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Advancing Green Cooling
through
Sustainable Public Procurement

MAITREE
MARKET INTEGRATION AND TRANSFORMATION PROGRAM FOR ENERGY EFFICIENCY

eds environmental design solutions

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January 2022

Suggested Citation:
MAITREE 2022. Advancing Green Cooling through Sustainable Public Procurement; USAID/India, EDS

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This document is made possible by the support of the American People through the United States Agency for International Development (USAID) Market Integration and Transformation for Energy Efficiency (MAITREE) program. It was prepared by Environmental Design Solutions Pvt. Ltd. (EDS) under Agreement Number: AID-386-A-17-00001. The views expressed in this document do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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Ever-increasing energy use in buildings, especially for cooling, is a global concern. India is one of the first countries in the world to develop a comprehensive cooling plan to address growing energy needs. India's Plan includes a long-term vision to provide sustainable cooling and thermal comfort in the nation's buildings while simultaneously securing environmental and socioeconomic benefits for the people of India as well as a focus on green energy procurement. USAID recognizes that green energy procurement not only enhances energy security within India, but also lowers the carbon footprint for the entire South Asian region, contributing directly to cleaner, more stable power. For this reason and more, sustainable products and services have been a key element of the U.S.-India Energy Partnership since 2000.

In partnership with the United Nations Environment Programme, we were honored to support India in its efforts towards greening the supply chain by providing technical support for the development of a sustainable public procurement framework, ultimately leading to the launch of green room air conditioners.

This white paper, Advancing Green Cooling through Sustainable Public Procurement, provides an approach and insights for integrating sustainability into public procurement practices. The shared case studies, initiatives, and pilots will be especially relevant to countries embarking on their own sustainable public procurement journeys.

I would also like to commend USAID/India's implementing partner, Environmental Design Solutions, for its technical expertise and keen understanding of the market and public procurement process as well as its dedication to sustainable energy solutions. Public procurement of private sector products such as air conditioners is central to surmounting South Asia's energy sector challenges, and I am sure that this effort will support India's net-zero emissions target through its promotion of a systemic change towards green public procurement.

Veena Reddy

Veena Reddy

Foreword

The total volume of public procurement in India is estimated to constitute about 20-22% of GDP; hence its potential for shifting markets in the direction of a green economy is immense. Governments across the world are leveraging their scale of procurement to fast-track the adoption of sustainable goods and services. Sustainable public procurement (SPP) offers the opportunity to encourage extended producer responsibility and transform markets towards responsible consumption.

Sustainable Public Procurement enables the channeling of the immense purchasing power of the government towards a greener market. The SPP process, aligns itself with the national cooling goals of substantial benefits for the environment and improvement of the socio-economic status of India.

Advancing energy-efficient and climate-friendly cooling through Sustainable Public Procurement is inspired by the logic that governments must lead by example in transforming the market. Public Procurement of energy-efficient buildings, cooling equipment, trained and certified service technicians for public buildings have already been identified as one of the seven priority areas in India's Cooling Action Plan.

Through the implementation of sustainable public procurement, India can fast-track its commitment to reducing the economy's carbon intensity. The Sustainable Public Procurement framework formulated with the participation of stakeholders lays the groundwork for its implementation through a joint effort of government agencies in cooperation with the private sector.

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List of Acronyms

BEE	-	Bureau of Energy Efficiency
BIS	-	Bureau of Indian Standards
CFCs	-	Chlorofluorocarbons
EER	-	Energy Efficiency Ratio
EMS	-	Energy Management System
GeM	-	Government e-Marketplace
GHG	-	Greenhouse gas
GWP	-	Global Warming Potential
HCFCs	-	Hydrochlorofluorocarbons
HFCs	-	Hydrofluorocarbons
ISHRAE	-	Indian Society of Heating, Refrigerating & Air-conditioning Engineer
ISO	-	International Organization for Standardization
ISEER	-	Indian Seasonal Energy Efficiency Ratio
LCA	-	Life Cycle Assessment
LCC	-	Life Cycle Cost
LCCA	-	Life Cycle Cost Analysis
LCCP	-	Life Cycle Climate Performance
MTPA	-	Million tons per annum
ODP	-	Ozone Depletion Potential
RAC	-	Room Air Conditioners
RE	-	Resource Efficiency
SCP	-	Sustainable Consumption and Production
SDG	-	Sustainable Development Goals
SME	-	Small and Medium Enterprises
SPP	-	Sustainable Public Procurement
TCO	-	Total Cost of Ownership
TEWI	-	Total Equivalent Warming Impact
TR	-	Tonnage
UNEP	-	United Nations Environment Programme
USAID	-	United States Agency for International Development

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Cooling Conundrum

Photo by https://unsplash.com/@mikefilm

1 Cooling Conundrum

Cooling, in all its forms, is responsible for close to 10% of all annual GHG emissions, more than those from air travel and ocean shipping combined.[1] Space cooling represents a significant proportion of the overall GHG emissions. The global average energy consumption for space cooling is 272 kWh / per capita[2], cumulatively amounting to a global average annual emission of 1,504.4 million metric tons CO_2.

1.1 Drivers for Escalating Cooling Demand

Warming Planet

The average rate of change of global average surface temperature since 1901 was 0.7ºC – 0.9ºC per century and has nearly doubled in the period since 1975 (1.5ºC–1.8ºC per century)[3].

Continuing its current trajectory, hotter and longer summers are expected with the rise of global average surface temperature (2ºC - 5ºC by 2100).[4] An IEA study projects that by 2050 the cooling degree days (CDDs) will increase by around 25% globally,[5] with a larger share in tropical regions. Southern and Eastern Asia would see an increase in CDDs ranging from 15% to 40%.

A warming planet would lead to increased demand for cooling systems, which in turn would cause further global warming, creating a never-ending vicious loop. 2.2 billion people (nearly one-third of the world population) are already at risk of heat exposure for more than 20 days per year, and by 2100, up to three-quarters could experience this risk.[6] The future demand for cooling cannot be ignored.

[1] Rocky Mountain Institute
[2] IEA 2018
[3] Blunden, J., D. S. Arndt, and G. Hartfield, Eds., 2018: State of the Climate in 2017. Bull. Amer. Meteor. Soc., 99 (8), Si–S310

[4] IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC, Geneva, Switzerland
[5] IEA (2018a)
[6] Global risk of deadly heat," Nature Climate Change, accessed October 2018, https://www.nature.com/articles/nclimate3322

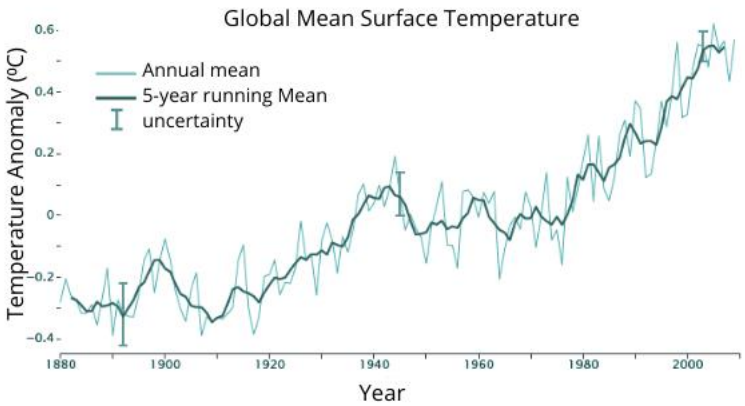

Figure 1: Rising global mean surface temperature a cause for increased demand for air conditioning (Source: NASA figure adapted from Goddard Institute for Space Studies Surface Temperature Analysis.)

Growing Urban Population

The population is growing by 75 million people each year, with 90% of this growth occurring in developing countries with warm climates, according to projections by Population Reference Bureau (PRB). The number of people in South Asia is projected at 2.45 billion in 2050.

The world's urban population has grown rapidly from 751 million in 1950 to 4.2 billion in 2018. 68% of the world population is projected to live in urban areas by 2050. Together, India, China, and Nigeria will account for 35% of the projected growth of the world's urban population between 2018 and 2050. By 2050, it is projected that India will have added 416 million urban dwellers.[7] Rapid urbanization in developing economies (such as Bangladesh, India, Pakistan, Sri Lanka) that are already populous and have warm climates, will result in denser developments, fewer options for cooling due to dense development of high-rise buildings, limited airflow, and exacerbated heat island effects. In the absence of greener and climate-friendly buildings, this will only increase dependence on air conditioners for thermal comfort.

Rising Incomes

Room air-conditioning penetration is presently low in developing countries, even where the climate is hot and humid. Only seven percent of households in India possess an air-conditioner, despite having extremely high cooling needs.[8] But air-conditioner ownership in households and its use is rising rapidly in India and warm countries with rising incomes and improvement in access to electricity. Simultaneously, due to the increased scale

[7] 2018 Revision of World Urbanization Prospects produced by the Population Division of the UN Department of Economic and Social Affairs (UN DESA)

[8] AEEE, (2018): Demand Analysis for Cooling by Sector in India in 2027 (Version 2)

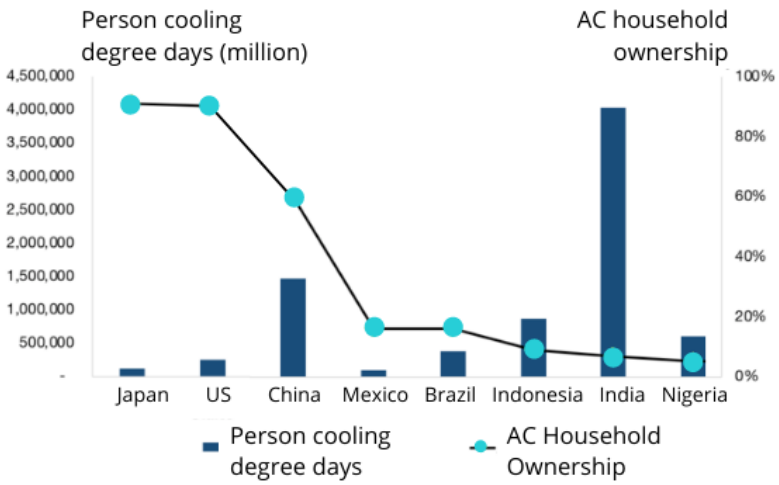

Figure 2: Cooling demand versus current AC ownership in different parts of the world, Source: World Economic Forum 2019, How India is solving its cooling challenge

of production, there is a fall in air-conditioner prices, making it accessible and affordable to the growing population. IEA's analysis shows that the rate of household ownership of air-conditioners rises with economic development and incomes and rises very sharply in the case of the hottest and most humid countries.

Summary

The combined effect of these drivers (rising global temperatures, rapid urbanization, and increasing purchasing power) is contributing to the exponential rise in the demand for energy-guzzling cooling systems to meet comfort cooling needs.

There is also an increasing realization that cooling is linked to human well-being and productivity and hence crucial for achieving the Sustainable Development Goals (SDGs). The Sustainable Energy for All's (SEforALL) report, Chilling Prospects draws attention to the social and economic impacts of heat stress and lack of access to cooling. In South Asia and West Africa, work-hour losses are expected to be as high as twelve percent.

Globally, with an increased focus on access to cooling, electrification, and enabling thermal comfort for all, there is a potential of further increasing the demand and penetration of air conditioners.

1.2 Cooling Buildings: Market Trend for Room Air Conditioners

Considering the increasing global demand for cooling, the number of room air-conditioners (RAC) is estimated to be 4.5 billion units by 2050, 3.7 times increase since 2018. Developing countries will see a five-fold increase in RAC demand over the same period.[9] An IEA study suggests that 67% of households across the globe will own ACs by 2050. Seventy percent of the projected growth will come from the

[9] Sachar, Sneha, Iain Campbell, and Ankit Kalanki, Solving the Global Cooling Challenge: How to Counter the Climate Threat from Room Air Conditioners. Rocky Mountain Institute, 2018. wssww.rmi.org/insight/solving_the_global_cooling_challenge.

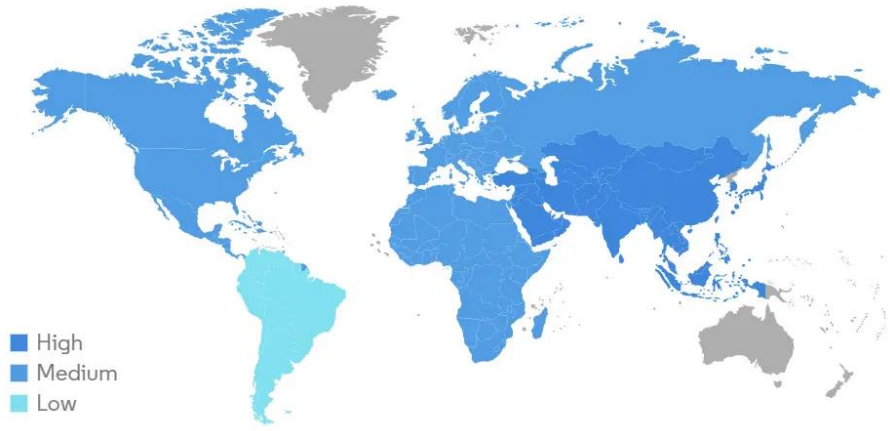

Figure 3: Air Conditioner Market - Growth Rate by Region (2021-2026) (Source: Mordor Intelligence)

emerging economies in the tropics and the subtropics. Air conditioner sales in India are growing at 10% - 15% per year.[10] India's cooling-related energy demand from RACs will increase 20-fold from 94 TWh in 2016 to 1,890 TWh in 2050, making India the world's largest energy user for space cooling.[11] The South Asian region is predicted to experience a high growth rate in the immediate years.

1.3 Impact of Cooling

The current trajectory of space cooling growth will significantly impact power systems, emissions, and consumers.

Power Systems

The rise in the room air conditioners stock will spike the electricity demand, stress the power infrastructure, and necessitate the need for significant additional generation capacity. It is expected to lead to

- 395% jump in global capacity needs, from 850 GW in 2016 to 3,350 GW in 2050.
- USD 1.7 trillion in generation capacity alone[12].

The increasing cooling loads will contribute to India's peak loads rise from about 10% to 45% in 2050[13]. This increased stress on the utility lends to issues of unreliability in energy access with blackouts. Though the peak demand is restricted to a short duration of time, the utility must be sized and maintained to cater to this exceptionally large and infrequent event.

Emissions

Coal-fired power plants, conventionally used to power cooling appliances generate pollutants, carbon dioxide (CO_2), and other greenhouse gases. The emissions have increased threefold from 1990 to approximately 1130 million tons (Mt)[14]. Due to electricity use for space cooling, emissions will double between 2016 and 2050, to over 2 GT[15].

A critical component of air-conditioning that enables cooling is the refrigerant, many of which have ozone-depleting potential and are potent greenhouse gases. Direct emissions from highly polluting refrigerants will increase the emissions further. Key reasons for ozone depletion are as below:

- Leakage of ozone-depleting substances from air-conditioning and refrigeration equipment during manufacturing, installation, and operation.
- End of life recovery and destruction.
- Direct CO_2-equivalent emissions.

Consumers

Rising global temperatures indicate longer operating hours of cooling equipment and create multiple demand peaks. The associated cost to utilities for catering to peak demand will finally trickle down to the consumers in the form of higher electricity prices. Space cooling expenditures already

[10] Shah et. al, Benefits of Leapfrogging to Super efficiency and Low Global Warming Potential Refrigerants in Room Air Conditioning, (2015)
[11] Sachar, Sneha, Iain Campbell, and Ankit Kalanki, Solving the Global Cooling Challenge: How to Counter the Climate Threat from Room Air Conditioners. Rocky Mountain Institute, 2018.
[12] RMI
[13] Singh, Manjeet, Phore, Gaurav, TERI Policy Brief 2020 Accelerating the uptake of Energy-Efficient Air Conditioners in India. New Delhi: The Energy and Resources Institute. 24 pp.

[14] The Future of Cooling Opportunities for energy- efficient air conditioning (2018). International Energy Agency
[15] RMI

account for 5-15% of the median household income in many parts of the world[16] and will continue to increase. This impact will be seen in emerging economies, with warmer climates, where the per capita cooling energy consumption is low and is expected to see major growth.

1.4 Integrated Approach to Climate Friendly Buildings and Cooling

An integrated approach that enables meeting cooling demands sustainably needs to become the norm. The steps to optimally address the space cooling challenge are as follows:

Reduce Cooling Loads

Implementation of sound passive design principles is the first stepping-stone to reducing a building's need for cooling equipment. Climate-specific approaches based on sun, wind, light, and micro-climatic considerations can be employed to design energy efficient buildings.

The decisions about building form, orientation, shading, and ventilation, taken during the early design stage have the most significant impact on the energy use of the building. Passive design strategies aim at achieving thermal comfort using as little active cooling and heating as possible. This means reducing cooling requirements during the summer and heating in the winter through appropriate orientation, external shading, an appropriate amount of glazing, and natural ventilation. Drastically reducing or eliminating the need for artificial lighting through filtered, indirect, glare-free daylight is imperative for sustainable buildings. Daylighting not only reduces the energy needed for lighting and air-conditioning but is also linked to the health and well-being of the occupants.

The building skin – walls, windows, and the roof – moderates the effect of the climate. Selection of building envelope with appropriate thermal mass, insulation, and color based on climate and functional requirements can reduce the number of heating or cooling hours required to maintain comfort.

[16] RMI

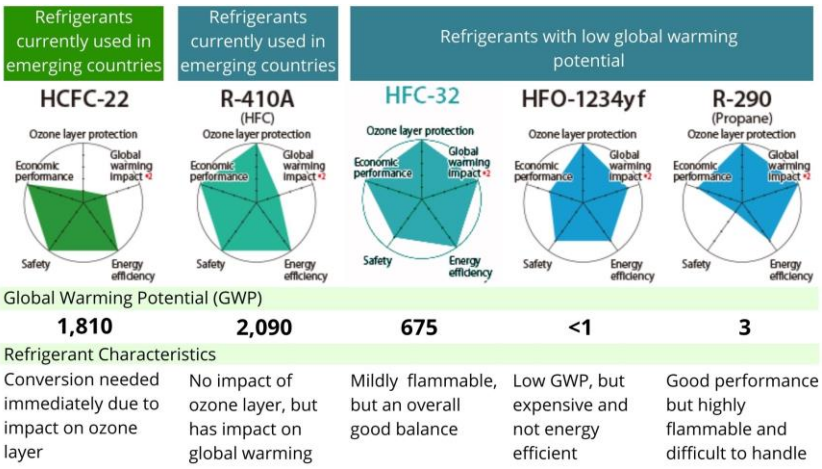

Figure 4: Characteristics of possible next-generation refrigerants (Source: Daikin-Low Environmental Impact Refrigerants).

Using evaporative cooling through water bodies and evaporative coolers can further reduce the requirement for air conditioning, especially during hot and dry periods. Ceiling fans, typically use less than 10% of the energy consumed by a Room Air-Conditioner for an equivalent space. Using a combination of energy efficient air-conditioner at higher than usual temperature and a ceiling fan for circulation of cold air can reduce the energy use without compromising on comfort.

Procure Efficient Cooling Equipment

Comfort systems contribute to 40-60 percent of the energy used in conditioned buildings. The procurement of energy efficient and climate-friendly cooling equipment can help achieve the required amount of cooling with less energy as well as lower emissions. In addition to selecting energy efficient equipment, it is important to select the correct system type, size, and design for optimized energy efficiency. Procurement of inappropriate and oversized systems can penalize the building with high capital and operational costs. Estimating appropriate cooling load requirements is a key step as this will affect the capital and operational cost, thermal comfort, ventilation rate & indoor air quality, and energy efficiency.

In the room air conditioning sector, the market is concentrated around the lowest first cost units. A less-efficient entry-level room air conditioner can cost double over its lifetime, compared with high-efficiency RAC units, and this difference will increase in places where electricity is not subsidized.

Procurement of cooling systems based on the total cost of ownership (initial acquisition cost + operation & maintenance cost + disposal cost) is not only beneficial for the planet but also for the customer.

Optimize, Control, and Maintain Cooling Loads

Comfort systems have a negative impact on the environment over its entire life cycle – energy consumption, refrigerant leakage, refrigerant disposal, etc. The procurement

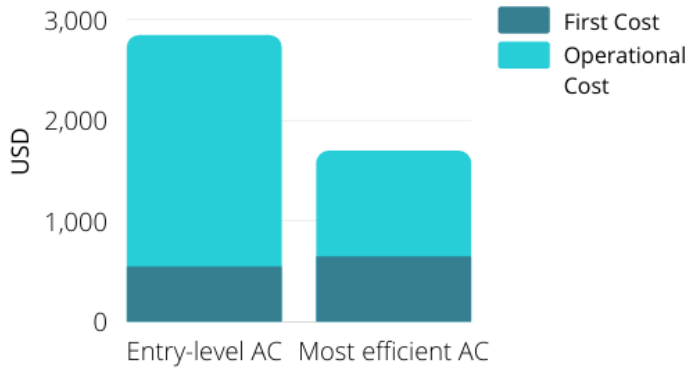

Figure 5: Typical Entry-level Room Air Conditioner (RAC) and the most efficient RAC sold in India (Source: RMI, Solving the Global Cooling Challenge)

of an appropriate comfort system is not enough. It is equally important to manage, optimize and maintain systems to increase their durability, optimize their performance, etc.

A building management system (BMS) is a complete automation program that links all building components, energy use, controls, and schedules with a central system that monitors the energy use pattern of the building and optimizes energy. Building automation and controls ensure that comfort is delivered at the right place when needed. Effective use of BMS ensures optimized building performance and reduced energy use. This leads to reduced operational cost and increased operational life of equipment by reducing loads and operating hours. Key features of a BMS are as below:

- Monitors and records the building energy use based on the season and relevant schedule
- Estimates the energy use for each building component and highlights the energy efficiency potential in each component based on the building performance compared to international best practices
- Develops an energy management plan for the facility manager based on the energy use pattern, design conditions, and component-wise energy use.
- Highlights recommendations based on energy efficiency and energy use pattern so that the facility team could incorporate energy efficiency equipment, controls, other relevant strategies on the component with high energy efficiency potential.
- Identifies the equipment abnormalities and failure early in time
- Supports the identification of unusual patterns of energy usage.

Servicing practices hold the key to energy efficiency as well as environment-friendly handling and maintenance of air conditioners. The servicing sector alone accounts for forty percent of refrigerant usage[17], and the efficiency of equipment and units remains dependent on installation and servicing practices. Global studies indicate efficiency sub-optimization of up to sixty percent, contingent on equipment not being properly maintained and servicing poorly implemented[18]. As the refrigerant transition takes hold from HCFC phase-out towards refrigerants with low global warming potential, the servicing sector must be ready to work with a suite of gases. The air conditioning servicing should include safe handling and proper leak prevention to minimize emissions directly resulting from refrigerant leakage and venting as well as ensure safety and on-job security of the technicians.

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[17] A Universal Certification System for India's Refrigeration and Air-conditioning Servicing Sector, Shikha Bhasin, Apurupa Gorthi, and Vaibhav Chaturvedi, Issue Brief July 2020
[18] Frankel, Heater, and Heller 2012

2

Role of Public Procurement

Photo by https://unsplash.com/@dieterdevroomen

2 Role of Public Procurement

The world's annual public procurement spend is estimated to be USD 13 trillion (2018)[19]. As per Open Contracting Partnership and Spend Network estimates, fourteen countries spend between USD 100 billion and USD 1 trillion per annum. In descending order, these are Japan, Germany, India, France, United Kingdom, Indonesia, Canada, Italy, South Korea, Australia, Brazil, Netherlands, Russia, and Spain.

Considering the role of public procurement and the scale of annual GHG emissions from the space cooling sector, public entities can be the key levers to address the cooling conundrum. Advancing building energy codes and improving building design to reduce the cooling demand is a long-term sustainable measure. However, immediate actions can be undertaken by public entities to promote climate-friendly buildings and cooling.

2.1 Procurement as a strategy to reduce climate impact of cooling buildings.

Between now and 2040, 230 billion square meters of new buildings will be built. Billions of air conditioners will be produced to meet the growing demand for cooling in a warming world. The built infrastructure for fast-growing cities in developing countries alone could release 226 gigatons (Gt) of CO_2 into the atmosphere by 2050 – more than four times the amount already used to build existing developed world infrastructure[20]. Thus, there is a huge opportunity to shift the future of cooling buildings and its energy and environmental impacts by changing the trajectory of the building design, technologies, solutions, and behaviors that drive cooling demand and its impacts.

[19] How governments spend: Opening up the value of global public procurement

[20] Bai X., Dawson R., Ürge-Vorsatz D., Delgado G., Barau A., Dhakal S., Dodman D., Leonardsen L., MassonDelmotte V., Roberts D., Schultz S., (2018) Six research priorities for cities and climate change, Nature, 555, 23-25.

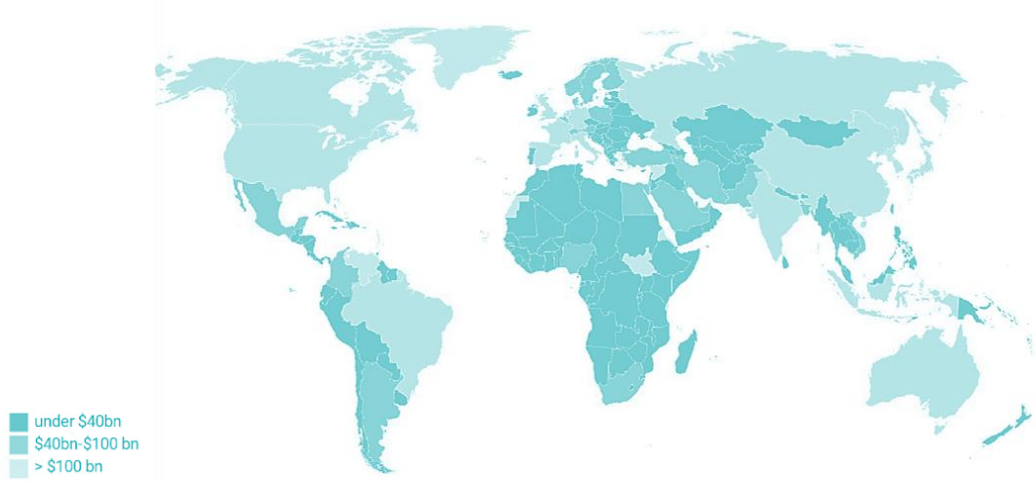


Figure 6 How the world compares in public procurement spending (USD) 2018 (Source: How governments spend: Opening up the value of global public procurement)

Opportunity for Public Procurement

The International Energy Agency (IEA) has warned that to reach net zero, direct building CO_2 emissions will have to fall by 50% by 2030, or around 6% per year. Governments are directly responsible for vast amounts of infrastructure and the built environment, with central and local governments owning or leasing a substantial proportion of the world's building stock. And while not all built environment assets are owned and operated by governments directly, the legal and economic frameworks and incentives around their construction, operation, and maintenance are also the responsibility of governments. Through both their procurement power and innovation policy decision-making, then, governments can shape the direction of advancement for the future of infrastructure. These decisions will critically impact the lives of future citizens and the health of the planet.

2.2 Sustainable Public Procurement

Governments across the world are leveraging their scale of procurement to fast-track the adoption of sustainable goods and services. They are adopting Sustainable Public Procurement practices facilitated by legal reforms and policy guidelines.

Sustainable public procurement (SPP) is a "*process whereby public organizations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life-cycle basis in terms of generating benefits not only to the organization, but also to society and the economy, whilst significantly reducing negative impacts on the environment.*"[21]

The European Union defines GPP as: "*A process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured.*"[22]

A Global Review

The first Global Review of Sustainable Public Procurement[23] was initiated and published by UN Environment in 2013. As a follow-on, the 2017 Global Review of Sustainable Public Procurement[24] was published in the framework of the 10YFP Sustainable Public Procurement Program. Key findings of this review are as follows:

- All participating countries recognized the importance of SPP to drive innovation and sustainable development.
- Countries are using different policy vehicles to drive SPP, ranging from single-aspect regulations, such as focusing on procurement from army

[21] Definition adopted by the Task Force on Sustainable Public Procurement led by Switzerland (membership includes Switzerland, USA, UK, Norway, Philippines, Argentina, Ghana, Mexico, China, Czech Republic, State of Sao Paolo (Brazil), UNEP, IISD, International Labor Organization (ILO), European Commission (DG-Environment) and International Council for Local Environmental Initiatives (ICLEI) and adopted in the context of the Marrakech Process on Sustainable Production and consumption led by UNEP. and UN DESA; UNEP SPP Review 2017

[22] European Commission 2008

[23] UNEP, 2013, Sustainable Public Procurement: A Global Review 2013: http://www.scpclearinghouse.org/resource/sustainable-publicprocurement-global-review-2013

[24] UNEP, 2017, Sustainable Public Procurement: A Global Review 2017: https://wedocs.unep.org/bitstream/handle/20.500.11822/20919/GlobalReview_Sust_Procurement.pdf

veterans (example, the Republic of Korea) or buying recycled-content products, often characterizing early efforts, to comprehensive action plans.

- Ministries or agencies involved in the design of SPP policies are those associated with environmental, economic, and financial affairs, which are procurement agencies and ministries of environment, economy, and/or finance.
- SPP scope is expanding to include multiple sustainability objectives (socio-economic issues, human wellbeing, social justice) beyond energy conservation.
- SPP policies mostly relate to developing technical specifications that incorporate relevant sustainability criteria for the products and services.
- Countries are monitoring different aspects of SPP. Emphasis needs to be placed on ensuring procurement is delivering the desired environmental, economic, and social outcomes such as energy efficiency, emission reduction, waste prevention, local economic development, poverty reduction, etc.
- The perception that sustainable products are more expensive and the lack of expertise on sustainable purchasing remain key barriers to the implementation of SPP. Greater adoption of methodologies based on life-cycle costing will play an important role in helping to address concerns about costs.
- The existence of national legislation on SPP followed by strong political and organizational leadership and policy commitments are among two of the main drivers for SPP implementation.

2.3 International Best Practices

Berlin

Under the state of Berlin's Tendering and Public Procurement Act of 2010, public authorities are obliged to consider environmental criteria in the tendering process and offers are assessed based on their life cycle costs. To assess the potential benefits of GPP and identify areas in which greater environmental relief could be achieved, in 2014, potential environmental and economic savings offered by green as

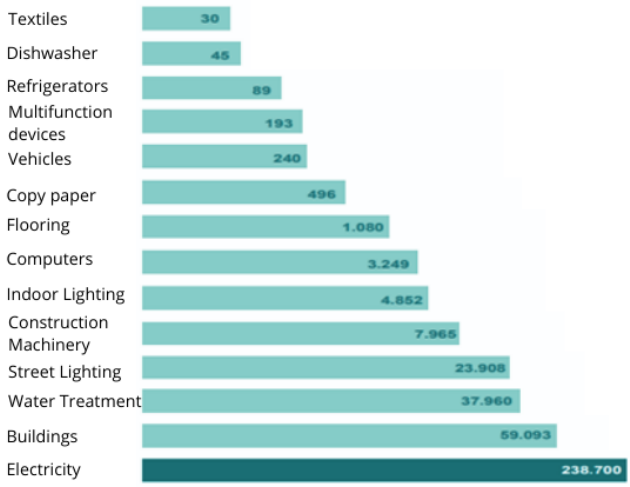


Figure 7: Extrapolation of the GHG emission reduction if all procurement and stock were green

opposed to conventional procurement if all stock and purchases were green was estimated.

Table 1 Extrapolation of environmental and economic impacts and costs

Effect	Annual Savings	Savings compared to conventional product
Cost savings	EUR 38 million	3.8%
Wood savings	9,300 MT	100%
Diesel particle reduction	12 MT	90%
GHG reduction	355,000 MT	47%

China

The implementation of GPP in China relies on product certification. Two separate schemes are in place in the form of independent product lists one for Energy Conservation Products (ECP) and one for Environment Labeling Products (ELP). Currently, procurement from the ECP list is mandatory, while procurement from the ELP list is voluntary. To determine the quantitative impacts of scaling up GPP, IISD used a system dynamics model. The model focuses on procurement in a set of product categories: Laptops, computers and monitors, air conditioners, lighting, buses, cars, cement, and paper. IISD's China GPP model also demonstrates the rewards that more ambitious GPP can provide.

Costa Rica

The Costa Rican Institute of Electricity (ICE) appointed a Committee of Green Procurement, in cooperation with CEGESTI. The mandate for Green Procurement Committee was to make GPP more feasible and easily accessible. All legal and environmental criteria are the admissibility criteria at the ICE, meaning that bids that do not meet these (high) environmental criteria are not considered for procurement. Considering all admissible bids will meet legal and environmental criteria, this enables ICE to evaluate bids only based on price.

European Union Green Public Procurement[25]

The European Commission's public procurement strategy focuses on six strategic policy priorities. At the EU level

[25] https://ec.europa.eu/environment/gpp/gpp_policy_en.htm

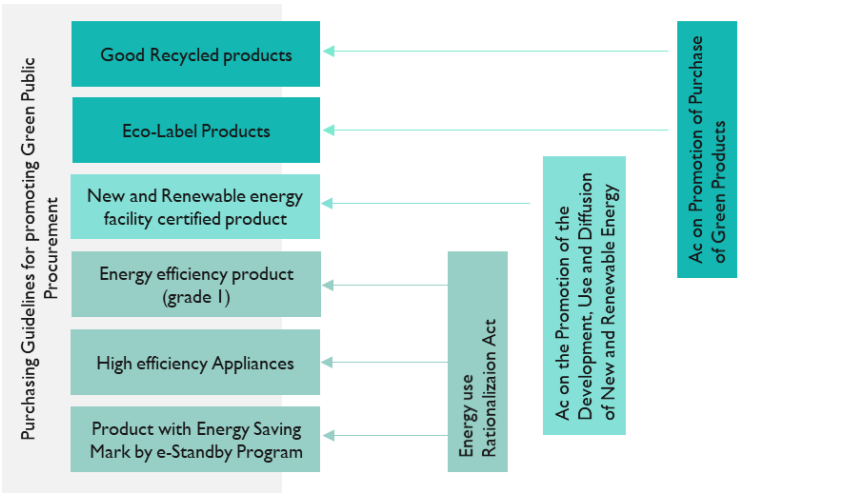


Figure 8: Product Procurement Guideline

the European Commission set an indicative target that, by 2010, 50% of all public tendering procedures should be green, where 'green' means compliant with endorsed common core EU GPP criteria. Since 2008, the European Commission has developed more than twenty common GPP criteria. The priority sectors for implementing GPP were selected through a multi-criteria analysis including scope for environmental improvement; public expenditure; potential impact on suppliers; potential for setting an example to private or corporate consumers; political sensitivity; the existence of relevant and easy-to-use criteria; market availability and economic efficiency. Additionally, the European Product Bureau was set up to support the implementation of European sustainable product policies: Ecolabel, Green Public Procurement, ErP (Ecodesign of Energy related products), and Energy Label.

Korea

The Green Public Procurement (GPP) policy in Korea was introduced with Korea's Eco-label system under the Act on Development and Support of Environmental Technology in 1994. GPP took a more concrete form when the government introduced the Act on Promotion of Purchase of Green Products (hereinafter the "Green Purchasing Act") in 2005 which was built on the established green criteria of the Korea Eco-label and Green Recycled Mark.

By linking these two policies, administrative costs to set the green procurement standards have been limited by each institute, thereby inducing the rapid growth of the green public market. It was after the government's clear signal to scale up the GPP that green products became competitive and diversified in the market. This approach can be strategically replicated in other countries considering the adoption of both eco-labeling and GPP simultaneously.

Netherlands

The Dutch government has developed criteria and practical instruments to implement Sustainable Procurement within the organization. PIANOo, the Dutch Public

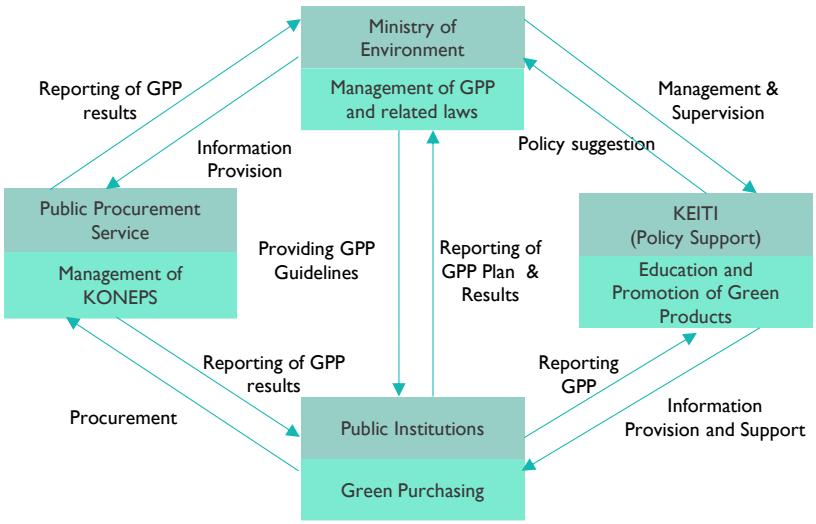


Figure 9: Green Public Procurement system in Korea

Procurement Expertise Centre, was set up to professionalize procurement and tendering in all government departments, to improve efficiency and compliance with the rules. Relevant themes[26] for sustainable public procurement were identified.

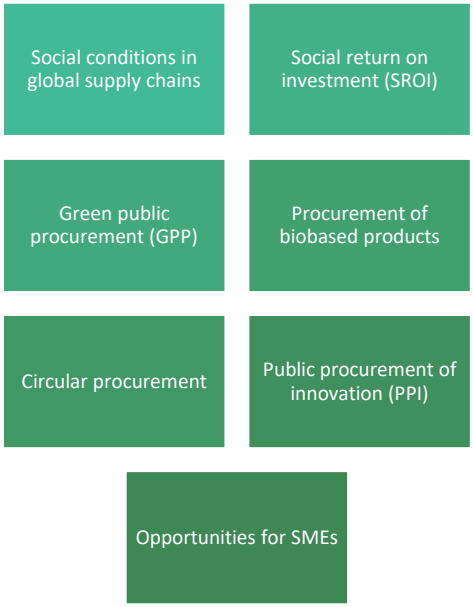


Figure 10: Sustainable Public Procurement Themes

To ensure consistency in criteria and increase applicability, European Union GPP criteria have been referred to wherever possible. Additionally, SPP is tailored to the individual circumstances of the situation. The procurer can not only set the minimum requirements, for instance but also formulate more aspirational award-based invitations to tender. A "Checklist for sustainable public procurement"[27] has been prepared which outlines common points for all procurement agencies to consider.

Figure 11: Checklist for sustainable public procurement

State of Massachusetts, USA

Since 2011, the state has been publishing annual reports on the accomplishments of the Environmentally Preferable Products (EPP) program (equivalent to GPP). Tools have been developed to estimate the benefits of GPP:

a) Energy Star Savings Calculator: to estimate the energy and operating costs savings of energy-efficient office equipment.
b) Electronics Environmental Benefits Calculator: to estimate the environmental benefits of greening the purchase, use, and disposal of electronics, including EPEAT-registered equipment.
c) EnviroCalc: to estimate the environmental benefits of purchasing recycled-content and energy efficient products.

[26] SPP themes | PIANOo - Dutch Public Procurement Expertise Centre
[27] Checklist for sustainable public procurement | PIANOo - Dutch Public Procurement Expertise Centre

d) EPA Waste Reduction Model (WARM): to calculate the greenhouse gas emissions produced by waste management processes in respect of a wide range of material types commonly found in municipal solid waste.

2.4 Sustainable Public Procurement for Cooling Buildings

As per the 2017 UNEP publication, "Factsheets on Sustainable Public Procurement in National Governments", the following countries have included air conditioners as a priority product for SPP: Argentina, Austria, Brazil, Chile, China, France, Germany, Israel, Italy, Japan, Lebanon, Malaysia, Paraguay, Republic of Korea, Singapore, Spain and the United States of America.

The brief, "Enhancing voluntary cooperation on cooling in the G20" calls for enhanced cooperation on cooling at the G20 level, to broaden membership, increase resourcing and commitment, and to better coordinate and learn from best practices, especially given the emerging policy needs presented by COVID-19. Some of the recommendations include,

- Phase out the most inefficient technologies and accelerate the adoption of the best available technologies.
- Encourage higher adoption of cooling solutions such as smart grids, building design, urban planning, and green spaces.
- Boost funding for next-generation high-efficiency, safe, low global warming potential cooling equipment that can effectively control COVID-19 transmission, without aggravating climate change.
- Enhance trade in high energy efficiency products and design of anti-dumping policies to prohibit the import of both new and used obsolete technologies.

The Nordic Council (87 representatives) is using Green Public Procurement as a method to promote sustainable development and use their collective purchasing power as a tool to boost the market mechanism by directing public procurement according to environmental criteria. The new public procurement guidelines exclude HFC refrigerants in refrigeration and air-conditioning and approve alternative low GWP or zero GWP refrigerants, to increase the proportion of natural refrigerants in public procurement. Where natural refrigerants (example: hydrocarbon, ammonia, CO_2) are not possible, only refrigerants with a global warming potential of less than 675 will be allowed.

2.5 Beyond Procurement; Green Cooling Programs and Initiatives

Biarritz Pledge for Fast Action on Efficient Cooling aims to transform the global cooling sector and reduce emissions by coordinating efforts to improve energy efficiency of air conditioners and other cooling equipment aligned with the phase-out of HFCs as per the Kigali Amendment.

Conference of Parties (COP) 26-UK has encouraged countries to increase financing for countries vulnerable to climate change, foster cooling solutions, and take actions to build back better from Covid-19. A key initiative of COP 26-UK has been the

Energy Transition Council (ETC) which promotes and supports ambitious clean energy transitions in emerging economies.

Cool Coalition works on advocacy, action, and knowledge exchange to expedite the global transition to clean and efficient cooling. Sustainable Energy for All's **Cooling for All Program** develops evidence, collaborations, policies, and economic solutions needed to provide sustainable cooling for all people while lowering the energy demand required to do so. The goal of the program is to provide affordable and long-term solutions to disadvantaged people's needs, such as access to nutritious food and safe medicines, as well as protection from heat during the transition to clean energy.

#CountOnCooling campaign launched by the European Partnership for Energy and the Environment to promote awareness about sustainable cooling. A white paper titled "Count on Cooling: A five-step approach to deliver sustainable cooling" outlines key actions that can be implemented to achieve long-term cooling, including instances of how the EU policy framework has already progressed and an assessment of the remaining hurdles.

UNEP's **District Cooling Initiative** intends to foster market transformation by assisting local and national governments in developing local expertise and implementing enabling policies that will drive investment in modern, low-carbon, and climate-resilient District Energy Systems.
The World Bank's **Efficient and Clean Cooling Program** aims to accelerate the adoption of sustainable cooling solutions across sectors by addressing important sustainable development concerns such as providing access to cooling while reducing negative climate consequences.

Climate and Clean Air Coalition's **Efficient Cooling Initiative** has developed high-level political leadership and facilitated stakeholder participation with the intent to improve cooling sector energy efficiency while countries follow the Montreal Protocol targets for phase-down of HFC refrigerants.

University of Oxford's **Future of Cooling** Program investigates the future of cooling as a dynamic system, as well as its interconnections with other SDGs in both the developing and developed worlds.

UNEP's **Global Alliance for Building and Construction** brings together the building and construction industry, countries, and enterprises to increase awareness and support the global transition to low-emission, energy-efficient structures. The GABC brings together 23 countries and 64 non-governmental organizations from across the world who are united in their pursuit of a shared goal: a zero-emission, efficient, and resilient building, and construction sector.

Global Cooling Prize was created in 2018 to encourage the development of a superefficient, climate-friendly, and economical cooling solution. The report 'Global Cooling Prize: Solving the Cooling Dilemma' provides critical results that will be useful for industry participants and policymakers, but it is also meant for consumers who are interested in the

efficiency and technological innovation of household air conditioners.

The Green Climate Fund's **Green Cooling Initiative** promotes green cooling technologies by facilitating exchange between technology suppliers and users, as well as between the industry, public institutions, and civil society.

Kigali Cooling Efficiency Program (K-CEP) is a philanthropic collaboration to support the Kigali Amendment and the transition to efficient, clean, affordable cooling solutions for all. National Cooling Plans (NCPs) are national plans for a country's cooling sector which factors in national priorities and socio-economic benefits. NCPs helps nations to deliver to the commitments set under the Montreal Protocol and Kigali Amendment

United Nations Environment Programme (UNEP) **Refrigerant Driving License** is a globally recognized and accepted qualification program that establishes minimum standards for safe and proper handling of refrigerants in air conditioning, heating, and refrigeration equipment.

Alliance for Sustainable Habitat, Energy Efficiency and Thermal Comfort for All (Sheetal) program enables strategic actions to advance India's sustainable cooling agenda by facilitating the implementation of the India Cooling Action Plan(ICAP), through accelerated adoption of building codes, best practices in the cold chain and transportation sector, capacity building of service technicians for better livelihood, and up-scaling affordable energy-efficient and low GWP technologies to promote sustainable cooling in India.

UN Basel Agency for **Sustainable Energy's Cooling as a Service (CaaS)** initiative is an innovative pay-per-use business model that allows consumers to make decisions based on the equipment's life cycle cost rather than on the initial purchase price. It is a financial instrument to recapitalize technology providers to overcome significant market hurdles to clean and efficient cooling, without upfront investment. It also encourages technology providers to make their equipment modular, with reusable/recyclable parts, because ownership of the equipment is never passed to the client.

International Energy Agency's (IEA) **Technology Collaboration Program on Energy Efficient End-Use Equipment,** is a collaboration between twelve nations that have joined together to share information and expertise to encourage sound policy development in the sector of energy efficient appliances and equipment, known as EA 4E. Benchmarking is a key activity of the program that will allow governments to compare the performance of appliances and equipment across regions and better understand where improvements can be made.

UNEP's **United for Efficiency Program and Model AC Regulation Guidelines** are for governments in emerging economies considering a regulatory or legislative framework for products that are extensively used in household and light commercial settings. The document is a voluntary guide that requires new room air conditioners to be energy efficient and use low global warming potential (GWP) refrigerants.

3

Sustainable Public Procurement Framework

Photo by https://unsplash.com/@ussamaazam

3 Sustainable Public Procurement Framework

Procuring environmentally friendly products and services is important for achieving sustainable development. Sustainable Public Procurement (SPP) not only reduces waste generation and water consumption but also limits energy consumption and carbon emissions. It supports fair and sustainable economic growth and delivers social benefits through procurement. SPP is not just 'green' procurement but also involves socially and ethically responsible procuring while minimizing environmental impact through the supply chain and maximizing economic benefits. The Sustainable Public Procurement Framework is a guide for the government that aims to:

a) Define the criteria for Sustainable Public Procurement.
b) Approach for development of criteria of products, services, and works (such as technical specifications, evaluation criteria, and award criteria).
c) Integrate SPP criteria in the procurement cycle.

3.1 Policy, Standards, and Labels

Sustainable Development Goals

The 2030 Agenda for Sustainable Development includes seventeen Sustainable Development Goals (SDGs) and 169 targets, among which Goal 12 specifically addresses the need to "Ensure sustainable consumption and production patterns".

- Target 12.7 – aims to "Promote public procurement practices that are sustainable, in accordance with national policies and priorities."
- Indicator 12.7.1 – "Number of countries implementing Sustainable Public Procurement policies and action plans," has been specifically set to measure the achievement towards this target.

The One Planet Network implements the 10-Year Framework of Programs on Sustainable Consumption and Production Patterns and is a formally designated implementation and reporting mechanism for Sustainable Development Goal 12.

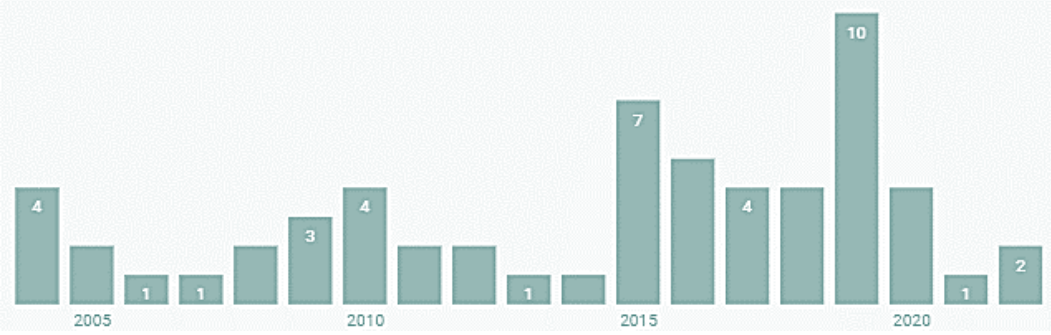


Figure 12: Policy instruments by year of adoption in Asia Pacific Region, Source: SDG 12 Hub

Environmental Performance Standards & Labels

Environmental Performance Standards are established by multi-stakeholder groups, which set specified levels of performance to claim that a product or service is "environmentally preferable". Ecolabels are marks placed on product packaging or in e-catalogs that can help consumers and institutional purchasers quickly and easily identify those products that meet specific environmental performance criteria and are therefore deemed "environmentally preferable"[28].

The ISO has undertaken efforts to standardize the principles, practices, and key characteristics relating to three major voluntary environmental labeling types –

- Type I - environmental labeling (ecolabels),
- Type II - self-declaration claims
- Type III - environmental declarations (report cards/ information labels).

Sustainable Procurement Standard

ISO 9001 (quality management systems), ISO 14001 (environmental management systems) and ISO 26000 provide a framework for organizations to achieve a minimum level of quality and sustainability in the supply chain. They also give substance to the organization's CSR principles. ISO 20400 guideline provides both public and private organizations with practical tips for designing and implementing a Sustainable Public Procurement Process. ISO 20400 is be based on the existing ISO 26000 guideline - the international guideline for Corporate Social Responsibility (CSR).

3.2 Approach to Sustainable Public Procurement

UNEP's SPP approach guides countries through a set of steps in building an effective SPP program. The goal is to create a policy framework for SPP and gradually transform the market in line with the objectives and

[28] EPA, Introduction to Ecolabels and Standards for Greener Products

Figure 13: Standards and Ecolabels, Source: EPA

priority areas. The SPP approach encourages public authorities to move towards more sustainable public procurement systematically and consistently. The SPP approach is structured into the following four key steps[29]:

Step 1: Scoping Study

The scoping study is a situational assessment of public procurement governance, institutional frameworks, implementation mechanism, and priorities of the country. The scoping study would aim to identify the key national focal organization(s) and arrive at a consensus on intent, goal, and objectives.

Step 2: Prioritization and Market Readiness Analysis

The next step is a review of sustainable public procurement initiatives, nationally or organizationally undertaken in the country, and identifying the areas of improvement. It also includes a review of the legal and regulatory framework of the country. SPP requires a systematic approach to achieve positive outcomes and it is important to understand the risks and opportunities associated with certain procurement decisions. Therefore, the SPP Approach includes a robust Prioritization Exercise for deciding which products and services should be part of an eventual SPP policy and action plan.

Figure 15: Steps in conducting prioritization exercise(Adapted from, Sustainable Public Procurement Implementation Guidelines)

[29] Sustainable Public Procurement Implementation Guidelines, Introducing UNEP's Approach (http://www.unep.fr/scp/procurement/docsres/ProjectInfo/UNEPImplementationGuidelines.pdf)

Figure 14: Approach to Sustainable Public Procurement (Adapted from, Sustainable Public Procurement Implementation Guidelines)

A Market Readiness Analysis will be carried out for the shortlisted products and services to assess the existing production capacities of sustainable products and services, analyze the market responsiveness to SPP tenders, capacity to meet future public procurement requirements, and identify relevant verification instruments and tools.

Step 3: Creation of an SPP Policy and Action Plan

The results from the Status Assessment, Legal Review, Prioritization Exercise, and Market Readiness Analysis form the basis for formulation of the SPP Policy and Action Plan, which forms a roadmap of implementing SPP for the country.

Step 4: Implementation

This step deals primarily with the development and insertion of sustainability criteria throughout the procurement cycle.

3.3 Integrating SPP in Procurement Cycle

In conventional procurement, products and services are evaluated and purchased based on the initial cost of acquisition. Hence all products that meet the technical specifications would qualify for financial evaluation. The product which is technically qualified and has the least initial cost is often selected. This linear approach does not consider the total cost of ownership or the environmental impact of the product or service throughout its life cycle.

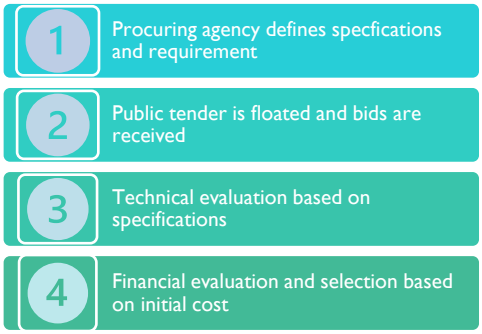


Figure 17: Conventional procurement approach

Sustainable Public procurement aims to integrate sustainability criteria at each stage within the procurement cycle. The evaluation process values the environmental concerns by ranking products or services

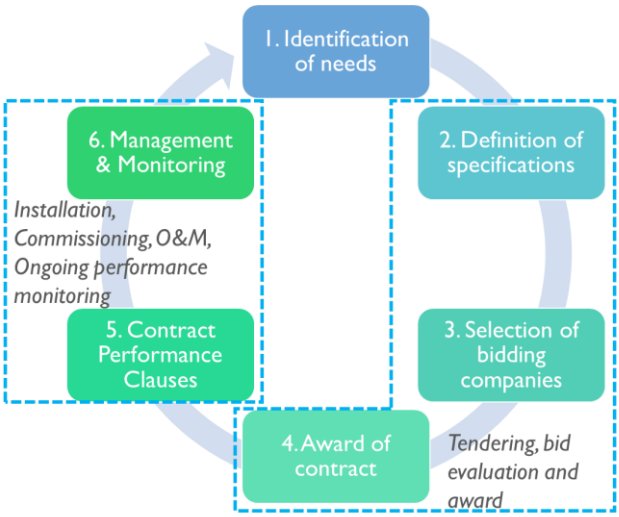


Figure 16: Typical Procurement cycle

based on a holistic combination of environmental attributes, quality, and cost. Whilst different countries may have different procurement terminology, the procedures and stages in the procurement cycle are often similar.
In the context of emerging economies (for example India), steps 2, 3, and 4 encompass the tendering, bid evaluation, and award stage. Steps 5 and 6 encompass installation, commissioning, operation, and maintenance (O&M) and ongoing performance monitoring.

Identification of Needs

Every good or service procured has some impact on the environment, the economy, and people. "Re-thinking" needs is the foremost step in successful implementation of SPP. "Product service systems," where procurement agencies shift from buying products to buying services and system solutions is one such concept. For example, procurement of "cooling as a service" will shift requirements of procurement of air conditioners as products to the procurement of air conditioners as a service. This rethinking promotes product design to consider overall lifetime operation to enhance the durability and life of the product and ensure easy reparability. This will also ensure less "waste" generation at end of life.

Definition of Specifications

Specification setting drives the sustainability agenda of the procurement agency with the manufacturers and suppliers. When defining specifications, sustainability criteria for products and services need to be determined. Types of SPP criteria in specifications:

- Environmental performance criteria (Example, Energy Efficiency Ratios of Air conditioners)
- Threshold criteria defining minimum or maximum levels.
- Preferred criteria (for higher standards of performance).
- Criteria referring to ecolabels.

For a successful implementation, SPP criteria will be applied to each stage of the procurement process, including evaluation of suppliers, award of bids, etc., beyond the definition of specifications. The development of SPP criteria has been covered in detail under section 3.4 of this document.

Selection of Bidding Companies

When implementing sustainable public procurement, sustainability risks could be managed by the selection of bidding companies/ suppliers; for example, choosing suppliers that meet environment management systems or standards. Alternatively, procurement agencies can define organizational criteria within specifications and bid evaluation to determine who is awarded the contract.

Production and manufacturing processes can have a considerable environmental and social impact. Manufacturers can also control and manage the sustainability performance of their suppliers and contractors. Requirements that encourage a sustainable practice through the supply chain can be incorporated within the organization criteria. Organization criteria have been detailed in section 3.4 of this document. Procurement agencies may also seek the organizations' relevant experience with SPP. This is more applicable in the case of procurement of services versus that of products, such as in the case of waste management services, or cleaning and housekeeping services.

Rating of suppliers can also be integrated that enables reward of performance to suppliers by giving them the opportunity for more business. This also encourages suppliers to improve upon their ratings by focusing on specific areas. Parameters based on sustainability can be considered to provide ratings to suppliers.

Award of Contract

Bid evaluation determines which bid wins the contract and eventually how sustainable the contract will be, once awarded. Conventionally, bid evaluations are based on "least cost", and contracts are not awarded on "life cycle" based evaluation. Evaluation criteria that consider "Total cost of ownership" and that assess non-cost factors, will ensure that sustainability is integrated, and risks are managed while awarding contracts and during the duration of the contract.

Contract Clauses, Management & Monitoring

Defining contract performance clauses are key to ensuring that sustainability criteria are integrated through the life cycle of the product/service. Contract clauses can include operation and maintenance practices as well as "end of life/disposal" criteria. Contract clauses ensure suppliers are responsible for optimal performance of the product/service throughout its life.

Contract management is essential to ensure that suppliers and contractors keep to the commitments they made in their bids. During the lifetime of major contracts, large sustainability benefits can be delivered, so effective contract management is especially important for realizing the gains of SPP. Lessons learned through monitoring of SPP contracts can be utilized for identification and formulating needs for the next contract.

3.4 Development of Sustainable Public Procurement Criteria

Steps towards the development of Sustainable Public procurement criteria.

Step 1 Define product/service type based on energy resource-use intensity
Step 2 Determine key environmental and social impacts, and approach for SPP
Step 3 Develop sustainability criteria
Step 4 Evaluate Market Readiness
Step 5 Integrate requirements in the procurement cycle

Step 1: Define Product / Service Type

Sustainability criteria for any product/service are defined based on the type of product or service and identification of its key environmental impacts across its life stages. Different sectors and products are energy and resource-intensive during varying life cycle stages. Based on this, all products and services can be broadly classified into five categories[30]:

- Raw Material Intensive: These products create the most environmental impact during the extraction of their raw materials. Such products typically consist of virgin raw materials. (Example: smartphones) Likewise, services that are dependent on and use virgin raw materials would also fall under this category.
- Manufacturing Intensive: Products that consume the most resources and

[30] "A Review of LCA Methods and Tools and their Suitability for SMEs"; Hannele Lehtinen et al., University of Manchester

generate the most waste during the manufacturing and processing of raw materials. They typically also tend to have a great social impact. (Example: consumer durables)

- Distribution Intensive: These products involve transportation, which adds to their environmental impact and tend to have the maximum impact when they are distributed to sellers in different locations. (Example: airfreight and refrigerated fresh vegetables and fruits)
- Use Intensive: These products are typically durable, go through multiple cycles of use and generate the most environmental impact during their operation. (Examples: automobiles, air conditioners, washing machines) Most services are typically "use intensive", such as cleaning and housekeeping, air-conditioning maintenance.
- "End-of-life" Intensive: These products typically tend to be non-biodegradable, contain hazardous substances, and are difficult to recycle or dispose of safely. They generate maximum environmental impact at the end of their life. (Example: batteries)

While formulating sustainability criteria, it is essential to define which category the product or service belongs to.

Step 2: Determine key environmental and social impacts and approach for SPP.

The key environmental and social impacts across the life cycle stages of the product or service are studied. The sustainability criteria are developed to reduce the detrimental effects of the product or service on the environment.

Table 2: Example of Key Environmental Impacts and SPP Approach for Room Air Conditioner (RAC)

Life Cycle Stages	Key Environmental Impact	Sustainable Public Procurement Approach
Manufacturing phase	Finite resources. Pollution (air, water, soil) Bioaccumulation due to hazardous constituents.	Procurement of RAC's from manufacturers that use recycled materials and follow relevant environmental protection & waste management rules.
Use phase	GHG emissions. Leakage of refrigerants. Health impacts due to noise.	Minimize CO_2 emissions. Minimize or eliminate the use of refrigerants with high GWP. Minimize product noise.
End-of-life phase	Generation of waste materials. Refrigerant disposal	Procurement of RAC's from manufacturers that follow the sustainable end of life practices. Minimize or eliminate the use of refrigerants with high GWP.

Step 3: Develop Sustainability Criteria

While in a conventional procurement scenario, the minimum requirement is limited to criteria concerning product specifications, safety, and performance, a more wholesome approach of SPP includes organizational and social criteria as well and which takes the product life cycle impact into cognizance. Sustainability criteria are developed based on the SPP approach to reduce environmental and social impact, review of international best practices, standards, and country's sustainability targets and priorities.

a) **Product / Service criteria** refer to specific product or service qualification requirements. This includes technical

specifications, functional requirements, and environmental performance requirements. *Product criteria for sustainable public procurement of a room air conditioner would include criteria for; Product type, Product Energy Efficiency Ratio (EER), Product noise, Refrigerant (Low GWP, OPD), Recycled plastic components, Paint use & Packaging.*

b) **Organization criteria** refer to compliance or certifications to comply with state and national level regulations and international standards for the conservation and protection of air, environment, and resources such as water, energy, etc. For example, to demonstrate good management practices, the manufacturers may have to produce third-party certification for compliance with ISO 14001 (Environmental Management System) to the procurement agency.

c) **Social criteria** can include compliance of acts, policies, programs, or rules to be followed by the manufacturers towards its employees and the environment. This adherence is typically required at the organization level.

d) **Evaluation & Award Criteria** enable the procurement agency to compare the relative advantages of different combinations of criteria. The criteria can be weighted, and each tender is scored based on its satisfaction with each criterion. Evaluation can also be based on Life Cycle Costs (LCC) which would include true costs of a product determined based on the overall environmental and social impact of the product/service throughout its life cycle. However, life cycle assessments are complicated and may not be standard practice in emerging economies. In this case, a "Total Cost of Ownership (TCO)" can also be considered as evaluation or award criteria.

Step 4: Evaluate Market Readiness

To ensure implement-ability, acceptability, and adoption of SPP criteria, it is important to evaluate the readiness of the market. Market readiness is also required to determine the cost differential of "greener"

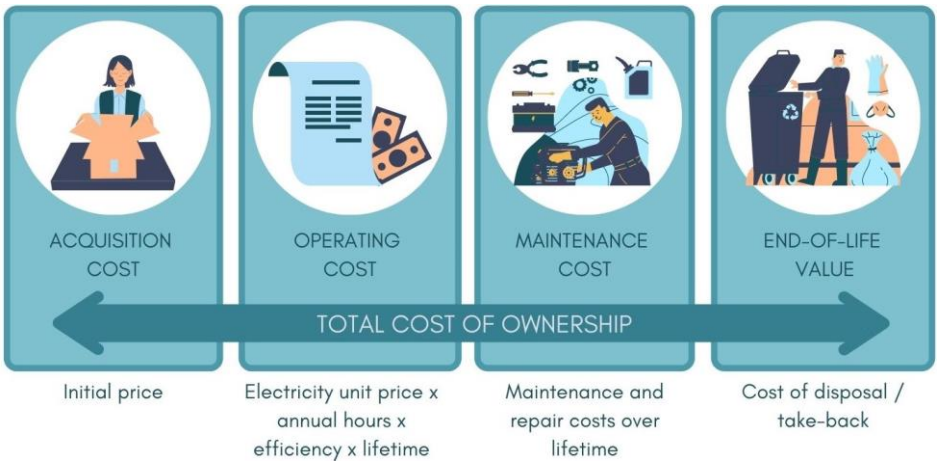


Figure 18: Calculating Total Cost of Ownership (TCO) for a Room Air Conditioner

products/services. This can be carried out through industry and expert consultations, surveys. This exercise further assists determine which criteria can be mandated or form the core requirements, and which criteria are futuristic or advanced. Such advanced criteria can form a part of the comprehensive requirements. A comprehensive market readiness enables a roadmap for the implementation of criteria– short-term, mid-term, and long-term.

Step 5: Integrate requirements in the procurement cycle

Based on market readiness for the roll-out of SPP and future market trends, the sustainability criteria can be categorized under two major headings:

a) **Conventional requirements**, business as usual requirements, and specifications.
b) **Core requirements**, designed to allow for easy application of SPP, focusing on the key area(s) of the environmental performance of a product or service. Core criteria can also be considered mandatory.
c) **Comprehensive requirements**, consider more aspects or higher levels of environmental performance, for use by authorities that want to go further in supporting environmental and innovation goals. This can be in the form of stringent specifications, method of evaluation for bids and products, etc.

The above terminologies align with that of the European Union Green Public Procurement (EU GPP) guideline. Following is a representation of the integration of criteria in the procurement cycle.

To ensure wider adoption of SPP, it is important to have all relevant stakeholders deliberate on the core and comprehensive criteria and define the implementation roadmap.

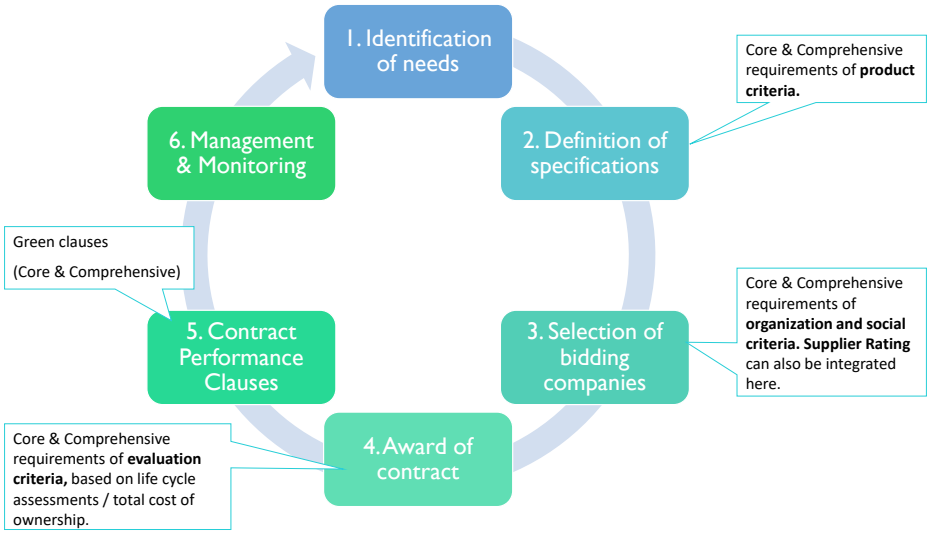
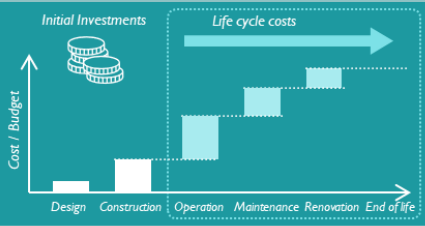


Figure 19: Sustainable Public Procurement cycle

3.5 Procuring Green and Energy-Efficient Buildings

1 Identify the building's **life cycle environmental impacts**



At procurement planning stage, assess building's environmental impacts over its life cycle.
Preliminary assessment of life cycle costs with budgeting.

2 Set **targets for carbon footprint**

International and National Case Studies Review, Market Assessment of Low Carbon Solutions including costs

Estimate Low Carbon Targets and Key Performance Indices

Frame functional and technical requirements.

3 Select **subject of procurement** and allocate targets to each of them.

- Design Services procurement
- Material & Equipment procurement
- Building Construction services

Specify the following,
- Description of procurement
- Procurement procedure
- Minimum Requirements *(In case of design it can also include submissions of low carbon design options)*
- Eligibility Requirements
- Selection criteria
- Evaluation criteria (basis of award of tender)

4 Prepare calls for tender and **evaluate tenders**

Include the targets and assessment methods in the contract notice.
Example: In case of a design services tender a vision of the procurement agency such as Net Zero Energy, Water, Waste, or achievement of a benchmark green building rating can be provided. Some quantifiable metrices that assist evaluation can be included as well.
- *Annual Energy Consumption Target (kWh/ square meter/ year)*
- *Water Consumption Target (Liters / person)*
- *Low Embodied / Low Carbon Materials*
- *Costs / Budget including life cycle costs*

5 Include **targets in the contract**

Monitor target implementation during contract period.

6 Document **results and lessons learnt**

Document experiences to assist in future procurement. Also, standardize templates, contract documents and tools for evaluations.

Figure 20 How to procure green and energy efficient buildings

3.6 Procuring Green Cooling Systems

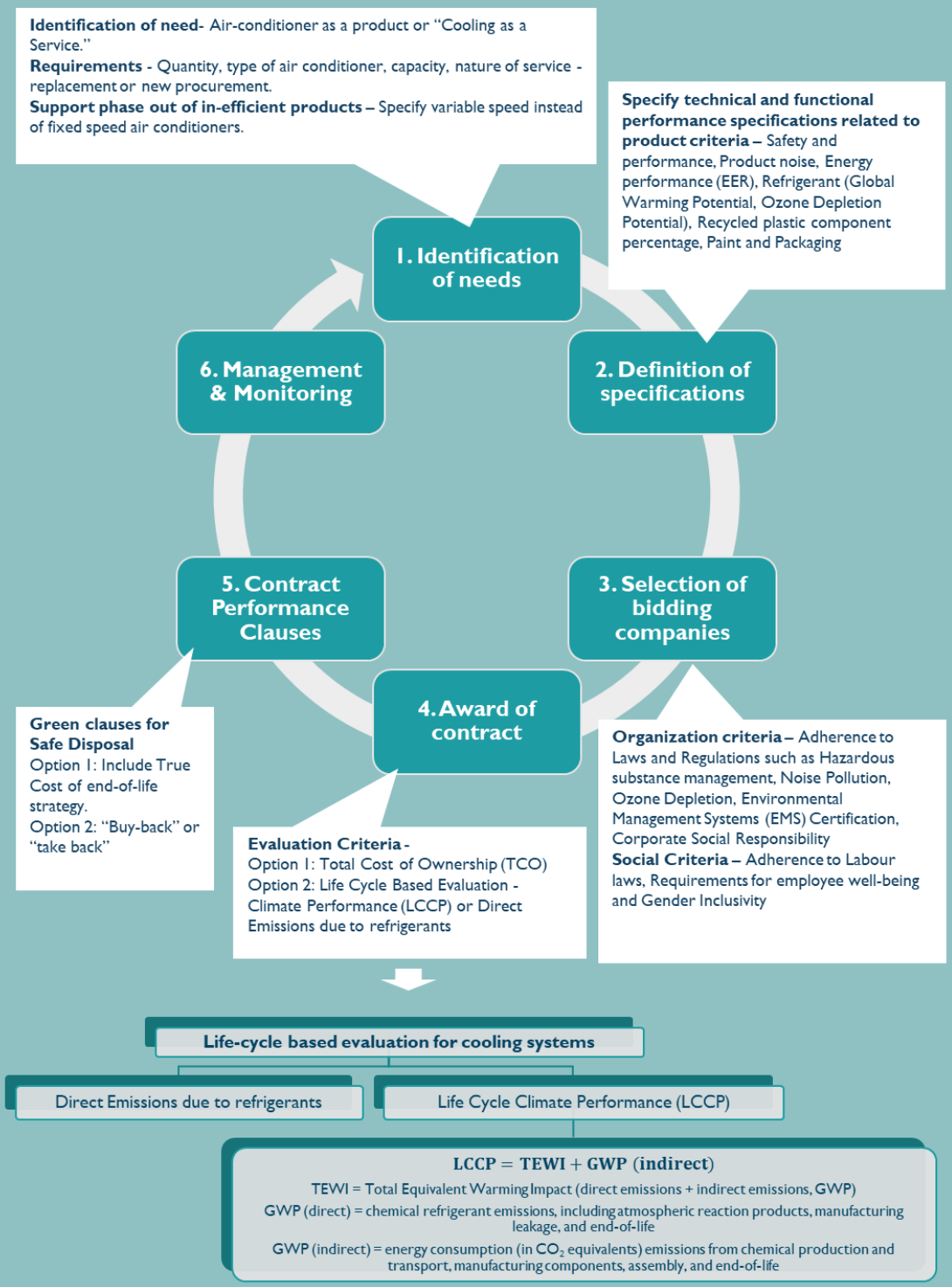


Figure 22: Sustainable Public Procurement Framework for Green Cooling Systems

4

Sustainable Public Procurement India Experience

Photo by https://unsplash.com/@joshihardik710

4 Sustainable Public Procurement: India Experience

Procurement is carried out by ministries, departments, municipal and other local bodies, statutory corporations, and public undertakings in India, at the Centre, State, and Municipal levels. The total volume of public procurement is estimated to constitute about 20-22[31] percent of the nation's GDP and hence the potential for shifting markets in the direction of a green economy is immense. The opportunity of using public procurement as a tool for advancing sustainable consumption and production is, however, relatively new.

At the level of Central Government, SPP can be approached by following the provisions mentioned under General Financial Rules 2017 and the Manual for Procurement of Goods, 2017. The Government of India has also issued a Public Procurement (Preference to Make in India), Order 2017, as part of its policy to encourage 'Make in India'. This order stipulates preferences be given to local suppliers in procurement. The Public Procurement Policy for Micro and Small Enterprises (MSME) has mandated that every Central Ministry/ Department/ PSU shall set an annual goal of a minimum of 25 percent of the total annual purchases from the products or services produced or rendered by MSEs. Even though the practice of SPP has not evolved systematically, several public-sector entities (NTPC, ONGC) and government ministries and departments (Energy, Railways, Tourism, Defense, Highways, Transport, Heavy Industries) have started considering environmental and energy efficiency criteria in their procurement decisions.

In 2014, the Planning Commission documented the need for SPP to develop a low-carbon economy recommending, "government and public sector procurement officers should be empowered to buy on a life-cycle cost basis".[32] In 2017, NITI Aayog published a Strategy Paper on Resource Efficiency in India which includes an action plan for promoting resource efficiency in India. SPP is one of the action points in the strategy paper. The Indian Government set up a Task Force on Sustainable Procurement in 2018[33]. In early 2020, a prioritization study that identified priority products and proposed sustainability criteria for Writing, and Printing Paper and Room Air Conditioners were submitted to the Task Force. Sustainability public procurement criteria and product specifications for Green Room Air Conditioners were detailed and integrated on the Government eMarketplace for voluntary purchase by the Government bodies. Official instructions from Ministry of Finance regarding the procurement of Green Room Air Conditioners is awaited.

The following sections outline some of the best practices in SPP for the buildings and the cooling sector in the country.

[31] Ministry of Finance, FM Reviews Capital Expenditure & Payments of Maharatnas and Navratnas CPSEs, Posted on: 28 SEP 2019 by PIB Delhi

[32] The Final Report of the Expert Group on Low Carbon Strategies for Inclusive Growth, Planning Commission, Government of India, 2014

[33] https://doe.gov.in/divisions/task-force-sustainable-public-procurement

4.1 Green Room Air Conditioner on Government e-Marketplace

Government eMarketplace (GeM), is a digital platform for all public procurement in India. It is an end-to-end procurement system developed for the purchase of goods and services of common use by government buyers. It sees a high volume of sales of air conditioners, with sales of over 44,000 air conditioners worth INR 1.7 billion in 2020-2021. Integration of green room air conditioners within the public procurement system aims to be a catalyst for market transformation towards green and climate-friendly cooling. The GeM green room air conditioner procurement is envisaged to be implemented in two phases. The first phase is a pilot program, wherein the green product criteria have been included in the public procurement platform. Green Room Air Conditioners product category was launched on June 5, 2021 for voluntary purchase by Government bodies.

The development of the green room air conditioner specifications was aided by a study of existing national and international evidence-based policies that could be

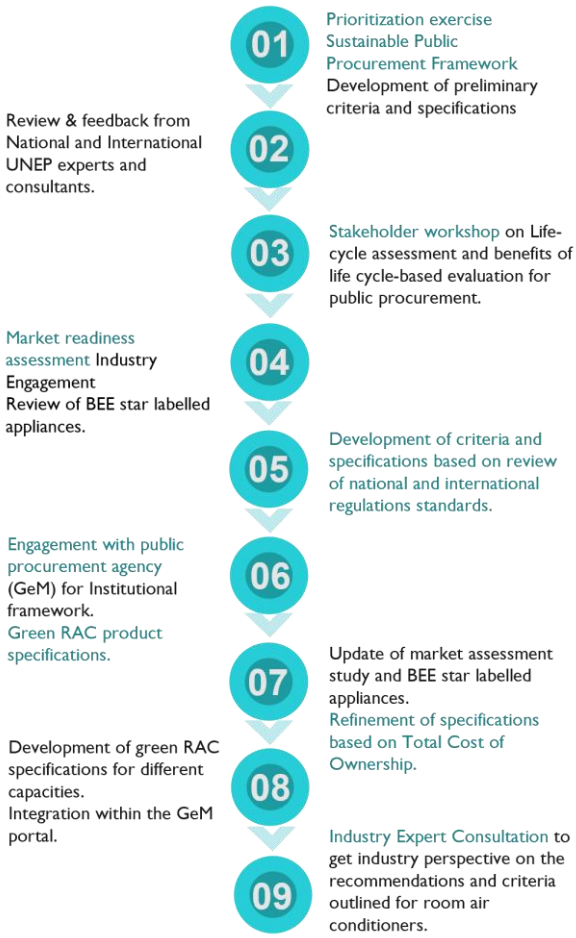


Figure 23: Process outlining the Sustainable Public Procurement Framework Formulation and Development of Green Room Air Conditioners

applied and adapted to India, integrating existing ecolabels and standards, and market studies. The specification thus arrived were based on the total cost of ownership which includes, initial cost, cost of operation through its use phase, cost of maintenance, and end-of-life disposal would help the procurement agency select air conditioners that have an overall lower impact on the environment.

Table 3: Comparing a 1.5 TR 5-star Split RAC with Green RAC

5- Star RAC initially costs INR 42,000- 70,000	Green RAC initially costs INR 42,000 - 75,000
On an average, consuming 890 kWh/year	On an average, consuming 750 kWh/year
Total Cost of Ownership over 7 years is INR 141,880	Total Cost of Ownership over 7 years is INR 122,090
GHG emissions over its lifetime 5,110 kg CO_2	GHG emissions over its lifetime 4,300 kg CO_2

Life-cycle cost assessments are the most thorough method of assessment for SPP; however, it can be challenging to implement given the complexities of the multiple tiers of assessment. Hence to allow for incremental adoption of SPP, procurement criteria that are less technically cumbersome to implement have been developed. However, these are based on

Table 4: Green Room Air Conditioner specifications on GeM

Compressor Type	Variable speed
Safety & Performance	Conform to the requirements for quality, safety, and performance prescribed in IS 1391 Revised /IEC 60335-2-40 (under preparation) and all requirements specified as under.
Product Noise	Air conditioner noise levels shall be as notified under the Environment (Protection) Act, 1986, and as per BIS (IS 1391 Revised).
Energy Performance	3517 W to 5240 W (1-1.49 TR) – ISEER greater than or equal to 5.8 5275 W to 6682 W (1.5-1.99 TR) – ISEER greater than or equal to 5.4
Refrigerants	Refrigerant should have Zero ODP. Global warming potential (GWP) not exceeding 700 (100 years)
Recycled Plastic Components	Product shall be designed to promote recycling Utilizing at least 80% by weight of plastics for recycled plastic components
Paint	Paints used in the product shall not contain heavy metals or their compounds include mercury (Hg), lead (Pb), cadmium (Cd), and hexavalent chromium (Cr).
Packaging	The air conditioner packaging shall be made of recycled or biodegradable materials. Plastic packaging shall not contain halogenated hydrocarbon.
Green Disposal	Take-back or buy-back option is available with the manufacturer.

This initiative has enabled and encouraged all central and state government agencies to buy efficient and environment-friendly green ACs, thereby paving a way for SPP in India.

Further Reading

Purchase Green Room Air Conditioner on Government e-Marketplace at https://gem.gov.in/

Details on SPP framework and Green RAC Brochure

Sustainable Public Procurement in India: Selection of priority products and Preliminary Market Assessment

4.2 EESL Super-Efficient Air Conditioner Program

Bulk-procurement programs can help the next generation technologies penetrate the market. This is done by aggregating the demand for the technology and establishing a demanding market for participating manufacturers, thereby leading to a rapid reduction in prices. Demand-aggregation concepts, although novel in the Indian context, have been previously applied in the US to promote their rooftop solar PV market.

The Super-Efficient Air Conditioning program by Energy Efficiency Services Limited (EESL) is one such bulk procurement program launched in February 2019 which aims to integrate energy efficiency in India's cooling sector. Room air-conditioners are the fastest-growing segment of cooling technologies in India and will have the largest share in national cooling demand by 2030. Within this product category split air conditioners of 1.5TR cooling capacity have the highest market share. The program through collaboration with leaders in the air conditioning industry introduced super-efficient room air conditioners into the market. A super-efficient air conditioner is 30% more efficient than the best-in-the-market product and uses low GWP refrigerants.

The pilot phase expects to install 50,000 super-efficient air conditioners across the country, resulting in annual energy savings of 107 million kWh and annual GHG mitigation of 91,000 tons.

Market research to assess efficiency of room air conditioners, product pricing structure, supply chain, and financing schemes by dealers to enhance retail sales of energy efficient ACs formed a part of the program design. To encourage consumer demand, EESL also offered comprehensive after-sales support and 100% upfront financing through the ESCO model.

Technical specifications for super-efficient ACs have been decided based on the best technology available in the market. Super-efficient ACs had a minimum ISEER (Indian

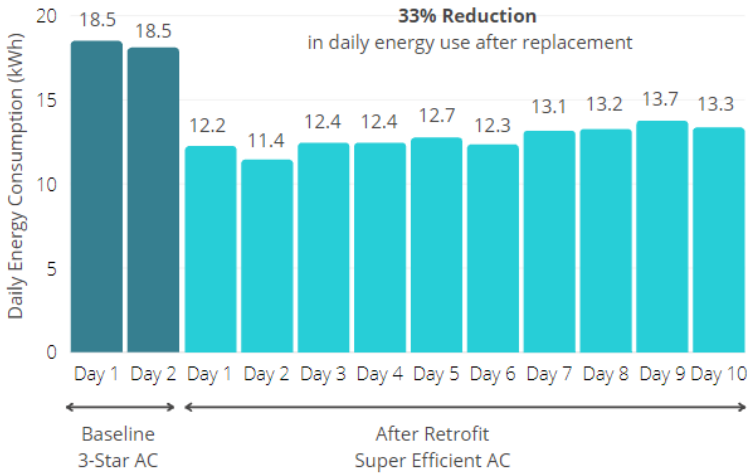


Figure 24: Monitored energy use after replacing a 3-Star fixed-speed split AC with a 5.2 ISEER split AC in a Bank ATM in Mumbai.

Seasonal Energy Efficiency Ratio) of 5.2 in Phase I tender and of ISEER 5.4 in Phase II tender. The tender requirements mandated that the suppliers design, manufacture, supply, install, and provide after-sales O&M with extended customer support.

Figure 25 Technical Specifications of Super-Efficient Room Air Conditioner

Even though it was a first attempt at bulk procurement for super-efficient ACs, 40% of the bids for Phase-I tender was awarded to a supplier providing low-GWP refrigerant, while also meeting the other criteria. Phase-II included low GWP refrigerant criteria in addition to higher ISEEER (5.4) as well as other sustainability criteria such as buy-back scheme, safe disposal of refrigerant and e-waste disposal, green certificates, and customer care grievance redressal mechanism.

Because of demand aggregation, the prices of super-efficient air conditioners were made comparable to the most energy-efficient air conditioners available in the market. ESEAP resulted in a price drop of 22% of split air conditioners and pushed all major manufacturers to start supplying split ACs of a minimum of 5.4 ISEER.

Further Reading

Program dashboard: https://eeslmart.in/
Details on USAID MAITREE Technical Assistance
Vision document and Brochure

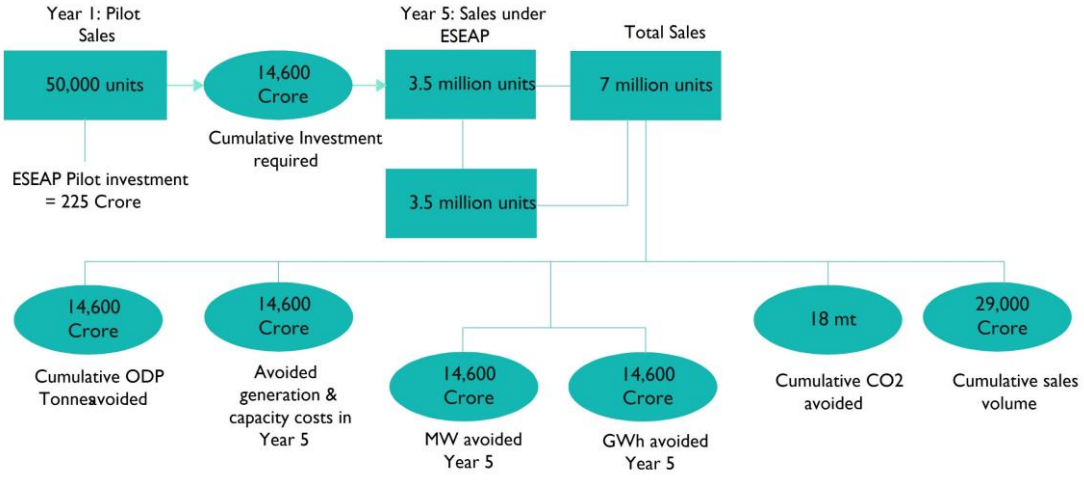


Figure 26: Plan for scaling Super-efficient Air Conditioning Program (Source: Vision document)

4.3 Retrofit of Air-conditioning to improve Indoor air quality for Safety and Efficiency (RAISE) program

Poor air quality has been a concern in India and has become even more important considering the COVID-19 pandemic. The narrative preceding the pandemic considered energy efficiency and air quality at two opposite ends and required one to be compromised for the other, with air quality often taking a backseat. It is a known fact that most existing buildings in India are not equipped to establish and maintain healthy indoor air quality and need to be upgraded. Maintaining good indoor air quality is essential for reducing pathogen spread and ensuring the safety and wellbeing of occupants, as people return to their offices and public spaces. However, there is no standardized approach to retrofit in response to the COVID-19 response.

Responding to the COVID-19 pandemic, a national level program "RAISE (Retrofit of Air-conditioning to improve Indoor Air Quality for Safety and Efficiency)" was launched jointly by EESL (Energy Efficiency Services Limited, an energy service company of the Government of India) and USAID. The initiative is aimed at making workplaces healthier and greener. The retrofits focus on enhanced indoor air quality (IAQ), thermal comfort, and energy efficiency (EE) in the air conditioning system.

To boost the reach of this initiative, RAISE was added to the range of other energy efficiency technologies that EESL offers as an Integrated Energy Efficiency Services Model (IEESM). The IEESM has demonstrated success by integrating various energy efficiency services for a better value proposition along with a reduction of transaction costs for the customers.

RAISE was first implemented as a pilot at EESL offices in May 2020. Additional pilots were carried out at the Shram Shakti Bhawan (Office of Ministry of Power) and Office of Ministry of Home Affairs to test the integrated approach. The retrofit measures implemented in the pilot projects were:

a) Integration of energy efficiency measures including up-gradation of air

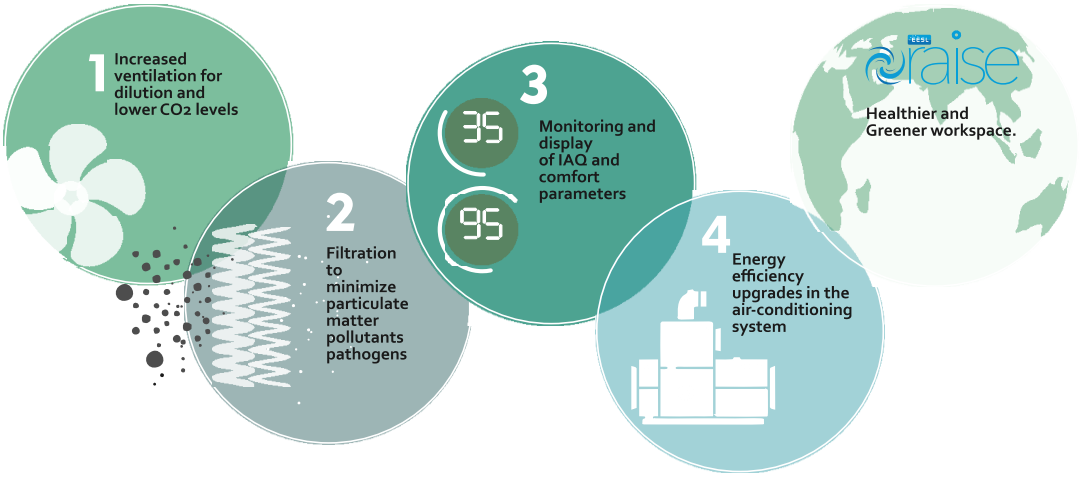


Figure 27: Integrated approach for healthy & energy efficient buildings

conditioning systems for enhanced energy efficiency and cooling performance

b) Increased ventilation for dilution and lowering the buildup of pollution and pathogens. Sensor controlled automation of fresh air dampers enables the ventilation system to respond to the building's occupancy
c) Enhanced filtration to minimize particulate matter, pollutants, and pathogens
d) Monitoring and display of IAQ and comfort parameters in real-time to occupants

Pilots retrofitted under the RAISE program have shown a marked improvement in indoor air quality with an over 95 percent reduction in pollutant concentration compared to outside levels. In buildings where the RAISE program has been implemented, the air quality index often registers within the "healthy" range giving occupants confidence about building safety, even when outside monitors read "hazardous".

The budget for the program's first phase is USD 12 million. Based on the experience of the initial pilots; retrofit specifications were developed, for nationwide scale-up of the RAISE initiative. Over the next few years, the program will expand across India fulfilling a critical need for clean air and reduced energy consumption. The next steps for RAISE also include a large-scale procurement for air filtration and monitoring systems and a nationwide awareness campaign.

Further Reading

Program Dashboard - https://eeslindia.org/en/raise/
USAID MAITREE Technical Assistance & RAISE Brochure

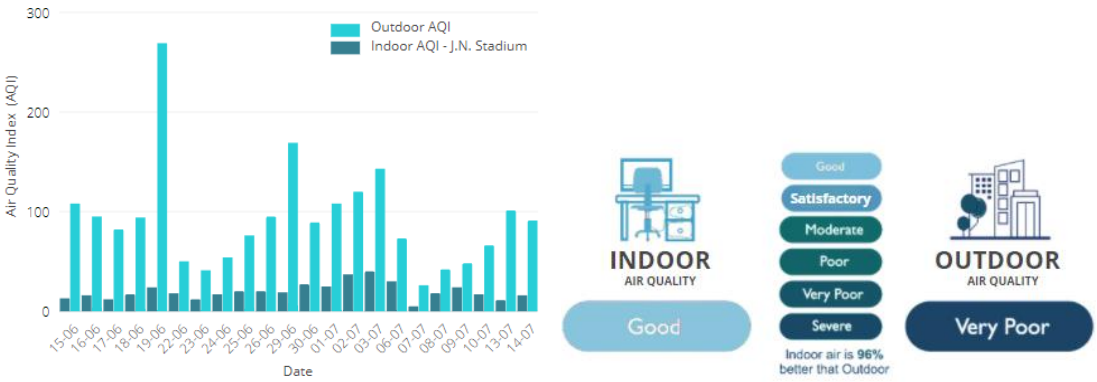


Figure 28 Indoor versus Outdoor AQI after Retrofit

4.4 Chiller Energy Efficiency Program

Since the construction boom began in 2000, the installed stock of chillers has been adding up. 30% to 40% of energy consumption in buildings is due to cooling systems. Chillers alone contribute a significant percentage. National strategies for controlling cooling demand identify central cooling systems as a focal area for reining in energy use due to space cooling. A market-centric initiative to stimulate the timely retirement of inefficient chillers and ancillary central plant systems can substitute inadequate policy drivers. Market demand assessment for ESCO financing and forecasts for chiller replacement indicates a 1.5 billion USD market till 2030. Cooperating with the market to build demand for replacement also holds potential for pushing deep changes in chiller markets towards energy efficiency.

Conceptualized and developed in partnership with the USAID MAITREE program, EESL's Chiller Energy Efficiency program aims to expedite the timely replacement of superannuated, inefficient chillers and other central cooling plant equipment with energy efficient models. The program will incentivize manufacturers to invest in research, development, and deploy more efficient technologies.

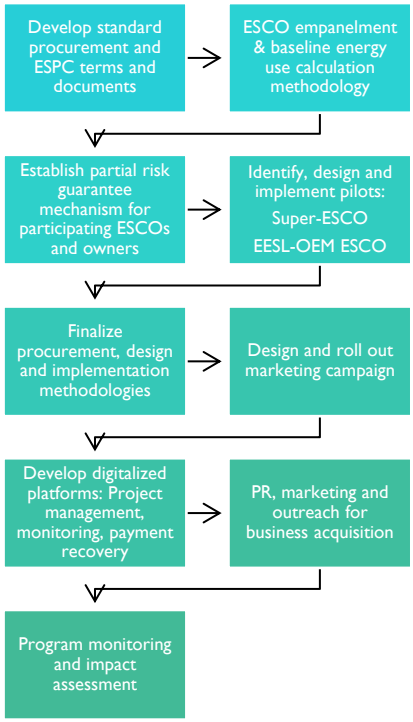


Figure 30: Chiller Energy Efficiency Program Model

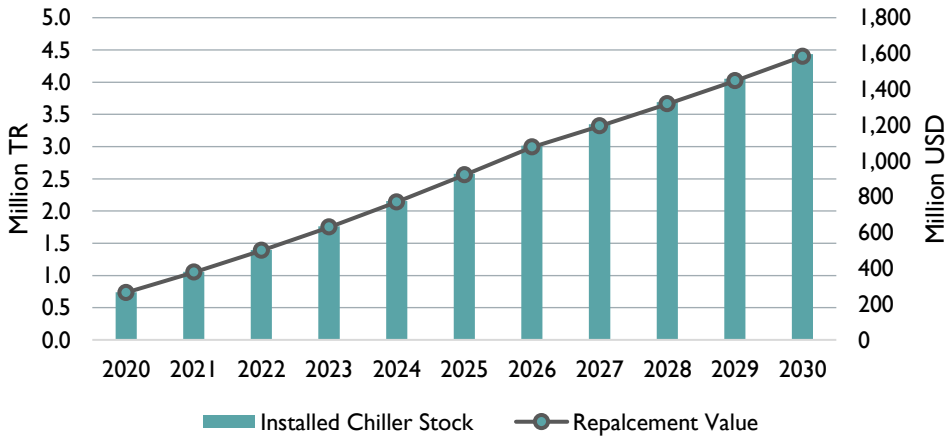


Figure 29: Replacement Market Size & Value Projections

A suitable business model was deduced after conducting a market feasibility assessment for chiller replacement in India and assessing the distribution of chiller population by age, cooling capacity, technology, etc. ESCO financing adopted consists of EESL providing 100% financing upfront. Project-specific deemed savings are the basis of estimating returns for EESL and the customer. Monetary savings resulting from the replacement or retrofit will be shared in a pre-determined ratio with the customer.

Figure 31: Business model

Owners will be able to save 20-30% energy, at zero upfront cost, while upgrading to highly efficient machines compliant with BEE's Standards and Labeling Scheme and matching global efficiency benchmarks. About 40% of the stock, ready for replacement is installed in government or public buildings. Hence, the first phase will target government, public, and hospitality buildings. The program can support the realization of the cooling energy savings target identified in the India Cooling Action Plan (ICAP) by increasing the market penetration of energy efficiency chillers. By 2030, replacement of superannuated chiller stock is expected to result in 4,000 GWh energy saving and reduction of 3,300 tons of CO_2e GHG emissions. Other ICAP goals realized through this program will be:

a) Thermal comfort for all, lower energy or electricity costs to users, higher user productivity, and improved health as socio-economic benefits of sustainable space cooling
b) Mandatory public procurement guidelines for highest-efficiency ACs, fans, chillers, etc. and recommendations for low-GWP options where available
c) Retrofit of existing buildings to reduce cooling requirements and energy consumption.
d) Development and production of low-GWP alternative refrigerants to replace the widely used high–GWP HFCs.

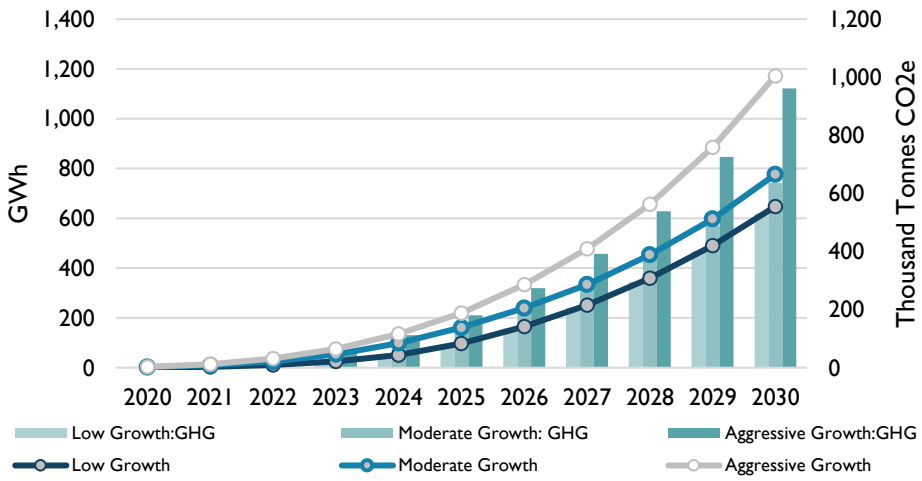


Figure 32: Projected Energy Savings & GHG mitigation potential

4.5 Lucknow Development Authority's Green Building Criteria

Energy use in buildings, especially due to air conditioning, is on the rise across the tropical region. While increased energy use in buildings and better thermal comfort bring many benefits for building occupants, managing this growth requires careful planning. Because much of the building infrastructure is yet to be built in the developing world, there is an opportunity to design and construct buildings that are economical, comfortable, and energy efficient.

In the case of India, a household's share of total electricity is expected to grow from 22% in 2014 to 37% by 2030, as the country approaches (and achieves) the targets for 'Power for All' and 'Housing for All by 2022'. Increased energy efficiency in the residential sector is, therefore, vital to any strategy for lowering the overall electricity consumption of the country.

The Lucknow Development Authority (LDA), which is the key development body under the Uttar Pradesh Housing and Development Board, plans and develops several types of construction projects; including, its projects as well as provides land for the development of residential and commercial (such as malls, schools, factories, hospitals) buildings.

LDA aims to ensure the easy provision of affordable housing to economically weaker sections of society. Under the Pradhan Mantri Awas Yojana (PMAY), the LDA planned to construct affordable housing comprising of 48,000 dwelling units in various parts of the city to cater to the Economically Weaker Sections (EWS) and the Low-Income Group (LIG) categories. Such large-scale construction is conventionally energy-intensive in terms of embodied energy of the large volume of materials used and is also operating energy used for maintaining thermal comfort during the building's use.

LDA mandatorily adopted Green Building Criteria (GBC) for all (residential & commercial) its buildings as an SPP approach. The criteria formulated accounted for the following -

a) Scalability & Cost-effectiveness for LDA to be able to oversee a robust growth in its building stock, without compromising its green agenda
b) Energy Efficiency by minimizing the energy demand through sound design principles and incorporating efficient technologies during the design stage.
c) Favorable thermal comfort conditions that would enhance mental and physical health, thereby increasing occupant wellbeing.
d) Given that outdoor (ambient) air pollution has been deteriorating, buildings must be resilient and protect occupants from pollution. Given that people spend a majority of their time indoors, healthy, and resilient indoor environments are of paramount importance.
e) Opting for green building materials for construction. Building specifications incorporated into the tender documents are complying with energy codes such as ECBC-R. The envelope materials would allow low heat transfer resulting in reduced indoor temperatures and increased thermal comfort

Photo by Nalanda University

4.6 Nalanda University

Nalanda University (NU) is a postgraduate, research-intensive, international university supported by the participating seventeen countries of the East Asia Summit. The University was established in November 2010 by a special Act of the Indian Parliament and has been designated as an "institution of national importance".

Vision for the Nalanda University campus development

"As an integral part of the approach to which the University is committed, the development will consciously 'walk' the path of Net Zero or Near Zero Environmental Impact. The ultimate aim is to achieve a campus that is Net Zero Energy, Net Zero Emission, Net Zero Waste, and Net Zero Water. The term Net-Zero or Near Zero is based on a long-term approach and qualified by assessment of life-cycle costs, related environmental and social benefits in making informed decisions."

MAITREE Partnership with Nalanda

Nalanda university campus is being built as a 455 Acre as a Net Zero Energy, Water, and Waste campus. USAID has been providing technical assistance to this project since its inception in 2012, initially under PACE-D and now under the MAITREE program. USAID support includes:

a) Advocacy and assistance for setting the Net Zero vision for the entire Nalanda University campus
b) Development of the NZEB design criteria and support the sustainable public procurement process for selection of an architect
c) Design advisory for NZEB campus design focusing on energy efficiency, air conditioning design, and renewable energy integration including technical advisory services for all the design, specification, and procurement aspects of NZEB.

Further Reading

USAID PACE-D Technical Assistance - Brochure
USAID MAITREE Technical Assistance Case Study at Net Zero Energy Building Knowledge Portal

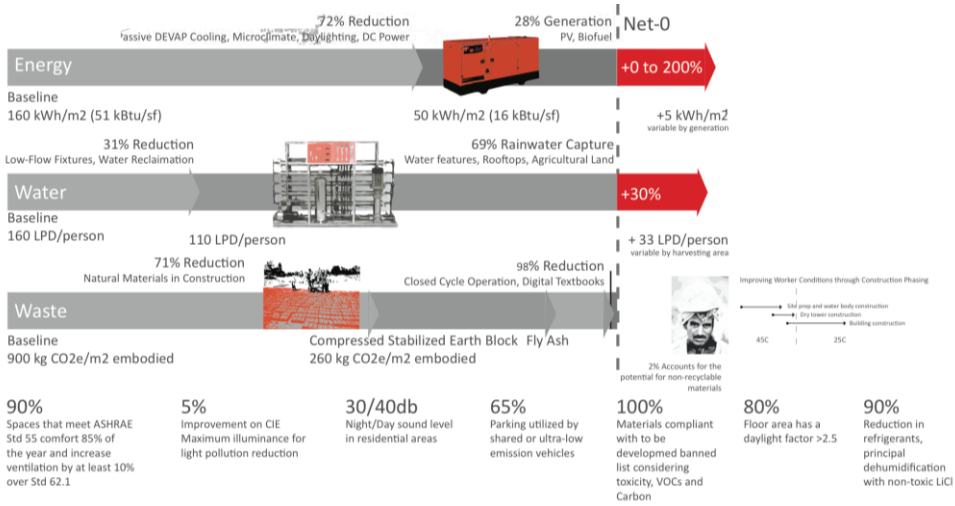


Figure 33 Nalanda University: Net Zero Living Plan

Photo by AB Lal Architects, Telangana State Renewable Development Corporation

4.7 TSREDCO Super ECBC and Grid-Interactive Net Zero Energy Building

USAID is working with the State of Telangana on a pathbreaking initiative to reduce the climate change impact on buildings. The first-ever Grid-Interactive Net Zero Energy Building is being piloted in Hyderabad, to showcase the feasibility and set an example for future buildings to follow. The building will house the offices of the Telangana State Renewable Energy agency and TSSPDCL, a utility. This is an example of a government agency using the mechanism of pilots to develop and test a sustainable public procurement process for low carbon buildings.

This is the first Grid-Interactive Net Zero Energy Buildings (G-NZEB) in South Asia and can be described as 'highly energy-efficient, grid-connected buildings that meet their energy needs through renewable means, while maintaining a two-way communication with the grid' to balance demand with electricity supply.

USAID MAITREE program has supported the program from inception with technical support for design and the procurement process. The project is funded by the State government with an additional grant from the Central govt for the Super ECBC compliance demonstration. The procurement process included:

a) Designing an Expression of Interest that outlined the requirements for the proposed Net Zero Energy Building.
b) Shortlisting design teams as per the eligibility criteria to be a part of the design competition.
c) Preparation of an RFP, highlighting the requirements of the NZEB design and competition.
d) Tender evaluation considering both technical and financial bids for the selection of an architect.
e) Technical assistance is being provided during implementation.

Figure 34 TSREDCO: Sustainable measures for Net zero target

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USAID MAITREE

United States Agency for International Development (USAID) Market Integration and Transformation Program for Energy Efficiency (MAITREE) is a bilateral program with the Ministry of Power, Government of India. MAITREE aims at accelerating uptake of cutting-edge technologies, innovative business models, and end-user engagement, for adoption of energy efficiency at scale. MAITREE works with a range of public sector, private sector, and international partners. Environmental Design Solutions [EDS] is the implementing partner for the program.