F. No. 3(4)/5/2019-IC.II (pt.1)
Government of India
Ministry of Environment, Forest & Climate Change
(International Cooperation Division)

Indira Paryavaran Bhawan,
Jorbagh Road,
New Delhi -110003

Date: 23rd July, 2019

OFFICE MEMORANDUM

Subject: Draft National Resource Efficiency Policy, 2019 - Inviting comments and suggestions of stakeholders including public/private organizations, experts and concerned citizens

Natural resources form the backbone of any economic development. India, as one of the fastest growing economies with GDP at 2.6 trillion USD, has increased its material consumption to six times, from 1.18 billion tonnes (BT) in 1970 to 7 BT in 2015, however this economic growth has been coupled with inherent cost on natural environment. The material consumption is to further increase in order to provide for economic growth, increasing population, rapid urbanization and growing aspirations. Enhancing resource efficiency and promoting the use of secondary raw materials has emerged as a strategy for ensuring that the potential trade-off between growth, resource constraints and environmental well-being can be minimized. An overarching national policy framework is required in order to mainstream resource efficiency across all sectors and regions of the country.

2. In this context, the Draft National Resource Efficiency Policy, 2019 has been prepared by the Ministry of Environment, Forest and Climate Change after due deliberations and the same is herewith placed in public domain for information and submission of specific comments

3. All stakeholders including public/private organizations, experts and concerned citizens are requested to kindly send the comments and suggestions on the Draft National Resource Efficiency Policy, 2019. Such comments should be very specific and relevant so that these comments could be considered by the Ministry for finalizing the policy. The comments should be sent through email as word/pdf file in the prescribed format to bhawna.singh@gov.in/kaushik.rishi@nic.in (please mention Draft National Resource Efficiency Policy 2019 in the subject of email and provide your contact details) **within one month** of time. Comments received beyond this deadline will not be considered.

This issues with approval of the Competent authority.

(Kushal Vashist)
Director

To,
All relevant stakeholders including public/private organizations, experts and concerned citizens

Format for Comments

Draft National Resource Efficiency Policy

Name:

Name of organization:

Contact details:

Email:

Comments:

S.No.	Page no.	Line no.	Original text	Revised text
Other comments (if any)				

National Resource Efficiency Policy, 2019 (Draft)

- Charting a Resource Efficient Future for Sustainable Development

Ministry of Environment, Forest and Climate Change
Government of India

CONTENTS

Statement of Purpose

Natural resources form the backbone of any economic development. Resources not only help in meeting our basic needs, but also fulfill human aspirations for a better quality of life, higher standards of living. The recent upsurge in economic growth and consumerism has driven demand for various natural resources, thus exerting pressures on the environment and raising sustainability concerns. Enhancing resource efficiency and promoting the use of secondary raw materials has emerged as a strategy for ensuring that the potential trade-off between growth and environmental well-being can be minimized. An overarching policy framework is required in order to enable efficient use of resources and upcycling of wastes across all sectors of the economy.

To this end, the National Resource Efficiency Policy (NREP), 2019 seeks to create a facilitative and regulatory environment to mainstream resource efficiency across all sectors by fostering cross-sectoral collaborations, development of policy instruments, action plans and efficient implementation and monitoring frameworks. NREP, 2019 is guided by the principles of (i) reduction in primary resource consumption to 'sustainable' levels, in keeping with achieving the Sustainable Development Goals and staying within the planetary boundaries, (ii) creation of higher value with less material through resource efficient and circular approaches, (iii) waste minimization, (iv) material security, and (v) creation of employment opportunities and business models beneficial to the cause of environment protection and restoration.

NREP, 2019, creates a dedicated institution for fostering resource efficiency as 'National Resource Efficiency Authority (NREA)' that draws its power from Environment (Protection) Act, 1986, to provide for the regulatory provisions of this policy. NREA will have a collaborative institutional structure with members from line ministries, state governments, government agencies and stakeholders. An inter-ministerial National Resource Efficiency Board (NREAB) will provide necessary guidance on the aspects critical to the implementation of resource efficiency across all sectors. The process of developing and implementing resource efficiency strategies will inherently be carried out by concerned line ministries and state governments with NREA providing collaborative set-up as well as coordinating actions among ministries and state governments

NREP, 2019 aims to implement resource efficiency across all resources including both biotic and abiotic resources, sectors and life cycle stages. The policy draws inputs from available sectoral studies and initiates sections on selected sectors for early take-up. With formal establishment of NREA and expected participation of line ministries to grow, more resources including biotic resources will also be covered.

These rules are viewed as first step for mainstreaming resource efficiency in the country and provide for review after 10 years, following which a restructuring could be carried out including that of the institutional mechanism, if needed.

List of Illustrations

List of Abbreviations

BT	Billion Tonnes
C&D	Construction and Demolition
CE	Circular Economy
DALY	Disability Adjusted Life Year
EAF	Electric Arc Furnace
ECI	Environmental Cost Indicator
EEE	Electrical and Electronic Equipment
EPR	Extended Producer Responsibility
EU-REI	European Union - Resource Efficiency Initiative
GDP	Gross Domestic Product
IGEP	Indo-German Export Promotion
InRP	India Resource Panel
IRP	International Resource Panel
LCA	Life Cycle Assessment
MEAT	Most Economically Advantageous Tender
Mha	Million hectare
MOEF&CC	Ministry of Environment, Forest and Climate Change
MRF	Material Recovery Facilities
MRZ	Material Recycling Zone
NREA	National Resource Efficiency Authority
NREAB	National Resource Efficiency Advisory Board
OECD	Organisation for Economic Co-operation and Development
PET	polyethylene terephthalate
PPP	Public Private Partnership
PRO	Producer Responsibility Organization
PV	Photo Voltaic
R&D	Research and Development
RE	Resource Efficiency
SCP	Sustainable Public Procurement
SDGs	Sustainable Development Goals
SRM	Secondary Raw Material
TERI	The Energy and Resources Institute
USD	United States Dollar
VGF	Viability Gap Funding

प्रकृतिः रक्षति रक्षिता

Nature Protects if She is Protected

1. Introduction

Use of natural resources and materials form the backbone of global economies and in turn of human development and well-being. Driven by rapid economic and population growth, the demand for natural resources, especially materials have grown manifold over the last few decades. In the endeavor for economic growth, natural resources have been largely indiscriminately exploited, adversely impacting the environment and biodiversity. Further, cross linkages between resource use, climate change, land degradation and biodiversity loss has been scientifically well established. Concerns over rapidly depleting vital resources and adverse impacts on natural environment have lately gained greater prominence, resulting in increasing focus on judicious use of resources globally through combination of conservation and efficiency measures and advocating transition towards circular economy.

India, as one of the fastest growing economies with GDP at 2.6 trillion USD, has increased its material consumption to six times, from 1.18 billion tonnes in 1970 to 7 billion tonnes in 2015, however this economic growth has been coupled with inherent cost on natural environment. The material consumption is projected to more than double by 2030, in order to provide for increasing population, rapid urbanization and growing aspirations. The projected pace of economic development is going to put pressure on already stressed and limited resources and may lead to serious resource depletion and environment degradation affecting the economy, livelihoods and the quality of life. Further, material use is also closely associated with the problem of increasing wastes, which when suitably processed could deliver valuable secondary resources. **(BOX B1. Need for Action)**.

India as a signatory to UN Sustainable Development Goals is committed to provide for sustained economic growth along with sustainable use of natural resources and safeguarding environment **(BOX B2. Resource Efficiency is central to Sustainable Development Goals)**. Resource efficiency has a vital role towards mitigation of climate change, land degradation and biodiversity loss. It is thus, imperative for India to charter and take the path of economic development supported with efficient use of resources and minimum negative impacts on environment, ultimately leading to sustainable development.

Resource efficiency means to create more output as products/services using less inputs. It reduces waste, drives greater resource productivity, delivers a more competitive economy, addresses emerging resource security/scarcity issues, and helps reduce the associated environmental impacts. Circular economy keeps resources in use for as long as possible extracting the maximum value, recovering and regenerating products and materials at the end of each service life; so as to limit the extraction of natural resources to maximum possible extent **(BOX B3. Definitions)**.

160 Resource efficiency offers benefits on multi-dimensional aspects of economic, social and
161 environmental well-being. Cost savings from reduced material use, resource security,
162 reduced conflict and displacement eg. from mining, employment opportunities in green jobs,
163 reduced greenhouse gas emissions, pollution and ecological degradation among other
164 benefits drive the cause of resource efficiency. **(BOX B4. Costs and Benefits of Resource**
165 **Efficiency)**

BOX B1. Need for Action

Economic growth and development in India over the last two decades has brought decline in poverty rates, increased urbanization and has put tremendous demand for various goods and services. India is likely to be the largest populated country in the world in a decade, with urbanization expected to rise to 50% from its current level of 34% by 2030. Meeting the demand for products and services, of rising population with increased aspirations has led to mostly indiscriminate exploitation of natural resources and would further lead to increased pressure on resources resulting in environmental degradation, thereby raising sustainability concerns.

Current Status

- Resource extraction of 1580 tonnes/acre is much higher than the world average of 450 tonnes/acre
- 3rd largest material demand (year 2010)
- Low material productivity compared to global average
- Much lower recycling rate at 20-25% vis-à-vis of as high as 70% in developed countries (Europe).
- 3rd highest CO_2 emitter, responsible for 6.9% of global CO_2 emissions.
- Highest water withdrawal globally for agriculture.
- 30% of land undergoing degradation.
- High import dependency of many critical raw materials.

Material Demand *(Source: NITI Aayog, 2017)*

In scenario with continuing current dynamics (8% growth in GDP p.a. until 2030, thereafter 5%), total material consumption in 2030 is projected to be 14.2 BT (billion tonnes) consisting of about 2.7 BT of biomass, 6.5 BT of minerals, 4.2 BT of fossil fuels and 0.8 BT of metals. This means tripling of demand for primary materials compared to 2010, particularly the demand for energy carriers, metals and non-metal minerals.

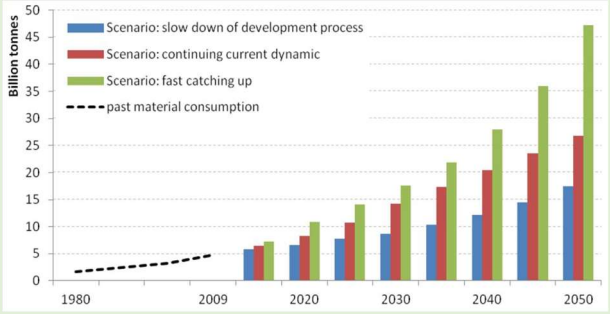

Figure B1.1. India's past material demand and future projections until 2050 (IGEP, 2013 *In NITI Aayog, 2017*)

- Self-sufficiency in mineral raw materials for thermal power generation, iron and steel, ferro-alloys, aluminium, cement and different kinds of refractories.
- Highly import dependent for certain critical materials as Molybdenum (100%), Nickel (100%), Cobalt (100%), Copper (95%), Oil (70%) etc.

Environmental Impact of Material Extraction (Source: OECD, 2018)

Life-cycle environmental impacts quantified for global extraction and production of specific materials show a wide range of environmental consequences linked to materials use, including significant impacts on acidification, climate change, cumulative energy demand, eutrophication, human toxicity, land use, ozone layer depletion, photochemical oxidation, and aquatic and terrestrial eco-toxicity. Regional differences can, however, be large. These impacts are projected to more than double and in some case even quadruple by 2060.

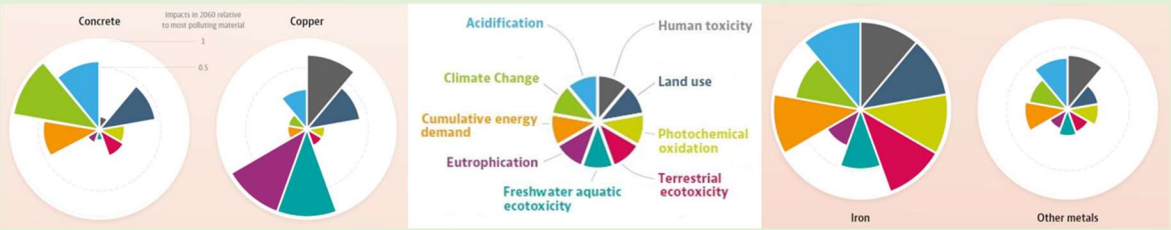

Figure B1.2. Global environmental impacts of materials

Current Policy Landscape:

Multiple policies addressing the issue of resources are in place however, they are all isolated interventions and fail to capture the opportunities of resource efficiency across all the stages of the life cycle. Life cycle thinking towards addressing the larger cause of resource efficiency needed to minimize trade-offs between economic growth and environmental well-being. Collaborative institutional structure is needed to be formed and strengthened to take forward the resource efficiency agenda leading to sustainable development.

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BOX B2. Resource Efficiency is central to Sustainable Development Goals

The 2030 Agenda for Sustainable Development comprises 17 Sustainable Development Goals or SDGs. While attainment of all the SDGs requires to a large extent the sustainable management and use of Earth's natural resource base, no fewer than 12 of the goals (Figure B2.1) refer directly to resources and the environment as fundamental to their achievement (IRP, 2017). SDG Goal 12 - Sustainable Consumption and Production predominantly rely on the principle of resource efficiency.

Figure B2.1. SDGs directly linked with Resource Efficiency

Few of the linkages with SDGs targets are stated below:

- **Goal 2 (End Hunger, Achieve Food Security and Sustainable Agriculture):**
  2.4. By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production …
- **Goal 6 (Availability and sustainable management of water):**
  6.3. By 2030, improve water quality … halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally;
  6.4. By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity...

- **Goal 7 (Access to affordable, reliable and secure energy):**
  7.3. By 2030, double the global rate of improvement in energy efficiency
- **Goal 9 (Build resilient infrastructure):**
  9.4. By 2030, upgrade infrastructure and retrofit industries to make them sustainable …
- **Goal 11 (Make cities and human settlements inclusive, safe, resilient and sustainable):**
  11.1. By 2030, ensure access to adequate, safe and affordable housing and basic services …;
  11.2. By 2030, provide access to safe, affordable, accessible and sustainable transport systems..;
  11.6. By 2030, reduce adverse per capita environmental impact ... special attention to ... municipal and other waste management
- **SDG Goal 12 (Ensure sustainable consumption and production patterns):**
  12.1. Implement the 10 YFP on Sustainable Consumption and Production patterns …;
  12.2. By 2030, achieve the sustainable management and efficient use of natural resources;
  12.3. By 2030, halve per capital global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses;
  12.4. By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle … significantly reduce their release to air, water and soil … minimize their adverse impacts…;
  12.5. By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse;
  12.6. Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle;
  12.7. Promote public procurement practices that are sustainable …;

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BOX B3. Definitions

Natural resources
Natural resources are materials or components found within the environment, that may be transformed to produce benefits as increased wealth or enhanced well-being, and in the process may be consumed. On the basis of origin, resources may be categorized into abiotic and biotic resources. ***Biotic resources*** are obtained from the biosphere (living and organic material) eg. forests and animals, and the materials that can be obtained from them. ***Abiotic resources*** are those that come from non-living, non-organic material including land, fresh water, air, rare earth metals and heavy metals including ores such as gold, iron, copper, silver, etc.

Secondary Raw Materials (SRM) are recycled materials that can be used in manufacturing processes instead of or along with virgin raw materials.

Life Cycle Analysis (LCA)
Life Cycle Analysis is a holistic and systematic assessment of environmental impacts associated with all the stages of a product's life from raw material extraction, material processing, product manufacturing, use and maintenance, disposal or recycling.

Resource Efficiency (RE) and Resource Productivity

Resource efficiency (RE) implies judicious use of earth's limited resources to achieve maximum benefit for sustained human well-being while minimizing the adverse impacts on environment. It is the ratio between a given benefit or result and the natural resources use required for it. While the term ***'resource efficiency'*** is predominantly used in business, product or material context; term ***'resource productivity'*** is used in context of regional or national economy. Resource efficiency reduces waste, drives greater resource productivity, delivers a more competitive economy, addresses emerging resource security/scarcity issues, and helps reduce the environmental impacts associated with both production and consumption.

Circular Economy (CE)

Circular economy (CE) is an alternative to the traditional linear economy in which resources are kept in use for as long as possible, extracting the maximum value, recovering and regenerating products and materials at the end of each service life.

6Rs Principles

6Rs Principle is key to drive resource efficiency and refers to reduce, reuse, recycle, refurbish, redesign and remanufacture. ***Reduce*** means to require less use of material, ***reuse*** is the use of goods or items again by different set of consumers or by re-purposing them for a different use, ***recycle*** means transformation of the good into raw material that can be reshaped into a new item, ***refurbish*** means restoration of a used product for its intended use by performing minor alterations, ***redesign*** means to rethink the design of a product to minimize use of materials, facilitate recyclability and reduce environmental impacts, and ***remanufacture*** means rebuilding a product to specifications of the original product using reused, repaired and new parts

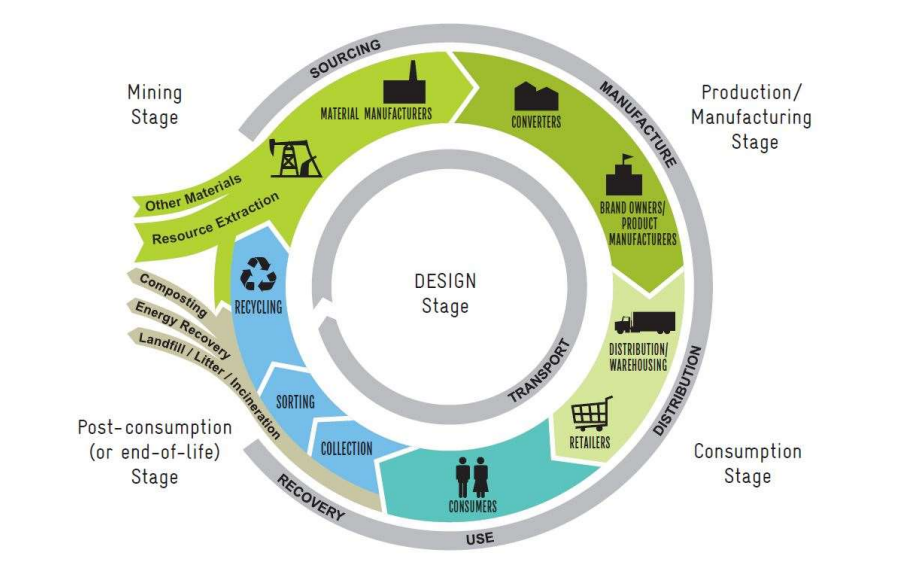

Figure B3.1. Life Cycle approach using 6Rs principle *(Source: www.spcadvance.com In InRP, 2017)*

Each life cycle stage associated with any product or system is intended to be made maximum possible resource efficient using one or more of the 6Rs principles as relevant to that stage, bringing a circular economy approach, so as to minimize the resource use and adverse environmental impacts through the whole life cycle.

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BOX B4. Costs and Benefits of Resource Efficiency

Resource efficiency brings about multiple benefits along the three dimensions of sustainable development - economic, social and environmental. It has enormous potential for cost savings from reduced material use, reduction in social conflicts due to mining, increased job opportunities, reduction in climate change and environmental degradation

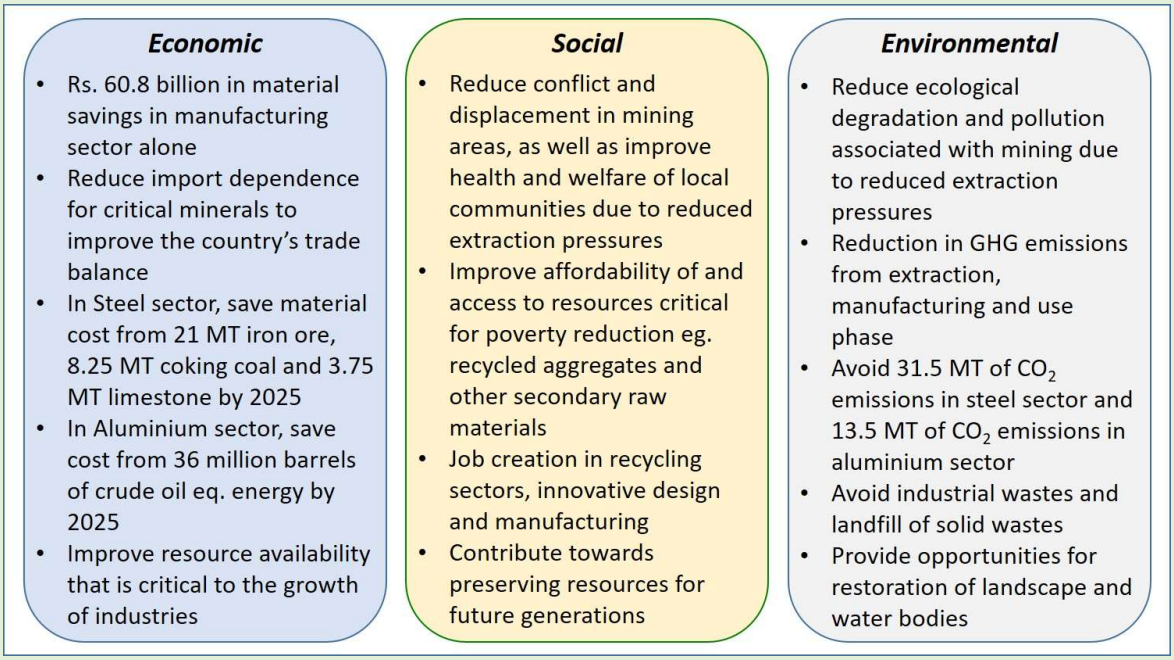

Figure B4.1. Benefits of resource efficiency to India (*NITI Aayog, 2017; TERI, 2019*)

Cost of Resource Efficiency Policy

The multi-dimensional benefits of the resource efficiency will drive the agenda of resource efficiency. Cost savings from the reduced material use and regulatory instruments as polluters-pays-principle, precautionary principle, differential pricing of virgin raw materials, landfill taxes/ban etc. will provide economic impetus to resource efficiency. Consistent, well-defined and efficient pro-resource efficiency and environmental regulations together with the existent support system for SMEs will enhance development of innovative business models to further the cause of resource efficiency.

2. Vision

The National Resource Efficiency Policy envisions a future with environmentally sustainable and equitable economic growth, resource security, healthy environment (air, water and land), and restored ecosystems with rich ecology and biodiversity.

The guiding principles of the policy are set as:

- Reduce primary resource consumption to 'sustainable' levels, in keeping with achieving the Sustainable Development Goals and staying within the planetary boundaries
- Create higher value with less material through resource efficient and circular approaches
- Minimize waste creation and loss of embedded resources at the end-of-life of products

- Ensure security of material supply and reduce import dependence for essential materials
- Create employment opportunities and business models beneficial to the cause of environment protection and restoration

3. Scope

Scope of the National Resource Efficiency Policy encompasses resources and materials used across all life cycle stages of any sector. Resources can be broadly defined to include both biotic and abiotic resources as well as ecosystem services that include air, water, forest, land, metals, minerals, fossil fuels, biomass etc. The National Resource Efficiency Policy covers these resources (biotic and abiotic) across all the life cycle stages including raw material extraction, material processing, production, use, disposal and end-of-life management of any product or system.

3.1. Resources and materials

3.1.1. Water: India has around 4% of world's fresh water, out of which 80% is used in agriculture. Only 48% of average annual precipitation (4,000 billion cubic meters) is absorbed in surface and groundwater bodies. Ground water is a source of irrigation to 65% of the total agriculture area and contributes to about 85% drinking water supply in rural areas and more than 60% of the urban water needs. With dwindling surface water sources, intensive and unregulated extraction of ground water for agriculture and drinking and inefficient water use management, water resources are already acutely stressed in many regions, jeopardizing our progress towards achieving many of the sustainable development goals.

3.1.2. Land and Soil: India supports 18% of the world's human population and 15% of the world's livestock population, but has only 2.4% of the world's land area. Soil degradation in India is estimated to be occurring on 147 million hectares (Mha) of land (out of total land area of 329 Mha). For year 2014-15, economic losses from land degradation and change of area of land use stood at 2.54% of India's GDP, with land degradation alone accounting for 82% of the cost.

3.1.3. Air: Deteriorating air quality in India is emerging as a major threat to human health in particularly in urban areas. Air pollution has been found to contribute significantly to India's burden of cardiovascular diseases, chronic respiratory diseases, and lower respiratory infections. Outdoor air pollution caused 6.4% of India's total Disability Adjusted Life Years (DALYs) in 2016, while DALY estimated from household air pollution was 4.8%, and lead to over 2,750 cases of deaths or severe illnesses per lakh people in 2016.

3.1.4. Fossil fuels: India imports more than 80% of the oil that is processed in the economy and about 85% of its coking coal demand. Their consumption is projected to increase to 4.2 billion tonnes in 2030 as per current trends, meaning that India would have to import about 2/3rd of internationally traded fossil fuels.

3.1.5. Non-metallic Minerals: Extraction of non-metallic minerals, predominantly used for construction has notably grown. In 2010, such minerals constituted 38% of the total material consumption of 5 billion tonnes, and the same is projected to rise to 6.5 billion tonnes in 2030 in a continuing current trends scenario. Mining for extraction of these resources and wastes in the value chain put socio-environmental challenges along with possible increased costs for imports.

3.1.6. Metals: Demand for metals is projected to be 0.8 billion tonnes in 2030 for continuing current trends. Import dependency is nearly 100% for majority of the 'most critical' materials such as cobalt, molybdenum, copper, chromium, nickel, lithium, rare earths that find extensive application in high-end technology industry. Coupled with challenges with extraction, processing wastes and end-of-life product wastes may pose severe import dependency constraint.

3.1.7. Biomass: Biomass is a unique renewable resource and finds applications as source of food and feed, fuel, industrial raw material, and also has numerous ecological functions such as habitat and carbon reservoir. Though India has decades of experience in managing biomass however considerable inefficiencies remain that lead to wastages in the supply chain.

3.2. Life Cycle Stages

Life cycle of any product covers all stages including raw material extraction, material processing, production, use and maintenance, disposal and end-of-life management. There are multiple interlinked economic-social-environmental concerns at each life cycle stage. Figure 3.1 illustrates few of the environmental concerns associated with each life cycle stage, and requires multi-pronged approach to minimise. The policy aims to minimize resource use, minimize adverse environmental impacts, prevent trade-offs and problem shifting at all life cycle stages by adopting the concepts of resource efficiency and circular economy viz. reduce, reuse, recycle, refurbish, redesign and remanufacture.

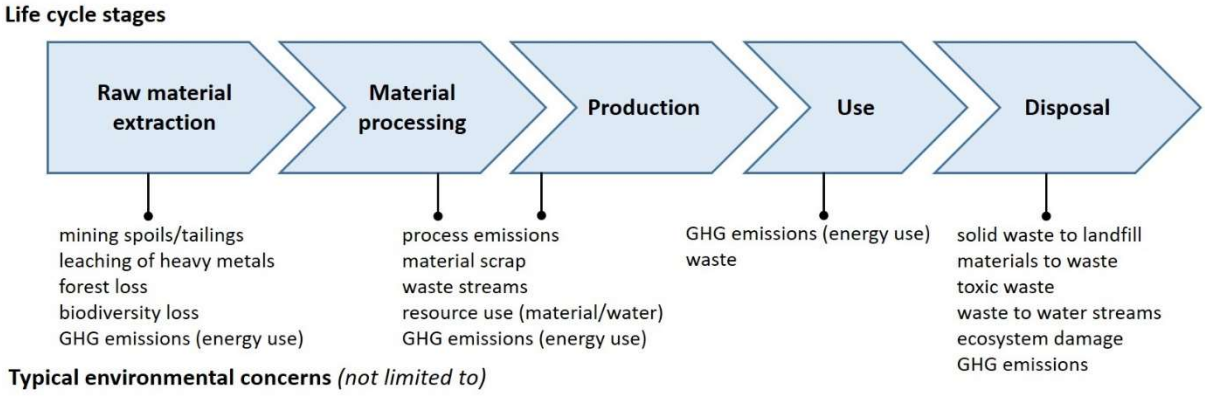

Figure 3.1. Life cycle stages

4. Priority Resources, Materials, Sectors, Indicators and Targets

4.1. Priority resources, materials and sectors

The policy aims to cover all resources (biotic and abiotic), environmental aspects and all sectors across all life cycle stages, necessary for sustainable development. These will include resources and materials (both biotic and abiotic), dependent sectors, waste (or secondary resources) generated from these sectors, few of which are categorized as under (non-exhaustive list):

- **Resources and materials:** Metals, non-metallic minerals, air, water, land, biomass, fossil fuels
- **Sectors:** Construction, transport, plastic, packaging, electrical and electronic equipment, agriculture, metal industry (steel, aluminium etc.), textile, renewable energy (solar, wind etc.), food
- **Wastes:** Municipal solid waste, plastic packaging, waste electrical and electronic equipments, industrial waste

4.2. Indicators

The progress on resource efficiency will be tracked on the set of indicators that will include the established indicators, sector specific indicators, recovery and recycling indicators.

Set of ***established indicators*** will include:

- **Resource Productivity -** ratio of monetary output to resource input
- **Domestic Material Consumption** - total amount of materials consumed by the economy
- **Domestic Material Extraction** - input from natural environment to be used in the economy
- **Direct Material Input** - direct input of materials for use in economy

Sector specific indicators will include amount of resources/primary materials/secondary raw material used and environmental emissions/stressors relevant to the sector

Resources covered in these metrics will include metals, non-metallic minerals, fossil fuels, biomass, water, land, energy

Waste recycling related indicators eg. secondary raw materials recovered, recovery rate, waste to landfill etc. will also be tracked.

The National Resource Efficiency Authority (NREA, proposed in this policy) will specify details (eg. resource type, imports) for established indicators and design sector specific indicators (eg. specific resource/primary material/secondary material use, waste to water/air/soil, waste recycling efficiency) and recycling related indicators in consultation with the concerned stakeholders. The indicators so defined will be made a part of the progress monitoring framework.

4.3. Targets

The targets will complement the sustainable development goals (at minimum) till 2030 and will include targets on environment restoration along with the resource efficiency targets for period beyond 2030. Resource efficiency targets will be developed for each specific sector (and region) by the concerned Ministries (and state governments) in consultation with stakeholders.

5. Institutional Set-up

Institutional set up for design and implementation of the National Resource Efficiency Policy comprises of multiple stakeholders that will work together on developing policies and regulations. The Ministry of Environment, Forest and Climate Change through a dedicated in-house body - National Resource Efficiency Authority - will in coordination with the ministries, state/union territory governments and other stakeholders develop plans, compile information, review progress and undertake tasks for capacity building and others, to forward the agenda of resource efficiency. State governments, industry organizations, scientific experts, civil society organizations, education and research organizations and government funding agencies will form an integral feedback and implementation group.

5.1. National Resource Efficiency Authority (NREA)

Ministry of Environment, Forest and Climate Change is the apex administrative body in the country for regulating and ensuring environmental protection and develops the legal and regulatory framework for the same. National Resource Efficiency Authority (NREA) constituted under the provisions of Section 3(3) of the Environment (Protection) Act, 1986 will be mandated to drive the agenda of resource efficiency across the country.

NREA will have a collaborative structure with a core working group housed in the Ministry of Environment, Forest and Climate Change and a members group with representations from different ministries, state/union territory governments, government agencies and other stakeholders. An inter-ministerial National Resource Efficiency Advisory Board (NREAB) will provide necessary guidance on the aspects critical to the implementation of resource efficiency across all sectors.

NREA will oversee, administer and review implementation of the National Resource Efficiency Policy. NREA will act as a facilitator for cross-sectoral collaborations, regulator for resource efficiency, will be a repository of resource efficiency related data, undertake capacity building of stakeholders, prepare action plan and progress report. Authority for development and implementation of sector and region specific resource efficiency strategies will lie with the concerned ministries and state/union territory governments.

5.1.1. Key functions of NREA

- **Mainstream holistic and integrated approach** to identify and integrate resource efficiency concerns in relevant sectoral and cross-sectoral policies, develop synergies

among regulators and identify emerging areas for legislation, through review and consultation.

- **Develop action plans** with defined time frames, for NREA functions and different sectors in consultation with the stakeholders
- **Establish resource efficiency targets** in consultation with the concerning government agencies and stakeholders for material recycling, reuse and landfilling targets for various sectors.
- **Set standards and guidelines** for reuse of secondary raw materials to address concerns regarding material quality, for product design to make products more durable, make use of secondary materials, and easy to repair and/or recycle.
- **Create and maintain database** of material use and waste generated, recycled and landfilled, across various sectors and life cycle stages and across different regions (states/zones). To this purpose NREA will design database templates which will be fed in by concerned government agencies.
- **Measure progress** on identified resource efficiency indicators by compiling the inventorized database and use them to establish targets.
- **Establish audit mechanisms** with deterrent penal provisions regulated by law, which will be undertaken by the concerning government agencies.
- **Support collaborations** between different stakeholders including government, communities, research institutions and industry associations and also facilitate dialogues with relevant government and foreign agencies on experience sharing, knowledge transfer and governance models for achieving resource efficiency.
- **Provide training and capacity building** to key actors responsible for undertaking or overseeing resource efficiency plans and strategies.

5.2. Shared responsibility of Stakeholders

To achieve Resource Efficiency and foster the transition to circular economy, it is important to have influence, participation and collective action of all major stakeholders including industry, policy makers, government agencies, academic, civil society organizations including non-profit institutions, think tanks and business groups, consumers, and technology developers.

5.2.1 Role of Government

- Set-up in house resource efficiency institution (resource efficiency cell) in their ministry/region to work and coordinate the tasks on resource efficiency in their concerned sector/region
- Develop resource efficiency strategies for their concerned sector/ region in consultation with stakeholders
- Implement the resource efficiency strategies, for their concerned sector/region
- Develop and implement policy instruments and enabling regulatory frameworks for resource efficiency in their concerned sector and/or region.
- Facilitate data compilation on resource efficiency relevant datasets for their concerned sector/region
- Facilitate setting-up of infrastructure for recovery and recycling eg. setting-up of Material Recycling Zones (MRZs) that co-locate recyclers and end use producers with common facilities and shared infrastructure.

- Facilitate industrial symbiosis through setting up of industrial parks and clusters that enable the utilization of the waste of one sector or industry as secondary raw material in another
- Develop quality standards and certification schemes for secondary raw materials to increase the confidence of potential users of the materials
- Set up/accredit testing and research laboratories to assess quality of secondary raw materials
- Institutionalize product labelling requirements that include relevant information about product with information on its safe usage and disposal
- Implement green public procurement that includes procurement of products manufactured from recycled scrap materials, use of recycled materials etc.
- Implement waste segregation at sources in all its offices, residential areas and other establishments
- Incentivise production and consumption of resource efficient products through appropriate fiscal incentives in order to correct for market failures
- Establishment of audit mechanisms and regular inspections regulated by law and imposition of deterrent fines
- Facilitate access to finance for technology and process improvement
- Create a Research & Development Fund to acquire technology for resource efficient design, production and management of waste
- Provide platform for exchange of best practices, research and industry collaboration and peer to peer learning for designing innovative solutions

5.2.2. Role of Manufacturers and service providers

- Integrate design for recovery and recyclability in the product design, improving design of products to be reusable, repairable and recyclable with recyclable and optimised packaging
- Use less (and eventually no) virgin material and more recycled or renewable materials
- Formulate and implement end-of-life management policy as applicable to their industry
- Minimise resource usage and waste generation at each stage, through more responsible and efficient production processes and technology use
- Set up local branches to provide repair, upgrade, refurbishment and maintenance services through their licensed stores or by local actors in the informal sector
- Implement Extended Producer Responsibility for management of end-of-life products
- Collaborate with authorized recycling companies or with Producer Responsibility Organizations (PROs) for end of life management of their products
- Provide training to its employees. For example, those in operations need education in dematerialization and remanufacturing, while those in design need to be trained in eco-design, recyclability, and practices that extend product lifetimes
- Provide consumers with information on product use, management of broken and unwanted products, with emphasis on options for reuse, return through take-back programs, and recycling ahead of disposal and destruction
- Label product parts to facilitate disassembly for source-separated material recovery

5.2.3. Role of Consumers

- Create demand for resource efficient products and services
- Engage in shared use of products (for example car-sharing, outcome oriented services)
- Engage in environmentally safe disposal of their end of life products
- Assume personal responsibility for responsible consumption

5.2.4. Role of Civil Society Organizations

- Undertake awareness generation activities informing benefits of resource efficiency
- Building awareness and advocating use of secondary material use
- Push for long terms targets on aspects such as recycling, landfilling of waste etc.
- Design and initiate innovative mechanisms to bring behavioural change in consumption
- Educate the informal sector managing waste about occupational and safety hazards, pushing for their integration with the formal sector

5.2.5. Role of Recyclers

- Maintain required statutory norms and standards for occupational Health, Safety and Environment at premises
- Engage in training, skill development and research and development for efficient recycling
- Provide opportunities to the informal sector to become part of their formal set-ups and build on their practices and experience

5.2.6. Role of Academia

- Introduce practices of waste sorting, waste collection, recycling, concept of 'Circular Economy' and 'Resource Efficiency' in school and college/university curriculum
- Undertake research on resource flows, life cycle analysis, secondary materials and provide capacity building and technical support for setting up MSMEs/start-ups in the waste sector
- Introduce short training courses on different aspects of resource efficiency such as resource efficient designs, recycling and waste reduction in all public administration, health, engineering, training and education programs
- Engage in multi-disciplinary research and development, establishment and testing of developed frameworks and tools to address the implementation and challenges of resource efficiency

6. Policy instruments

To improve material resource efficiency and promote circular economy, it is necessary to handle all the drivers viz. regulatory instruments, market based incentives and disincentives, public procurement, capacity building of stakeholders, awareness raising and information sharing, and to involve all stakeholders, such as businesses, consumers, communities, scientists and academics. A mix of instruments is able to address the multiple resource domains and contains interacting instruments targeting multiple actors, levels of

455 governance and sectors and life-cycle stages of resource use. **(BOX B5. Case examples of**
456 **policy instruments)**

457 ## 6.1. Addressing regulatory gaps

458 A coherent and future-ready regulatory framework that integrates resource efficiency and
459 circular economy across life cycle stages needs to be developed across various life cycle
460 stages with adequate focus on efficient extraction of resources, fostering design for
461 resource Efficiency and circularity, enhancing implementation of waste management laws
462 and ensuring product recycling across sectors and for different materials.
463

Life cycle stages	Policy instruments
Extraction	• Taxes on virgin materials • Restrictions on mining of materials • Differential pricing • Pricing of virgin materials to internalize cost to environment • Mandating good mining practices
Design	• Life Cycle Assessment based standards • Standards for longevity, durability etc. • Environment technology verification scheme • Research partnerships • Grants for Research and Development
Production	• Product Taxes • Emission or performance standards • Advisory services for SMEs • Soft loans to green SMEs
Consumption	• Deposit refund schemes • Pay-as-you throw pricing for waste collection systems • Product restrictions or bans • Labelling and certification schemes • Behaviourally informed interventions • Green Public Procurement
Recycling	• Tax benefits for recycled materials • Standards for recycled materials • Platforms to match supply and demand of secondary raw materials • Promoting industrial symbiosis • Grants for Research and Development
Waste disposal	• Landfill and incineration taxes • Bans/restrictions on landfill • Information on dismantling products • Take-back schemes • Soft loans to construct waste disposal facilities

464

465 **Figure 6.1. Policy instruments for implementing resource efficiency at different life cycle stages**

466 **Guidelines for best available technology and processes** addressing each life cycle stage is
467 needed to achieve the potential of resource efficiency. **Quality standards for use of**
468 **secondary materials** should be prioritised, followed by more complex standards targeting
469 resource efficiency in the design phase **(design for recycling)** gradually over time. With
470 **mandatory eco-design standards** producers will be encouraged to develop products that do
471 not inhibit the reuse and repair of whole products or their components and generate
472 relevant resource saving potentials. **Transparency about the materials used**, especially in

the case of complex durable goods (such as electronic appliances and devices), is necessary to facilitate methodical deconstruction of products to enhance material recycling opportunities. The amount of recycled content in these goods should also be public information. **Certificates to recognise remanufactured products** as comparable or equivalent to new products need to be designed. **Environmental liability** as a regulatory instrument makes the "polluter" pay for remediating the damage he has caused and is one of the forms of implementing the "polluter-pays" principle.

BOX B5. Case examples of policy instruments

Tax on natural gravel

Sweden, introduced a tax on natural gravel with an objective to promote the use of crushed rock and recycled materials, such as concrete, and thereby address the shortage/limited supply of natural gravel in parts of the country. The tax encouraged substitution of natural gravel with other materials. Between 1996 and 2010 the same was doubled primarily to increase the incentive effects.

Landfill tax

Landfill taxes are successful in mitigating the environmental impacts related to waste disposal, such as contamination of groundwater or soil, methane emissions from decaying organic waste, odour etc. Thus, landfill tax provides incentives for alternative and more sustainable ways of waste disposal. Several countries have 'landfill ban' that indicates how much of a certain types of waste may be landfilled. Revenue from landfill tax may be used for waste management, cleaning up of contaminated sites or other environmental measures.

UK demonstrated a continuously increasing tax level, whereby landfill tax has been increased by £8 per tonne to £80. This has led to closure of landfill sites, thus reducing the number of such sites from 1200 landfill sites in 2001, to 450 landfill sites in 2008/09.

LCA for Green Public Procurement

The Netherlands has adopted Life Cycle Assessment (LCA) using a software tool, DuboCalc, to support Green Public Procurement. DuboCalc calculates the environmental impact of construction materials considering the embedded environmental impacts of raw material extraction and production up to and including demolition and recycling. It also considers the energy consumed by infrastructure works during the use phase. Using LCA data from a built-in database, it calculates 11 environmental impact parameters. It then uses shadow prices (of avoided emissions) to calculate the Environmental Cost Indicator (ECI). The ECI is converted into a monetary value which is a measure of the avoided environmental impact that can be compared with the total cost of the project. The contracting authority may then use the most economically advantageous tender (MEAT) criterion to identify the preferred tender in a way that takes into account resource efficiency.

An important advantage of this approach is that it monetises the environmental impact, thus allows environmental factors to be considered in the framework of MEAT which is a commonly used criterion in public procurement.

6.2. Design of innovative market based instruments

It is fundamental to 'get the prices right' through internalising environmental costs and implementing the precautionary principle and polluter-pays principle. Market based instruments have the potential to take into account issues of equity and competitiveness

concerns in its design and help in transforming economies to become greener. These typically include fiscal instruments in the form of taxes, charges, subsidies, incentives and budget allocations, marketable permits, deposit-refund systems and performance bonds. These instruments can also help generate revenue for environmental and social purposes.

Taxes must incorporate the cost of externalities and better reflect the effects of extraction and value creation and may range from taxes on extraction to taxes and fees on generating hazardous waste. **Tax exemptions for components using recycled material** in the product value chains will help promote resource efficiency from the supply side, whereas **tax sops for eco-labelled products** to encourage consumers to purchase such products will help promote resource efficiency from the demand side. **Rationalization of tax regime to make secondary raw materials price-competitive** and incentivize businesses to enter remanufacturing, refurbishing and recycling sectors. **Subsidies or tax holidays** could be provided to businesses engaged in providing remanufactured/refurbished/recycled products and related services. **Grants or financial support** for cleaner and resource efficient technologies and innovative circular start-ups, is crucial to the innovation ecosystem and could be given to provide for the viability gap funding. Over time, it will be extremely important to move towards zero landfill. For this, it will be important to **dis-incentivize landfilling** by imposing landfill taxes, high tipping fees especially for bulk generators of waste, thereby encouraging the optimal use of material and redirecting of waste to appropriate channels for their management.

6.3. Green Public Procurement

Preferential procurement of products with lower environmental footprints, by large organizations, public or private, can be used to aggregate demand and create scale for products made from secondary raw materials, thereby bolstering market demand.

Public tenders that include **quotas for locally sourced materials** could be designed. **Green procurement guidelines** providing information on resource efficiency criteria to be used in the procurement processes for the prioritized products/service categories. **Circular procurement** (such as leasing or sharing options, or procurement of repaired and second-hand goods) can encourage the availability of more take-back options and third-party arrangements, e.g. between manufacturers and remanufacturer and/or recycling businesses. **A comprehensive and well-designed national level Sustainable Public Procurement (SPP) policy** can be a key instrument to promote Resource Efficiency in the economy, in addition to helping meet many other environmental goals.

6.4. Supporting recycling and recovery structures

Holistic transformation of country's waste management sector into a secondary resource recovery sector, coupled with its integration with the manufacturing sector, is a must to implement and promote circular economy. There is also the need to standardise materials and components to facilitate re-use, recovery and recycling.

Material Recovery Facilities (MRF) needs to be set up equipped with best available technology systems for efficient end-of-life collection, effective sorting after collection, and then the optimum suite of physical separation and metallurgical technologies for an

economically viable recovery of metals from the sorted recyclables. MRF operators should also enter into **collection contracts with industrial and commercial establishments** to gain additional sources of recyclables and should also **adopt buyback schemes** in coordination with the collection contractor. **Protocol should be developed for MRFs**, with clear minimum standards and criteria for the processing of recyclables to produce consistent, high quality streams of recyclable material. Common testing infrastructure should be set up which should be accessible to recyclers and provide them with a strategic, lower-cost approach to assess the quality of the recovered secondary raw material.

6.5. Strengthening product responsibility - Extended Producer Responsibility (EPR) and Shared Responsibility

Extended Producer Responsibility (EPR) has the potential to reduce the cost of end of life management of the products that is borne by tax payers and municipalities, and also incentivize integration of sustainability measures into the design of products, including design for value recovery.

EPR systems should be accompanied by **reporting and monitoring mechanisms** and could be supported by the creation and accreditation of **more Producer Responsibility Organizations** (PROs). The PROs, as contractors to the EPR system, need to design appropriate collection schemes which are adapted to the various local situations and carried out in cooperation with the local municipality. These collection schemes could be innovative and based on a register to be compiled of waste streams. Collection costs to be covered by the PROs **must cover the entire cost of end of life management** of the product. **Setting up of EPR waste-recovery targets** should be encouraged. **EPR principles need to be extended to other sectors** including automobiles, paper and cardboard, tyres and container glass industries, enabling systematic framework for collection and recycling of such material

6.6. Creation of resource efficient business models

Resource efficient business models must lead to value creation or profit for enterprises so that more and more companies are motivated to get involved. Business models for collaborative consumption and shared economy may be evolved. While some business models may be viable based on market prices there could be a need for government support through direct subsidies, viability gap funding, mandatory public procurement, networking and dissemination of solutions as well as regulation to accelerate adoption of certain technologies and/or practices.

Viability Gap Funding (VGF), which entails supporting projects till they can be financially self-sustaining, can enable firms to meet high initial costs and address long payback periods and also support scaling up or technology up-gradation. Local governments can provide **seed-funding for circular business models** that are suitable to the local context. Business models based on green technologies can be encouraged by using levers like **Public Private Partnership (PPP) models**. Creating a **dedicated Green Fund** to invest in emerging technologies, setting up Green science parks which promote collaboration between businesses, research institutions and universities and providing **fiscal incentives for early adopters** are also important instruments.

6.7. Awareness and capacity development of stakeholders

A robust awareness generation campaign and marketing strategy (along with labels and standards) is required by involving the consumer bodies, government, and these campaigns towards knowledge dissemination by showcasing benefits that directly and indirectly accrue to consumers as a result of lower environmental impact of the resource efficient products. The multi-stakeholder character of environmental issues and continuous developments in the field of environment, make it necessary to have a continuing focus on capacity building in all concerned institutions: public, private, voluntary, academic, research, and the media.

Waste related information should be provided to different stakeholders. To better account for the influence of raw material imports and hidden flows, a **material footprint approach** should be developed. **Education** about value of resources, sorting of waste types, proper collection routes, resource efficient technologies from an early age will play an important role in bringing about the needed behavioural change. **Capacity building should be done for local administration**, particularly the institutions of the municipality to support public policies and initiatives in the field of resource efficiency, among **students and entrepreneurs** to conceptualize, design and develop new RE/CE related services, products and co-operation frameworks, and **among citizens** to foster circular economy awareness, sharing and their participation and contribution. Informal sector involved in waste collection and sorting should be **integrated into formal sector** that uses newer processes of waste management. For this, **technical support to entrepreneurs** will encourage them to set up new businesses and create new employment opportunities. **Joint ventures** can also address issues associated with technology access and transfer, and enable cross-country learning, building domestic capacities.

6.8. Strengthening research and knowledge base

Research and Development (R&D) support should be oriented towards producing resource efficient solutions and the development of resource-efficient products and services. R&D to improve process efficiency and for introducing new processes that decrease the use of hazardous and rare materials in the production process and consequently improve the recyclability and resource recovery potential of materials at the end of life and help generate less waste should be encouraged and supported.

R&D should develop sound methodologies to carry out the **inventorization and characterization** of major waste streams. **Industrial training networks** should be supported where appropriate in order to deliver the required courses and skill sets needed for a resource efficient and low-carbon economy. It is important to **improve the knowledge and decision base for the secondary raw material sector** with databases and dynamic forecasting models. This will permit targeted analysis and assessment of volumes and types of waste and what percentage of the stock will be available as a source of secondary raw materials that can help substitute the virgin raw material in the future.

7. Action Plans

Action Plans with timeframe of 3 financial years will be prepared by NREA in consultation with concerned ministries, state/union territory governments, government agencies and stakeholders. Resource efficiency strategies will be developed for specific sectors and regions by the concerned governing authorities (Central Ministries/State Governments) in consultation with stakeholders, which will lay out sector/region specific scope, targets, timelines, action plans and interventions. NREA will adopt these resource efficiency strategies into the 3 year Action Plans, for monitoring and reviewing progress, in consultation with concerned government authorities (Central Ministries/State Governments), agencies and stakeholders.

Action Plans will lay out distinct tasks for NREA and implementing sectors with specific milestones and deliverables. The action plans will be guided by the long-term goals of the National Resource Efficiency Policy and developing sound supporting ground rules for markets to innovate and comply with resource efficiency targets will be set as part of the action plans.

To this effect the First Action Plan for the National Resource Efficiency Policy has been prepared as - Action Plan (2019 - 2022) and provided in this policy document. Action Plan (2019 - 2022) covers setting-up of dedicated required institutional structure of NREA and NREAB, data and indicator, capacity building, policy instruments, sectoral resource efficiency strategies, regional resource efficiency strategies, research and development, progress report and next action plan.

8. Monitoring Progress

Monitoring of progress of the action plans is critical to the successful implementation of resource efficiency. NREA will lay out the targets, set of inventory data points on which reporting by concerned sectors will be made, resource efficiency indicators and reporting time frames. Concerned implementation agencies will lay out simple and effective monitoring frameworks for respective sectors and will be responsible to provide data points inputs to be fed into the national database. Progress on tasks undertaken for capacity building, pilot studies, research and development will also be reported by the concerned stakeholders to NREA. NREA will compile the data into resource efficiency indicators and prepare 'Progress Report'.

The review of the progress will form an integral part of developing next Action Plan to further the agenda of resource efficiency.

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646 ACTION PLAN (2019 - 2022)

647 Action plan establishes tasks to be undertaken and their expected timelines.

Action Points			Agency	Timeline*
1.	**Institutional Set-up**	Set-up National Resource Efficiency Authority (NREA)	MoEF&CC	Q3 - Q4 2019
		Constitute National Resource Efficiency Advisory Board (NREAB)	Inter - Ministerial	Q3 - Q4 2019
2.	**Data and Indicators**	Identify inventory data points and indicators to be reported upon at different levels (sectoral/regional)	NREA in collaboration with stakeholders	Q4 2019 - Q1 2020
		Identify resource efficiency indicators to be reported in progress report	NREA in collaboration with stakeholders	Q1 2020
		Prepare database template and its user manual	NREA	Q4 2019 - Q2 2020
		Prepare framework for data collection, compilation and monitoring and evaluation	NREA in collaboration with EU-REI and stakeholders	Q2 - Q3 2020
		Reporting of Baseline data for selected sectors	Concerned Sector/State governing authority	Q3 2020 - Q4 2021
		Data Report (Baseline and Progress)	NREA	Q4 2021 - Q1 2022
3.	**Capacity Building**	Capacity building of state government/agencies on resource efficiency	NREA in collaboration with EU-REI and other funding agency	Q3 2019 Q1/Q3 2020 Q1/Q3 2021
		Capacity building of state government	NREA in	Q1/Q3 2020

		and sectoral stakeholders on indicator framework and monitoring	collaboration with EU-REI and other funding agency	Q1/Q3 2021
		Generic RE Manuals, Brochures and Videos - Innovative Communication Tools for visibility	NREA in collaboration with EU-REI	Q3-Q4 2019 Q1 2020
		Support Start-Ups and other agencies in development and commercialisation of Waste Exchange Platform	NREA in collaboration with EU-REI	Q3 2019 - Q2 2020
4.	**Policy Instruments**	Identification of products/sectors for which Eco-mark scheme be revised, strengthened and developed	NREA in collaboration with BIS and stakeholders	Q4 2020
		Work on development of standards for secondary raw material for selected secondary materials	BIS	Q4 2020 - Q3 2021
		Development of resource efficiency sectoral standards	NREA in collaboration with EU-REI, TERI and stakeholders	Q3 2019 - Q2 2020
		Deliberation on regulatory instrument (tax/ban on disposal to landfill) and Green Public Procurement	NREA and Stakeholder Ministries	Q2-Q3 2020
		Deliberation on strengthening and implementation of EPR	NREA and Stakeholders	Q2-Q3 2020
		Report on deliberations undertaken on policy instruments for resource efficiency	NREA	Q1-Q2 2021
5.	**Sectoral Resource Efficiency Strategy**	Develop sectoral resource efficiency strategies	Concerned Ministries with stakeholders	Q3 2019 - Q1 2022
		Adoption of resource efficiency targets as developed by concerned ministries into Action Plan as per	NREA in collaboration with	Q4 2019 - Q1 2022

		National Resource Efficiency Policy	Stakeholder Ministries and agencies	
		Development of Sectoral Toolkits on Resource Efficiency and Circular Economy	NREA in collaboration with EU-REI and TERI	Q4 2019 - Q1 2020
		Co-ordination with Ministries to cover more resources, sectors and life cycle stages for resource efficiency	NREA with stakeholder ministries	Q3 2019 - Q1 2022
6.	**Regional Resource Efficiency Strategy**	Develop regional resource efficiency strategies	Concerned State/Union Territory Government with stakeholders	Q3 2019 - Q1 2022
		Adoption of resource efficiency targets as developed by concerned state/union territory government into Action Plan as per National Resource Efficiency Policy	NREA in collaboration with Stakeholder State/Union Territory Governments and agencies	Q4 2019 - Q1 2022
		Co-ordination with State/Union Territory Governments to cover more resources, sectors and life cycle stages for resource efficiency	NREA with stakeholder State/Union Territory Governments	Q3 2019 - Q1 2022
7.	**Research and Development**	Organize workshop on Life Cycle Assessment	NREA in collaboration with funding agency	Q4 2019 Q4 2020 Q4 2021
		Identify sectors with need and scope of resource efficiency improvements and develop strategies for same	NREA in collaboration with EU-REI and TERI	Q1 2020 - Q4 2021
8.	**Action Plan**	Report on progress on Resource	NREA	Q1 2022

		Efficiency Action Plan (2019 - 2022)		
		Prepare Resource Efficiency Action Plan (2022 - 2025)	NREA in collaboration with stakeholder Ministries/State governments	Q1 2022

*For National Resource Efficiency Policy adopted in Q3, 2019.

(Q1 - January to March, Q2 - April to June, Q3 - July to September, Q4 - October to December); in consultation with stakeholders

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ANNEXURES

A. Chronology of National Resource Efficiency Policy, 2019

1. Constitution of India Resource Panel (InRP) in 2015

Ministry of Environment, Forest and Climate Change, Government of India constituted India Resource Panel (InRP) in 2015 to mainstream resource efficiency in policy formulation and in order to foster its implementation. The objective of the India Resource Panel was to advise the Government of India and relevant stakeholders on the potential for enhancing resource efficiency and the productive use of secondary raw materials. In addition, the panel made efforts to raise the issue's importance on the political agenda. In line with global best practices and on the basis of a rigorous policy analysis, the Panel came out with recommendations in April, 2017 that stressed that fostering Resource Efficiency would be achieved at scale only through enabling policy framework (InRP, 2017)

2. Joint Declaration of Intent with EU-REI and Memorandum of Understanding with TERI (June, 2018)

The Ministry of Environment, Forest and Climate Change signed a Joint Declaration of Intent with EU-REI and a Memorandum of Understanding with TERI in June, 2018.

3. Re-constitution of Resource Efficiency Cell at Ministry of Environment, Forest and Climate change in October 2018

The Ministry of Environment, Forest and Climate Change constituted Resource Efficiency Cell (RE Cell) with aim to institutionalize resource efficiency for sustainable consumption and production in policy and practice. Key functions of RE Cell are policy formation, knowledge management, capacity building and mainstreaming of resource efficiency. The RE Cell was re-constituted in October, 2018. The erstwhile India Resource Panel (InRP) was re-constituted as Resource Efficiency Steering Committee (RESC) in November, 2018, as an advisory committee to the RE Cell. The re-constituted RE Cell undertook the task to draft National Resource Efficiency Policy for India with aim to institutionalize resource efficiency and circular economy approach.

4. Initiatives by NITI Aayog

NITI Aayog along with EU Delegation to India prepared a Strategy paper on Resource Efficiency in November, 2017 (NITI Aayog, 2017). In January, 2019 NITI Aayog released four Strategy papers in the area of resource efficiency in Steel industry sector (with the Ministry of Steel), Aluminium sector (with the Ministry of Mines), Construction and Demolition sector

(with the Ministry of Housing and Urban Affairs) and E-Waste sector (with the Ministry of Electronics and Information Technology) (NITI Aayog (a,b,c,d), 2019). Status paper on Resource Efficiency and Circular Economy was also released in January, 2019 (NITI Aayog(e), 2019)

5. Works by TERI and EU-REI

Under the EU-REI project, consortium of GIZ, TERI, CII and Adelphi undertook sectoral assessment studies on potential and recommendations for implementation of resource efficiency. In September, 2018, four sectoral studies for resource efficiency strategies in solar photo voltaic sector, electric vehicles sector, construction and demolition sector and plastic and e-waste were completed (EU-REI (a,b,c,d), 2018).

Reference Report for Integrated Resource Efficiency Policy for India was prepared by TERI and submitted to the Ministry in April, 2+019.

6. Consultations on Draft National Resource Efficiency Policy

The draft National Resource Efficiency Policy was led through multiple rounds of consultations and comments so received were duly deliberated and incorporated. After initial internal consultations, the draft NREP was taken to the Resource Efficiency Steering Committee (RESC) that draws experts from government, international institution, industry association, academia, civil society among others. Revised draft, incorporating the comments was then put in public domain for consultation.

B. Sectoral Resource Efficiency Strategies

The National Resource Efficiency Policy aims to implement resource efficiency across all relevant resources including metals, minerals, fossil fuels, biomass, air, water, land, forests etc. and across all life cycle stages including raw material extraction, material processing, production, use, end-of-life management.

Towards this purpose, resource efficiency strategies for different sectors (resources/material/commercial sector/life cycle stages) and regions (state/union territory) will be developed by the concerned governing authorities (ministries/state governments) in consultation with the stakeholders. These strategies will layout the scope, baseline, life cycle approach, targets, interventions and plan. NREA with its collaborative institutional structure will facilitate development of these strategies, and adopt them into the 3 year Action Plan for the purpose of review and monitoring progress on the identified resource efficiency indicators.

At this point, resource efficiency strategies are provided for seven sectors - automotive sector, plastic packaging sector, building and construction sector, electrical and electronic equipment sector, solar photo voltaic sector, steel sector and aluminium sector - across the life cycle stages of manufacturing and/or post-consumer waste management. These sectoral strategies are drawn from the sectoral assessment studies done under EU-REI project, resource efficiency strategies developed by NITI Aayog, reference report for NREP and consultations with selected stakeholders by TERI. Factors that have been taken into consideration towards selection of hotspot sectors for assessing resource efficiency benefits include sectoral income share, use of critical raw materials and their import dependency. A summary of sectoral contribution to national income, use/generation of raw materials, import dependency of raw materials (virgin/scrap), are presented in Table B.1.

These brief strategies are only indicative and are provided mainly to illustrate and mainstream the life cycle approach as a key element of developing any of such strategies. As yet, these strategies have limited scope in terms of resources, life cycle stages etc. and are provided in this document to initiate early take-up of these sectors for implementing resource efficiency. With formal establishment of NREA and expected participation of line ministries to grow, detailed resource efficiency strategies will be developed for all biotic and abiotic resources, across all sectors and life cycle stages.

Table 4: Sectoral relevance based on share in national income, use of raw materials (including import dependency)

S.No	Economic Sectors	Share in national income	Selected raw materials	Import dependency
1.	Automobile sector (including electric vehicles)	7.1 %	**Internal Combustion Engine Vehicles (ICEV)**: Steel, Copper, Aluminium, Zinc, Nickel, Lead, Glass, Rubber, various plastics/synthetics **E-vehicles**: Lithium, Cobalt, Nickel, Rare Earths, various plastics/synthetics, Steel, Copper, Aluminium	Copper (50-60%), Lithium (100%), Cobalt (100%), Aluminium scrap (90%), Steel scrap (20%-25%), Lead (75%), Rare Earths (100%)
2.	Chemicals (plastics)	2 % (0.5 % - 0.8 %)	Crude oil	Oil (80 %)
3.	Building and Construction	9 %	Cement, Limestone, Clay bricks, Steel, Aluminium, Copper	Aluminium scrap (90%), Steel scrap (20% - 25%), Copper (50% - 60%)
4.	Electronics (including E-waste)	1.8 %	Gold, Silver, Rare Earths, Plastics, Platinum, Copper	Silver (75%), Rare Earths (100%), Gold (90%), Platinum (95%), Copper (50% - 60%)
5.	Solar PV	2.1%	Aluminium, Silver, Copper, Silicon	Aluminium scrap (90%), Silver (75%), Copper (50-60%)
6	Steel	2%	Iron ore, Molybdenum, Nickel, Tugsten	Steel scrap (20% - 25%), Molybdenum (100%), Nickel (100%), Tugsten (100%)
7.	Aluminium	0.8%	Bauxite, Aluminium scrap	Aluminium scrap (90%)

Source: Annual Survey of Industries (2015), NIPFP (2016), MoSPI (2017) *in TERI, 2019*

B.1. Automotive Sector

1. Introduction

The automotive sector, comprising of the automobile and auto component manufacturers, is one of the key sectors of the economy, having extensive forward and backward linkages. With more than 35 automobile manufacturing companies in the country, the industry contributes to more than 7% to India's national income and accounts for 7-8% of India's total employed population. However, growing use of internal combustion engine vehicles (ICEVs), increased road congestion and the consequent impact on tailpipe emissions, is increasingly posing threat to ambient air. This, indirectly, is creating opportunities for electric vehicles (EVs) on Indian roads. The government of India has demonstrated a strong commitment in introducing electric mobility in India and targets to increase the share of electric vehicles from its current level of less than 1% to nearly 30 % by 2030 while the share of electric buses is expected to reach as high as 100%. This implies that by 2030, the total number of electric two wheelers on Indian roads would be 211 million, and cars and buses will be around 34 million and 2.5 million respectively.

Total material demand for ICEVs is expected to increase from 14 million tonnes to 100 million tonnes by 2030. EVs will also require many newer materials for enhanced performance over ICEVs, particularly for manufacturing batteries and powertrain. Since the volume of production of electric vehicles that run on lithium batteries is currently limited, the demand for related materials is currently insignificant. Consumption of materials by 2030 for EVs will increase significantly from its current level of 0.03 million tons to 11 million tons. Ferrous metals will contribute to 53% of the total estimated demand, followed by 17.4% of plastics and synthetics, 2.5% of aluminium and 7.2% of copper. Price volatility, dwindling domestic materials availability and sharp increases in imports of critical materials, calls for tapping opportunities in improving material consumption along their value chain through resource use, recovery and recycling.

2. Life Cycle Approach for Automotive Sector

Figure B.1 illustrates typical environmental concerns and other resource efficiency related issues with the life cycle stages associated with the value chain of automotive sector. This sectoral strategy primarily focusses on the end-of-life stage of the sector.

3. Proposal for Action

A successful resource efficient automotive sector will need a very strong and financially viable end-of-life vehicle (ELV) management in India. Central Pollution Control Board has estimated that more than 8.7 million vehicles had reached the ELV status in 2015, and by 2025, the number of ELVs is estimated to reach over 21 million. Further, the recent ban on diesel vehicles by the National Green Tribunal implies that more vehicles will soon end up as ELVs. These vehicles usually end up reaching the un-organised dismantling centres. Auto components are either refurbished or sent for recycling. Efficiency of material recovery is

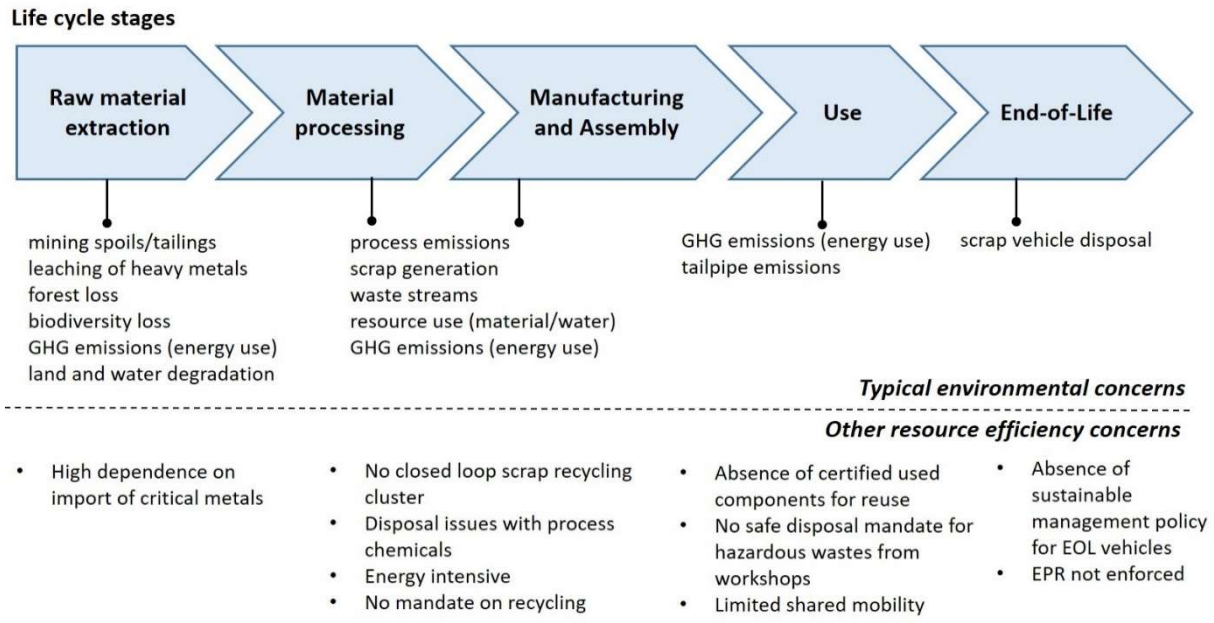

Figure B.1. Life cycle stages across value chain and related RE concerns

very low due to inefficient dismantling. CPCB had issued guidelines to regulate the sector in an environmentally friendly manner, recommending a system of "shared responsibility" involving all stakeholders - including government, manufacturers, dealers, insurers, consumers and recyclers. The guidelines also state that if large quantities of metal and other materials present in ELVs are salvaged or recycled, it can once again be used by various sectors, thus reducing the demand for virgin raw materials.

4. Needed Interventions

- Define ELV based in age, mileage and emission criterion
- Setting up of collection centres, which would collect vehicles from owners and carry out the deregistration process
- Setting up of de-pollution centres to remove hazardous materials from the vehicles. It will also be their responsibility to safely dispose the harmful materials
- Setting up of shredding centres which would segregate materials for recycling
- Introduction of recycling targets on dismantlers
- Careful separation at the de-pollution units and that could be sold to retailers or to used-part dealers with warranty
- Development of guidelines/Standard Operating Procedures (SOPs) by vehicle manufacturers to dismantle model and type of vehicle, which can prevent damage to components and encourage reuse of parts through proper channels and further label components for identification of materials for proper segregation and down-cycling

- Encourage material substitution and promote use of recycled materials in new ICEV and EV fleets

5. Targets

- 75% recycling rate for vehicles manufactured before 1990, 85% recycling rate for vehicles manufactured between 1990 and 2000, and 90% recycling rate for vehicles produced after 2000
- Establish 20 official dismantlers and equal number of PRO across major urban centres, by 2020
- Use of recycled materials in commercial vehicles and passenger vehicles to 25% of the kerb weight by 2030

B.2. Plastic Packaging Sector

1. Introduction

The plastics industry is characterized by a relatively high level of market concentration in upstream processes vis-à-vis low levels of concentration in downstream processes. With regards to upstream processes, industrial manufacturers control the market for supply of polymers alongside 200 equipment manufacturers which cater to roughly 30,000 plastic processing units. Further downstream, collection and recycling are mainly dominated by the informal sector with about 1.5 million workers in total, catering to around 4,000 informal and 3,500 informal recycling units (FICCI, 2017). Hence, downstream processes tend to be dominated by micro-, small and medium sized enterprises which specialise on certain end-use applications and processing technologies for injection moulding, extrusion, blow moulding etc.

The most common forms of plastic polymers on the market include Polyethylene terephthalate (PET), High density polyethylene (HDPE), Low density polyethylene (LDPE), Polyvinyl chloride (PVC), Polypropylene (PP) and Polystyrene (PS). There are a multitude of end use applications for these polymers which vary considerably across different national contexts and are swiftly replacing traditional materials due to their flexibility and unique set of properties. Packaging industry is the largest consumer of polymers in India. PE and PP accounted for around 33% and 29% of polymer usage respectively, followed by PET (17%), PVC (7%) and others (14%) in 2016 (FICCI, 2016).

Plastic waste is a critical concern as it contributes to 8% of the total solid waste (CPCB). Households generate maximum plastic waste, of which water and soft drink bottles form a large number. In India, around 43% of manufactured plastics are used for packaging purpose and most are of single use type. Multi layered plastics are categorized under either recyclable, energy recoverable or with some other alternate use, but their recycling is an expensive process.

2. Life Cycle Approach for Plastic Packaging Sector

Figure B.2 illustrates typical environmental concerns and other resource efficiency related issues with the life cycle stages associated with the value chain of plastic packaging sector sector. This sectoral strategy primarily focusses on the end-of-life stage of the sector.

3. Proposal for Action

Plastic Waste Management Rules (including the EPR) has become a central tool within the Indian waste policy landscape to address plastic pollution in India. However, monitoring and enforcement systems are yet to be fully implemented for effective implementation at sub-national level.

EPR schemes are needed to be complemented by policy instruments to support wide-spread adoption of secondary raw materials in markets. Typical instruments to facilitate this

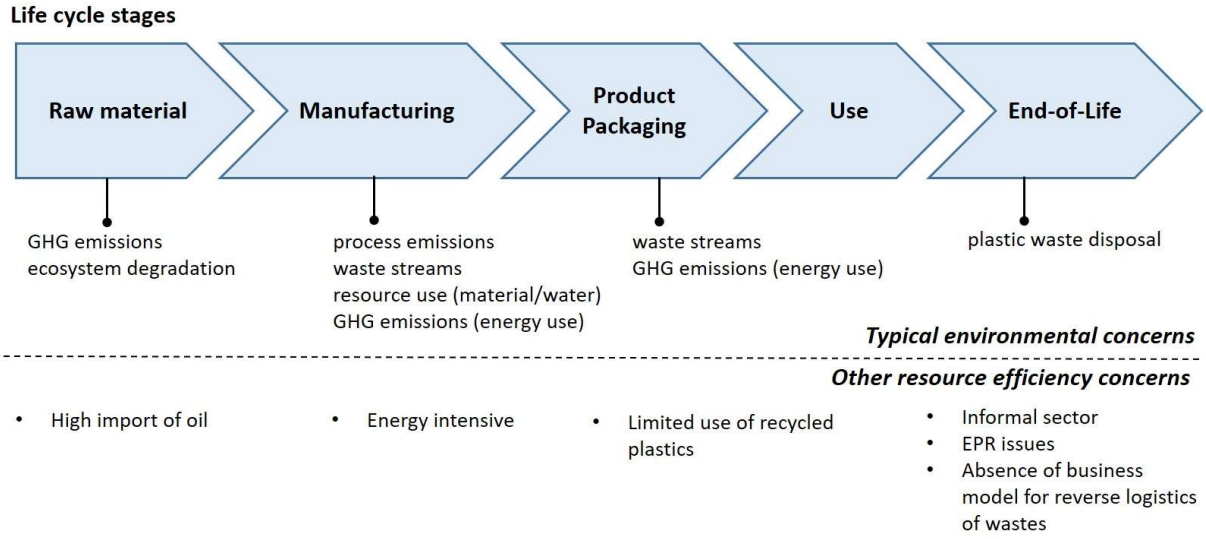

Figure B.2. Life cycle stages across value chain and related RE concerns

process are standards for secondary raw materials (SRM), which is a major barrier to uptake of recycled materials and create demand for SRM. By developing and facilitating the adoption of standards, this uncertainty can be minimized and manufacturers could be encouraged to substitute virgin feedstock with recycled materials in their production processes.

4. Needed Interventions

- Explore strengths and weaknesses of different implementation mechanics for EPR schemes at a pan-Indian scale
- Establish minimum requirements for EPR schemes in India to streamline implementation processes and create administrative synergies
- Promote large-scale formalization of the informal economy through dedicated guidelines, establishment of institutional framework and tailor made capacity building programmes
- Strengthen capacities of CPCB and SPCBs in order to monitor and evaluate the implementation of Plastic Waste Management Rules.
- Mandate step-wise introduction of minimum recycled contents in plastic (packaging) across selected target sectors
- Inclusion of collection targets into Plastic Waste Management Rules to ensure full accountability of producers
- Uptake of innovative and resource efficient processing technologies and inclusive business models to support environmentally sound recycling process which integrate the informal sector

- Introduce certification schemes in the field of CE and RE for high-priority packaging products

5. Targets

- 100% recycling and reuse rate PET plastic by 2025
- 100% recycling of PET plastic and 75% recycling and reuse rate of other plastic packaging materials by 2030
- Ban on disposal of recyclable waste (plastics, metals, glass, paper, cardboard and biodegradable waste) to landfills by 2025

B.3. Building and Construction Sector

1. Introduction

More than 30% of India's population lives in urban areas and it is projected that over 40% of the population will be living in urban areas by 2030 (UN State of the World Population report). It is estimated that almost 70% of buildings supposed to exist by 2030 are yet to be built. Such demand for infrastructure will rely heavily on raw materials like sand (for concrete and mortar), soil (mostly for clay bricks), stone (for aggregates) and limestone (for cement). The key challenge will be to make materials available in a manner that takes into consideration exhaustible nature of these resources and as well as address ecological impacts associated with their extraction and processing.

A new construction (including repair) may lead to waste generation in the range of 45 to 50 kg/sqm, however, demolition can lead to waste generation of 425 kg/sqm. India's annual consumption of sand is estimated at 750 million tonnes, while 350 million m^3 of soil is used mostly for manufacturing of clay fired bricks. Annually 2 billion tonnes of stones are used for making aggregates. Further 242 limestone million tonnes is consumed in cement plants to manufacture 297 million tonnes of cement a year. A substantial share of the new demand can be met using the waste of the existing stock. For resource efficient construction sector, companies need to make manufacturing of sustainable construction products from recycled materials. Dependence on virgin materials needs to be gradually reduced and enhanced reuse of the construction and demolition wastes needs to be adopted.

2. Life Cycle Approach for Building and Construction Sector

Figure B.3 illustrates typical environmental concerns and other resource efficiency related issues with the life cycle stages associated with the value chain of building and construction sector. This sectoral strategy primarily focusses on the end-of-life stage of the sector.

3. Proposal for Action

The responsibilities for managing the C&D waste rests with the local bodies. To effectively implement the Construction and Demolition Waste Management Rules, 2016, it is extremely critical to identify and notify designated areas where consumers responsible for demolition can dump the C&D waste. The C&D waste management rules mandates provision for giving incentives for use of material made out of construction and demolition waste in the construction activity including in non-structural concrete, paving blocks, lower layers of road pavements, colony and rural roads. Property taxes need to be rationalized periodically and funds can be allocated not only for incentivizing product development from recycled C&D waste but also possibly supporting demonstration projects.

As a part of the mandated public procurement of materials made from C&D waste, the Urban Local Bodies (ULBs) need to explore suitable construction avenues recreational parks,

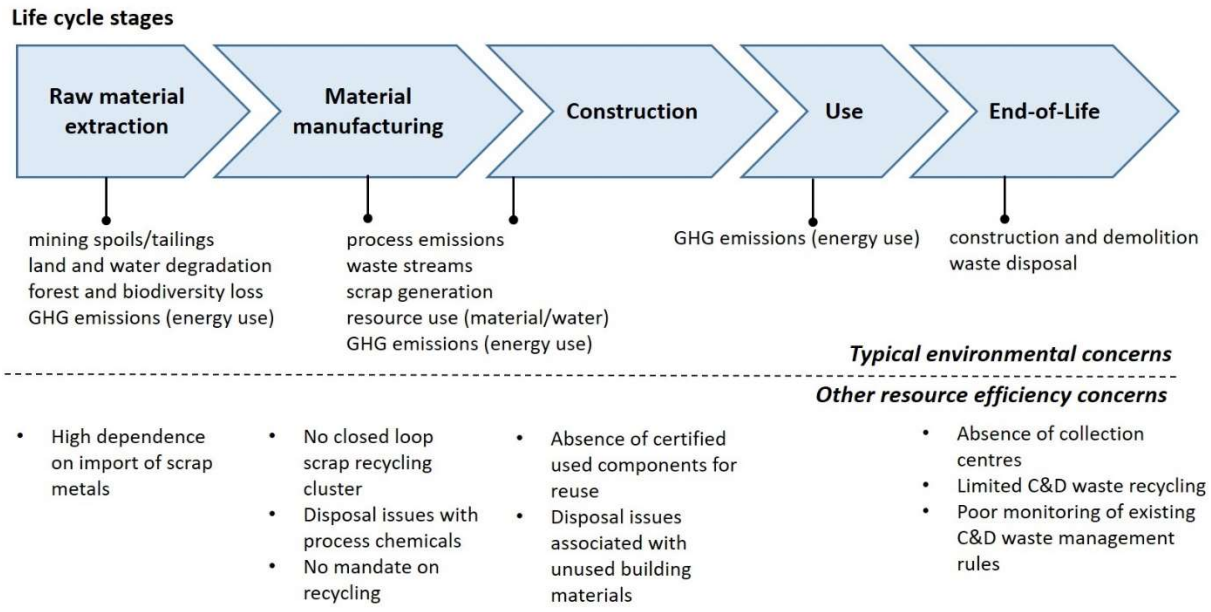

Figure B.3. Life cycle stages across value chain and related RE concerns

roads, pavements, filling of pits, and constructing buildings. Certification is an important way to improve market acceptance of products like tiles, paver blocks, and manufactured bricks. ULBs need to maintain a list of authorized sellers of these products and whose details can be provided in e-market place for the larger benefit of the consumers. ULBs need to create a sustained system of information, education and communication for construction and demolition waste through collaboration with expert institutions and civil societies.

4. Needed Interventions

- Develop codes and standards for quality of secondary raw materials to ensure confidence in the product
- Public tenders to include quotas for locally sourced materials
- Greater use of indicator frameworks and green rating schemes that enable comparability between building concepts with regards to their environmental impacts.

5. Targets

- Municipalities in Tier 1 and Tier 2 cities to start inventorizing construction and demolition waste data by 2022
- Recycling rate for C&D waste to reach 50% by 2025 and 75% by 2030
- By 2025, 30% of total public procurement of materials for civil construction from recycled materials

B.4. Electrical and Electronic Equipment Sector

1. Introduction

The Indian electronics market is one of the largest in the world and is anticipated to reach US$400 billion by 2020 with domestic production expected to grow at CAGR of 27% to reach $104 billion. Indian electrical and electronic equipments sector constitutes of about 31% consumer electronics, 22% industrial electronics, 20% electronic components, 10% communication and broadcasting, 17% computers and other equipments. Generation of e-wastes is an eventual outcome from consumption of electrical and electronic equipments. In 2016, India was the fifth largest producer of e-waste in the world and generated nearly 2 million metric tons of e-waste.

There are many challenges associated with managing growing volume of E-wastes in India. The informal sector in India is the backbone of recycling and resource recovery, thereby contributing towards development of a circular economy. However, owing to lack of economic prowess and access to technology, the ways and means employed are often archaic in nature leading to low yield of resources, creation of waste and often pose risks to human health and environment. Abrupt disruption to this informal sector will endanger livelihood security and has socioeconomic consequences, however transition to a completely formalized waste management sector that undertakes efficient recycling processes and follows standards for environment, health and safety is needed.

2. Life Cycle Approach for Electrical and Electronic Equipment Sector

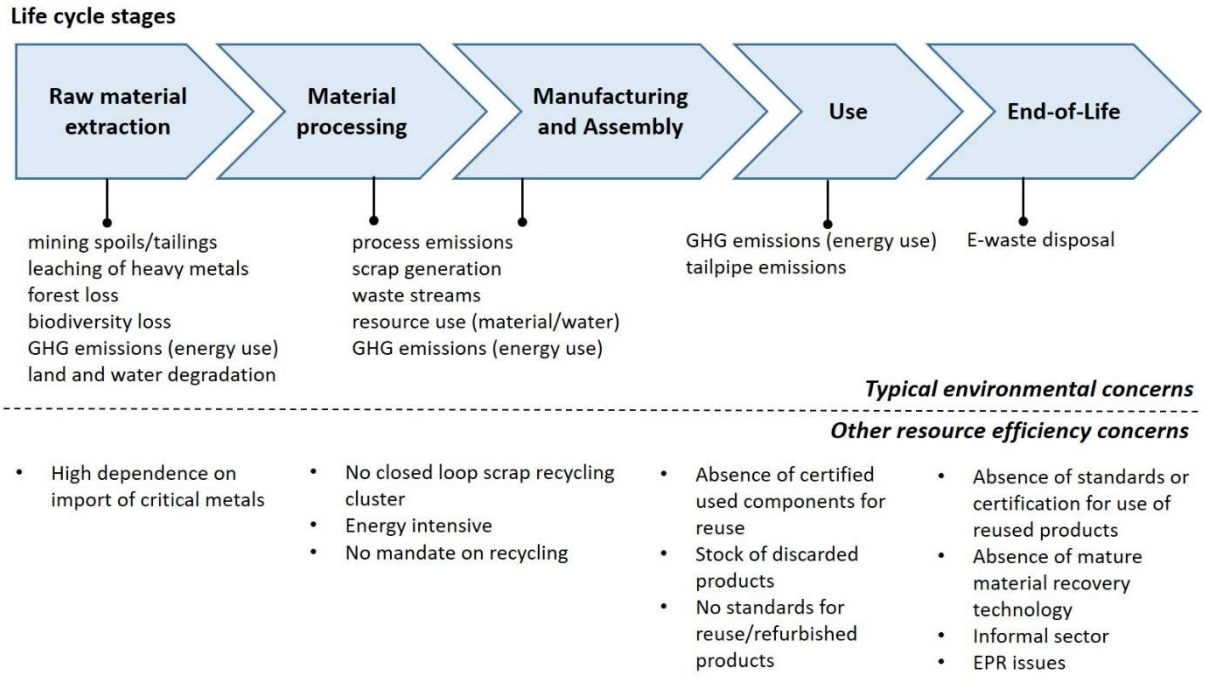

Figure B.4. Life cycle stages across value chain and related RE concerns

Figure B.4 illustrates typical environmental concerns and other resource efficiency related issues with the life cycle stages associated with the value chain of electrical and electronic equipment sector. This sectoral strategy primarily focusses on the end-of-life stage of the sector.

3. Proposal for Action

Material recycling efficiency of the informal sector is only about 20 to 30%. The informal sector has been at the heart of recycling of WEEE in India for the last two decades and its integration into a formalized sector is the key to ensure that collection costs be kept at sustainable levels. The informal sector, through its network of aggregators, dismantlers, recyclers has been able to develop an ecosystem which has been able to sustain multiple actors across different geographies in the country. Integration of the informal sector can potentially be done by setting-up industrial cluster firstly by co-locating the e-waste management industrial cluster in a manufacturing cluster, or secondly by co-locating e-waste management cluster in hubs where the informal actors have been working.

Schemes to promote use of secondary materials in products is needed to be devised. The use of secondary materials can be guided through a standardisation of technologies which are being used for extraction of the material during the recycling process. This will ensure voluntary certification by recyclers as the demand for secondary materials increases.

Extended Producer Responsibility (EPR) is an effective instrument that can help in making available of best technologies to recyclers. Strengthening EPR compliance will enhance access to secondary materials which will make economic sense for the recycler to then recycle the material rather than sell it in the informal sector or export the same. There is a need to gradually introduce penal system in case of non-compliance and the financial resources thus collected can be used for providing access of recycling technologies to the informal sector.

4. Needed Interventions

- Producers to introduce ‘Deposit Refund Scheme’ for e-waste exchange
- Establish recovery targets for various resources based on the volume of the e-waste generated
- Facilitate setting up of infrastructure for e-waste recycling which can disrupt movement of e-waste to informal sector and incentivise them to formalize
- Establish product design guidelines which can help make products and materials easier to dismantle and recycle
- Establish and implement standards for recycling to enable use of best available technologies to mitigate the environmental and health impacts of unsafe recycling in the informal sector

- Capacity building of monitoring and implementation agencies at the state level so that e-waste rules are enforced across stakeholders
- Outreach and advocacy with all stakeholders to ensure that the environment and health hazards are communicated for formalising of disposal mechanisms
- Research & Development on recycling technologies to address needed rapid technological advancement in EEE waste recycling

5. Targets

- Implementation of targets stated in the existing e-waste management rules.
- By 2020, introduce deterrent penalty mechanism for violation of E-waste management rules.

B.5. Solar Photo Voltaic Sector

1. Introduction

'Jawaharlal Nehru National Solar Mission (JNNSM)' with revised target, aims to deploy 100,000 MW of solar power. This will require supply and use of newer materials for manufacturing different solar PV technologies while maintaining cost competiveness in the sector and in this regard resource efficiency will be a key to achieve these objectives.

Silicon PV has more than 80% of market share and is expected to retain the share in the short time to medium term. Key materials that are used in manufacturing silicon crystalline solar PV are silicon, glass, silver, aluminium and copper. Typically, crystalline silicon solar PV contains 70% of glass while aluminium, silicon and silver account for 18%, 3.65% and 0.053% of total weight. Ethylene-vinyl acetate (EVA) encapsulation takes up 5.1% of the share while the back sheet represents 1.5% of the total weight. Under an ambitious solar energy deployment scenario of nearly 170 GW by 2030, total estimated demand for materials will increase from almost 0.7 million tonnes to 12 million tonnes between 2015 and 2030. Under this scenario demand for glass, aluminium, silver will reach 7 million tonnes, 1.7 million tonnes and 3.8 million tonnes by 2030, as compared to 0.4 million tonnes of glass, 0.1 million tonnes of aluminium and 0.2 million tonnes of silver was consumed in 2015 by the sector.

2. Life Cycle Approach for Solar Photo Voltaic Sector

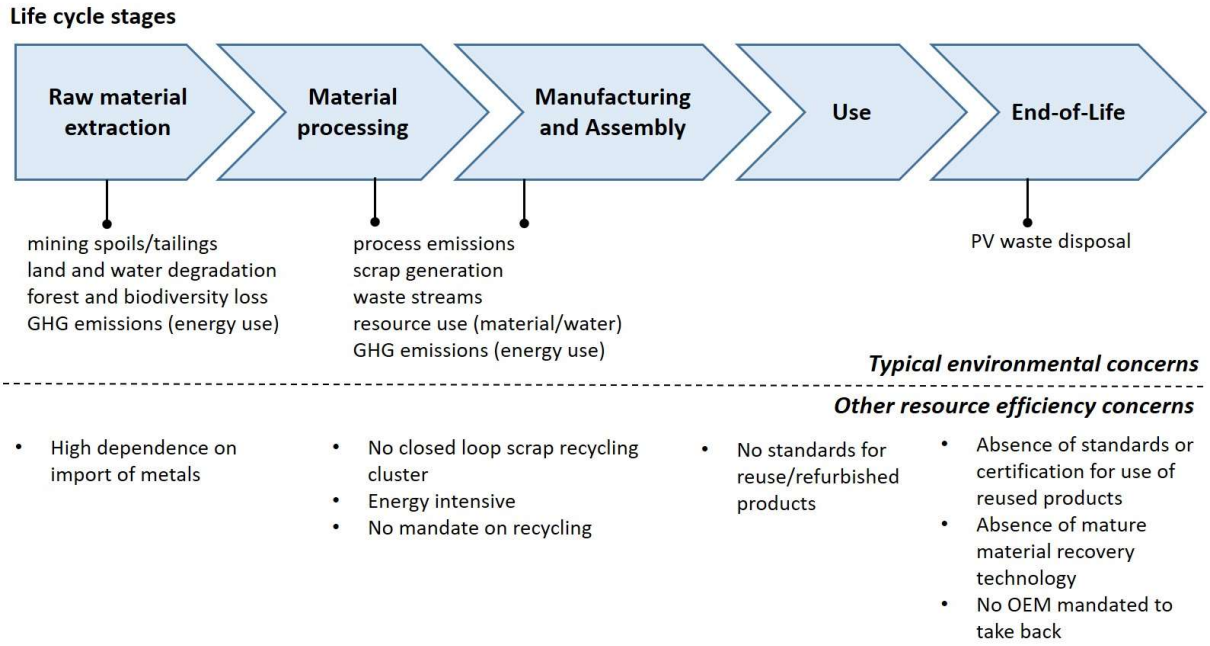

Figure B.5. Life cycle stages across value chain and related RE concerns

Figure B.5 illustrates typical environmental concerns and other resource efficiency related issues with the life cycle stages associated with the value chain of solar PV sector. This sectoral strategy primarily focusses on the end-of-life stage of the sector.

3. Proposal for Action

In order to make solar PV recycling sector ready for future stream of PV waste, there is a need to train commercial recycling companies on the constituents of solar PV and procedure to break them down. Nearly 75% of the material that gets separated out from solar PV is glass, which is easy to recycle into new products but also has a very low resale value. As solar panel technology improves, manufacturers will find ways around using components that would have value to recyclers, like copper and silver.

Setting up proper solar panel recycling infrastructure that can manage the large volumes of PV modules that will be disposed in near future, will facilitate increased scientific dismantling of panels. Role of EPR is extremely important to support cost effective business model of reverse logistics. Dealers' network for buy back of end of life solar rooftop panels holds the key while for large scale projects developers in association with original equipment manufacturers need to come together for the same. The cost of take-back arrangement needs to be specified within the total cost of installation.

Enforcement mechanism for such contracts should be designed by the Government in their tenders/schemes or PPA agreements. Awareness generation through showcasing innovation and good practices and exploring potential for up-scaling of the new technologies for end of life solar PV need to be undertaken hand in hand with other initiatives. Easy financing instruments need to be explored by banking and non-banking financial institutions for promoting investment in formal recycling set ups. A cluster based approach could be considered bringing different players can be undertaken close to PV manufacturing. The waste generated from solar PV should be treated as E-waste, to provide a legal mechanism for solar PV waste management.

4. Needed Interventions

- Setting up a proper solar panel recycling infrastructure that can manage large volumes of PV modules that will be disposed in near future
- Establish cost effective business model of reverse logistics and dismantling
- Generate awareness through showcasing innovation and good practices and exploring potential for up-scaling of the new technologies for end of life solar PV
- Easy financing instruments need to be explored by banking and non-banking financial institutions for promoting investment in formal recycling set ups
- The waste generated from solar PV should be treated as E-waste

5. Targets

- By 2025 establish 4 major authorized dismantling facilities and 8 such facilities by 2030
- 85 % recovery rate of materials from discarded PVs

B.6. Steel Sector

1. Introduction

India has witnessed more than 6 % growth in steel production capacity and has reached more than 100 MT thereby making India the third largest steel producer. Steel industry contributes nearly 2% of India's income and provides employment to 25 lakh people, directly or indirectly. Steel manufacturing output of India is expected to increase to 130 million tons by 2021 and it is estimated that increased per capita of steel consumption from 65 kg in 2017 to 160 Kg by 2030 will require increasing steelmaking capacity from present level of 125 million tons per annum (MTPA) to 300 MTPA by 2030-31.

A sector wise break up in steel consumption reveals that construction industry has the largest share of 35% followed by infrastructure development 20% and automobiles 12%. Given the fact that majority of the construction and infrastructure is expected to come up in the coming years, and human aspirations will drive vehicular ownerships, the potential future growth of steel consumption in these sectors will be the future key drivers.

Stainless steel production too has increased in recent years, largely to meet demand for their use in special application in special technologies, products and defence application. Production has increased from 2.4 MT in 2009-10 to 2.9 MT in 2013-14. Consumption of stainless steel during this period increased from 2.5 MT to 3.1 MT. The present demand of around 5 MT is likely to double by 2030. This implies that the overall requirement of stainless and alloy steel may be between 12-14 MT by 2030.

Steel manufacturing is extremely resource intensive. A quick analysis of material embodiment in 1 ton of steel produced from Basic Oxygen Furnace (BOF) route suggests that the same contains about 1.4 tonnes of iron ore, 0.55 tonnes of coking coal, 0.25 tonnes of limestone and 1.9 tonnes of air. By products consist of 0.3 tonnes of slag, 2.4 tonnes of blast furnace gases, and up to 0.05 tons of dust. This implies that by 2030, to produce around 300 MT of steel from the BF route having the same share of 75% in the total steel production, India will require 315 MT of iron ore per annum, 123 MT of coking coal, 60 MT of limestone.

2. Life Cycle Approach for Steel Sector

Figure B.6 illustrates typical environmental concerns and other resource efficiency related issues with the life cycle stages associated with the value chain of steel sector. This sectoral strategy primarily focusses on manufacturing and end-of-life stages of the sector.

3. Proposal for Action

India need to explore into systematic and efficient scrap processing as it prepares for an era when proportion of BF-BOF based steel making using coking coal and iron ore diminishes and scrap based EAF/IF processes becomes preferred choice. Modern scrap processing

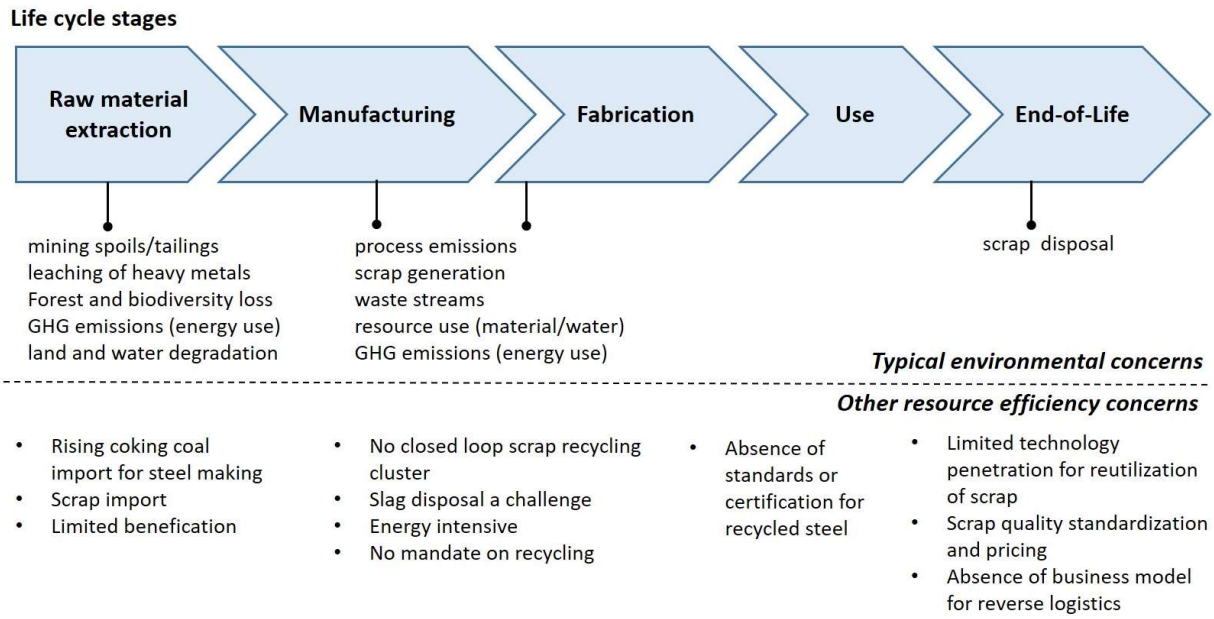

Figure B.6. Life cycle stages across value chain and related RE concerns

facility need to be planned which will source, separate, shred and process scrap that can be used as preferred input for quality steel production. More scrap processing units to be set up so that import volumes may be minimized. Therefore, Scrap Processing Units need to be set up near the centres/clusters of scrap consumers. For steel output to grow according to the plan, India's Electric Arc Furnace (EAF) output will have to rise by at least 16.85 million tonnes per annum, which can be achieved by full utilization of the existing EAF and induction furnace capacities.

India has about 55 million tonnes capacity of steel production through BOF route, where slag generation is about 150-175 kg/t of steel. While BF slag is mainly used for cement production, steelmaking slag can be used for road construction, hydraulic engineering, as fertilizer etc. BOF slag contains Ca, S, Fe, Si, P, Mg etc. which is useful for plant growth. It is useful for acidic soils as it gives pH around 8 when mixed with water. There is a need for better R&D collaboration between fertilizer and steel sector for up-scaling and commercialization of such products. Establishment of joint ventures between fertilizer and steel sector can possibly help in faster development of such products.

4. Needed Interventions

- Incentives on investments for steel recycling technologies and processes for manufacturing special steel products
- Incentives for joint ventures between scrap trading and steel companies that will minimize procurement costs
- Imposition of import duty for scrap imports beyond certain limits to promote utilization of domestic scrap

- Procurement targets by public and private sector infrastructure companies.
- Standards for scrap be established such that independent agencies can assess and certify scrap. Certified scarp be then linked to indexed price

5. Targets

- By 2030, zero import of steel scrap for recycled steel production and 100% of the recycled steel be produced from domestic scrap
- By 2030, establish 50% of the steel manufacturing capacity from the EAF route
- Increase steel recycling rate to 90%
- Ensure 50% overall utilization of slag by 2025 and 85% by 2030
- By 2022, introduce quality index-based pricing mechanism to facilitate continuous and smooth scrap supply to recyclers

B.7. Aluminium Sector

1. Introduction

India is the fourth largest producer of bauxite which is the key resource that goes into manufacturing aluminium. Between 2012 and 2017, annual consumption of Aluminium has increased from 2.85 million tonnes to 3.6 million tonnes. Currently, the electrical and electronics sector is the largest consumer of aluminium accounting to nearly 37% of domestic consumption followed by transportation (26%), construction (11%) and in consumer durables (8%).

However there are substantial resource use related issues (including environment damage) associated with primary aluminium production. The environmental issues of bauxite mining include, air, water and soil pollution due to bauxite dust; leaching of bauxite into water sources resulting in reduced soil fertility as well as affecting agricultural food products and aquatic life. Further, aluminium production depends heavily on conventional energy. Nearly one third of smelting cost accounts for power required for electrolysis process. Use of conventional electricity (coal based) is associated with emissions of carbon. In producing 1 tonne of primary Aluminium, there are simultaneous production of about 8-10 tonne of by-Products, in the form of bauxite residue (red mud), fly ash, spent pot liner (SPL), dross etc.

2. Life Cycle Approach for Aluminium Sector

Figure B.7 illustrates typical environmental concerns and other resource efficiency related issues with the life cycle stages associated with the value chain of steel sector. This sectoral strategy primarily focusses on manufacturing and end-of-life stages of the sector.

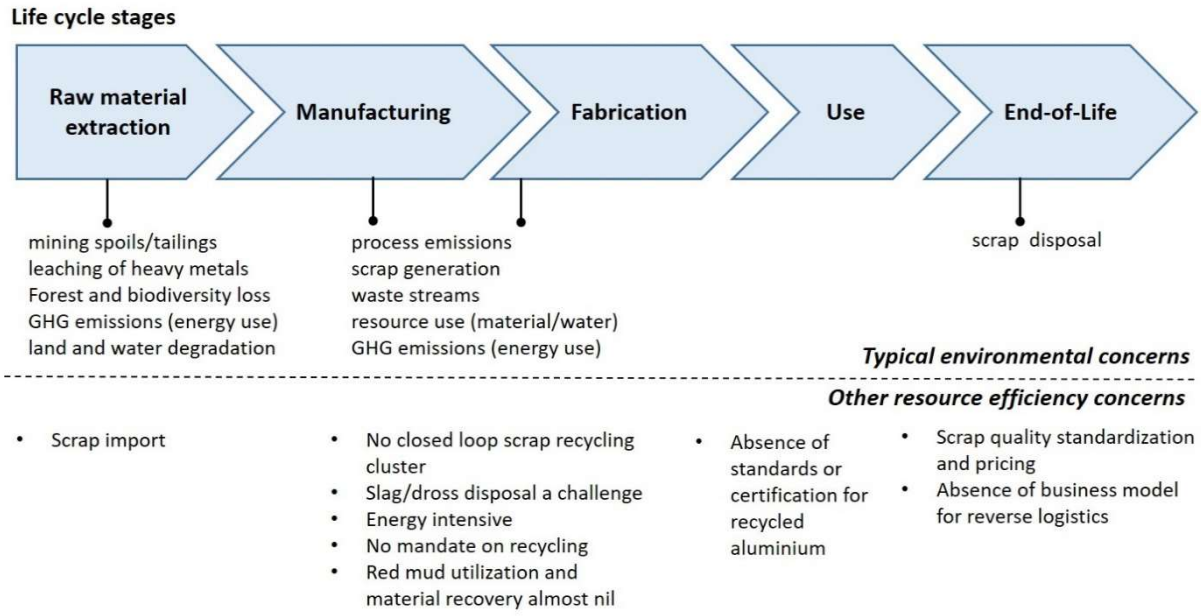

Figure B.7. Life cycle stages across value chain and related RE concerns

3. Proposal for Action

Aluminium sector being a very important material for the economy calls for classification as a core sector, which will increase the focus on the sector and enable production of high quality metal with provision of critical infrastructure to avoid global volatility in supply and prices.

Aluminium sector generates substantial waste during production of aluminium which can converted into value added products with less efforts and resources. This can be achieved through introduction of targets of resource recovery and reuse of wastes by various primary metal producers.

Since domestic scrap usage is diffused and not regulated without any standards or end-use restrictions. As a result there is heavy dependence on imported scrap. Increased availability of domestic scrap can be achieved through various economic instruments including export taxes, export quotas, and even export bans or punitive tax rate if recycler resorts to trade in scrap without processing or adding value. Direct support measures may be in the form of exemption on duties on scraps, capital subsidies on technologies for efficient recycling.

Product take-back through Extended Producer Responsibility (EPR) needs to provide for drop-off locations allowing product return, and economic responsibility for the management of end of life products by third party firms.

Organized metals recycling industry structure is needed. Due recognition of recycling could encourage users of aluminium particularly in transport, housing, packaging and durable sectors to broaden the organised markets for the scrap generated. Standardization and certification of recycled aluminium products is needed.

4. Needed Interventions

- A transition to zero waste concept by converting solid waste to value added products
- Promotion of aluminium scrappage and recycling
- Creation of zonal scrap collection, segregation and treatment facilities
- Quality standards for recycled aluminium products need to be strengthened in consultation with the bulk consumers

5. Targets

- By 2030, domestic scrap to fulfil 50% of the total aluminium scrap requirement
- Increase recycling rate to 50% by 2025 and 90% by 2030
- Increase rate of utilization of dross to 40% by 2025 and 80% by 2030

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