents to be prepared by the urban development authorities, municipal bodies are required to ensure specific procurement of alternative building materials for their infrastructure projects, so as to promote the use of these materials/products and ensure there is a viable market for them.

- City development plans to address recycling and use of C&D waste in manufacturing building products: When the new Construction and Demolition Management Rules, 2016 came into effect, it became vital that city development plans address this issue and develop strategies for robust management and processing of C&D waste. The value added as a result of proper recovery and processing of this waste would be an incentive for building material businesses to invest in producing C&D waste-based products.

- Tendering documentation for urban infrastructure projects should make special mention of the use of new alternative resource-efficient materials.
- City development plans to address the issues of C&D waste and develop strategies for effective management and use of C&D waste products.

3.2 RECOMMENDATIONS FOR DECOUPLING ENERGY

3.2.1 NATIONAL

- Quantifiable and time-bound targets for energy efficiency in buildings: Set energy efficiency targets for new buildings in terms of specific energy consumption as low as possible, based on the current situation (including nearly zero-energy buildings) and what is realistically cost-effective in the future. The aim is to increase annual rate of buildings constructed to these standards (in m2). These target levels should be regularly reviewed and updated. Targets for existing buildings should be set so that the greatest energy savings are made as early as possible in each retrofit. It is also important to aim for a high refurbishment rate and cost-effective approach (bigEE). Roadmaps for achieving the targets should be drawn up for a 20 to 50-year time frame in order to reduce the risk of a lock-in effect[5] of energy-inefficient buildings.
- Adapt and expand the scope of ECBC to residential buildings: To increase the potential for energy efficiency, the Energy Conservation Building Code (ECBC) must be adapted and made mandatory for residential buildings as well (not just commercial buildings in some states). This should especially include large residential developments with higher connected loads.

5 Lack of choices for energy efficient measures in the future.

- Support renewable energy investment and the generation potential at building level (on-site generation): Domestic and small to medium commercial customers with sufficient rooftop space should be seen as potential electricity generators rather than just customers. To enable such a transition, the system must be made financially viable for those customers until a point is reached when its capital and operating costs fall and it becomes competitive.
  - The Ministry of New and Renewable Energy (MNRE) should formulate directives for uniform capital subsidy programmes for the medium to long term and should expand these programmes across various states based on available roof area and installed capacity to increase the potential for using renewable energy (solar rooftops/ thermal etc.). The cost of such programmes could be covered by the savings to the treasury achieved by gradually reducing energy subsidies.
  - The Central Electricity Regulatory Commission (CERC), in consultation with MNRE and the Ministry of Power (MoP), must formulate guidelines for uniform feed-in tariff policies (to be included in the 2006 National Tariff Policy) that the State Electricity Regulatory Commissions (SERCs) can adapt for smaller installed capacities to suit residential buildings and small to medium office buildings.
  - MNRE/MoP should develop net metering guidelines to be followed by all the states
- Energy subsidies: As part of a long-term plan and based on economic, social and environmental benefits, energy subsidies should be reformed and then completely phased out. To mitigate the financial impact on vulnerable target groups, the subsidy reform should be implemented gradually in order to smooth the transition. Support should also be provided for low-income households, covering basic energy services and offering energy efficiency programmes for new energy-efficient low-income housing, for example (bigEE). In addition to the subsidy programmes for renewable energy proposed above, a subsidy for very low-energy houses (for example, those in the most energy-efficient classes of mandatory building energy labelling, cf. below) could be provided until these designs have been established in the market.

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- Setting quantifiable, time-bound energy efficiency targets for new buildings that are as stringent as possible.
- Domestic and small to medium commercial customers with sufficient rooftop space available should be seen as potential generators rather than just customers.
- Central Electricity Regulatory Commission (CERC) to formulate guidelines for uniform tariff policies that can be adopted by State Electricity Regulatory Commissions (SERCs) for smaller installed capacities to suit residential buildings and small to medium office buildings.

- Energy subsidies should be implemented gradually and support given to low-income households until these designs and capacities have been established in the market, thereby making them competitive.
- Green Building Rating Systems should advocate for higher levels of energy efficiency.
- To move towards higher efficiency, estimations of building energy performance should be made mandatory to ensure transparency and a more competitive market.

- Green building rating systems should advocate for higher levels of energy efficiency: The current green building rating systems, such as LEED India or GRIHA, have minimum baseline energy efficiency/energy performance index (EPI) requirements as a prerequisite for energy-related credits and also offer higher points for further energy optimisation. However, property owners and developers often do not attempt to achieve energy reductions over and above the minimum prerequisite levels even though they would be possible. This sometimes means that buildings with relatively low energy efficiency levels achieve higher green building rating by scoring well on non-energy-related criteria. Green building rating systems should therefore advocate for higher levels of energy efficiency whenever possible.
- Mandatory building energy labelling/ performance certification: The energy labels (BEE star-rating for office buildings), which are currently voluntary, increase transparency by giving information about the building's energy performance. But making them mandatory would remove energy inefficient buildings from the market, encouraging a move towards higher efficiency. For this, a national register/central database of energy labels should be set up to facilitate the administration and monitoring of the scheme, as well as quality control. Data collected can also subsequently be used for national statistics, and for monitoring and evaluating other building-related policies (bigEE).
- Capacity building: The buildings and construction industry in India still lacks skilled and qualified actors. The government should focus a great deal of attention on capacity building, otherwise the impact on the implementation of building regulations and on actual construction could be huge. With the relevant knowledge and skills, actors (architects, planners, developers, building contractors and real estate agents etc.) could facilitate energy-efficient building design, and monitor and assess building performance in line with the policy framework and the market. They could also correctly and convincingly inform investors and owners about social, economic and environmental benefits. The focus should be on supplying a

sufficient number of qualified trainers, running programmes such as train-the-trainer and continuing professional development courses on low-energy buildings and organising training, conferences and seminars on a regular basis.

- Support buildings demonstrating good practice: Good practices in energy-efficient design and construction in each state and the most important sub-state regions of the country will provide great benefits both for capacity building and for information campaigns addressing investors and the broader public.
- Develop a uniform definition for energy performance index of buildings: The energy performance index (EPI) should be treated with caution because the procedure for calculating total energy consumption and floor area is subject to the discretion of the individual rating system. For example, whether non-air-conditioned spaces, basements etc. are included depends on the specific rating system. Currently, there is no notation that is accepted nationwide. Projection data based on such diversified EPIs can produce gross approximations.
- Preferential procurement practices/guidelines for energy efficient products: Preferential procurement of more resource efficient materials and technologies in national government tenders is essential to boost their market uptake.
- Developing a framework for monitoring and data acquisition to objectively assess decoupling:
  - Develop a framework for the monitoring of energy savings obtained by targeted financial incentives, investments. It is absolutely crucial to have an appropriate policy framework in order to conduct an ex-post evaluation of various centrally funded and supported schemes targeting energy efficiency in buildings.
  - It is hard to obtain validated data on the energy savings obtained by adhering to Energy Conservation Building Codes (ECBC) with the exception of a few individual case studies. Most of the time, the savings have been estimated only, using energy simulation studies, but lack any monitoring or post-occupancy evaluation data. Confidentiality clauses and privacy issues in green building rating systems sometimes prevent such data from being obtained and shared even for green-rated buildings. Since green building rating systems have a credible mechanism for rating the energy efficiency of buildings, voluntary disclosure – even anonymous in nature – of post-occupancy monitoring and evaluation, helps to assess their actual performance and provides valuable guidelines necessary for course correction in ECBC, for example.

- Lay down technical guidelines for monitoring and verification protocol. Develop or adapt existing international guidelines on monitoring and verification protocol for measuring energy savings in buildings and conduct necessary training for stakeholders, similar to the training and examination system for energy managers and energy auditors.

- Development of capacity building and training for all actors to deliver the knowledge and skills needed to facilitate energy-efficient building design in the building industry as a whole.
- Demonstration of good practice in energy-efficient design and construction will facilitate acceptance and stimulate greater interest in replicating these practices.
- Robust monitoring mechanisms needed to acquire reliable data on post-occupancy building energy savings.

3.2.2 STATE

- Make ECBC mandatory and expand it to residential buildings: Only a few states have mandated Energy Conservation Building Codes (ECBC), and then only for commercial buildings, leaving the energy-saving potential in residential buildings untapped. Other states still need to change the status of the code from voluntary to mandatory, adapting it to suit their particular requirements (i.e. depending on the climate, technology availability and affordability in each state)
- Include energy efficiency in buildings in demand-side management (DSM) programmes run by state-owned utilities or provide other financial incentives: These should be coordinated in content and design with national-level incentive schemes.
- Make renewable energy affordable and increase investment opportunities: Electricity is distributed to residential users at subsidised prices. Renewable energy remains unaffordable for residential customers. Small-scale renewable utility providers shy away from making contracts with domestic users. Therefore, credible mechanisms such as Renewable Energy Certificate Regulations (RECs) should be devised by State Electricity Regulatory Commissions (SERCs) for domestic customers and small-scale utility providers to increase access to clean technologies, make them affordable and encourage investment.

- Energy Conservation Building Codes to be expanded to cover residential buildings.
- Establishment of net metering systems in all states to ensure greater affordability and boost opportunities for investing in rooftop PV systems.
- Need to increase specialised skills training in energy-efficient construction methods and technologies.

- Provision of net metering system in all states: Domestic customers only benefit from using PV if there is a provision to feed the excess energy generated into the grid and be paid for it. States should include the provision of net metering systems to use the potential of rooftop PVs and take advantage of the benefit of feed-in-tariffs. As at June 2016, net metering policy is available in 19 states and union territories. However, the total number of installed net meters is negligible compared to the number of installed rooftop systems.
- Build capacity (train workers and educate the general public): Although efficient technologies are available and building regulation is stringent, failures in building performance occur as a result of unskilled construction workers being employed. States should initiate training for workers and inform them about new construction techniques. Programmes to educate the general public on energy efficiency and its benefits are helping to increase the demand for energy-efficient solutions.
- Monitoring and tracking activities. The electricity distribution companies are likely to be important players in collecting data on building energy: State-Designated Agencies (SDAs) should work in coordination with utility companies and energy service companies (ESCOs) to track the progress of the various energy efficiency initiatives being implemented in their respective zones. This provides an opportunity to assess the efficiency of such initiatives and incorporate any necessary course correction within the existing schemes. It can also provide guidance for future schemes.

3.2.3 LOCAL GOVERNMENT – MUNICIPAL BODIES/ URBAN AUTHORITIES/STATE-DESIGNATED AGENCIES/LOCAL ELECTRICITY DISTRIBUTION COMPANIES

- An option to install a net meter should be provided when a new electricity connection is applied for: Whenever a new electricity connection is applied for, there should be a default option enabling the customer to choose a regular meter or a net meter. This reduces the paperwork needed to obtain a net meter if the customer chooses to install building-integrated solar PV at a later date.
- Capacity building for construction workers and building services technicians: Urban local bodies (ULBs) are better placed to identify local construction practices and standards. They should not only include energy efficiency construction standards in the building by-laws, but also train local masons, carpenters, plumbers and electricians to install and maintain technologies such as building insulation and green roof technologies. They should also be trained to identify and recommend efficient technologies, such as LED lighting, star-rated appliances etc., to customers.
- Implementation and inspection that ECBC is being complied with in commercial buildings and related capacity building: In addition to the regular building approval standards, elements of Energy Conservation Building Codes (ECBC) should also be included in local building by-laws once ECBC is mandated by the state governments. ULBs should train its workforce to implement and check compliance with the ECBC requirements.
- Monitoring and tracking activities: SDAs should work closely with local distribution companies (DISCOMS) to monitor actual energy savings in various centrally and state sponsored schemes on energy efficiency in buildings.

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- Urban local bodies (ULBs) to include energy-efficient construction standards in by-laws and to ensure training in installation and maintenance of these technologies is provided for local masons, electricians etc.
- ULBs and distribution companies to work closely on providing reliable data on energy savings.

4 THE WAY FORWARD

As the previous policy briefs have highlighted, some degree of decoupling of both energy and resource use is already taking place in the buildings and construction sector in India. In this series of policy briefs the focus has been on understanding the impact and resource decoupling that has taken place through improvements to certain technologies, more efficient use of materials or disruptive change in the overall technology or material used.

However, what these changes really highlight is the kind of 'leap-frogging' that is required in order to ensure decoupling, whether weak or strong. There is no doubt that India needs to develop new strategies so as to maintain human welfare with minimal damage to the environment. This means taking advantage of leap-frogging opportunities, such as minimising waste through effective use of construction and demolition waste, fly-ash etc. to produce a range of building products, passive building designs to improve energy efficiency in buildings, solar photovoltaics, and BEE-labelled electrical appliances etc.

Innovation at this stage combines technological potential with collective shifts in perception and plays a key role in taking advantage of opportunities for leap-frogging. The challenges described in the previous policy briefs are to create synergies between socio-economic benefits and environmental objectives. These synergies are required to overcome structural barriers such as systematic lock-ins and market failures. Thus, changes across research and development, capacity building, policy, technology and finance are needed to ensure decoupling in the buildings and construction sector. It is a combination of economic policies (taxes, incentives, temporary subsidies etc.), knowledge generation, capacity building, and regulatory policies that will eventually encourage businesses and households to transition to more desirable development trajectories. Governments (central, state, local), research institutions, industry and civil society therefore need to invest heavily in institutional strengthening to enable economic growth combined with a decrease in resource and energy consumption, thus ensuring environmental degradation is minimised.

The recommendations above have been formulated through a consultative process and are believed to determine the extent of decoupling that the Indian construction sector is capable of. In this way, the pursuit of greater resource and energy-efficient growth in the sector will not only lead to greater environmental sustainability but will also create markets that are socially and economically conscious.

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ABOUT DEVELOPMENT ALTERNATIVES GROUP

Development Alternatives (DA), the world's first social enterprise dedicated to sustainable development, is a research and action organisation striving to deliver socially equitable, environmentally sound and economically scalable development outcomes. Established in 1982 and headquartered in New Delhi, the DA Group pioneered the concept of business-like approaches to eradicating poverty and conserving the natural resource base on which human development depends. The Society for Technology & Action for Rural Advancement (TARA) is a social enterprise set up in the year 1985 at New Delhi, India. It is an "incubation engine" of the Development Alternatives Group which has been providing development solutions in India and elsewhere.

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The Wuppertal Institute undertakes research and develops models, strategies and instruments for transitions to sustainable development at local, national and international level. Sustainability research at the Wuppertal Institute focuses on the challenges connected with resources, climate and energy and their relation to economy and society. Special emphasis is put on analysing and stimulating innovations that decouple economic growth and wealth from natural resource use.


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