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Promoting climate resilient industry



INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT

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“UNIDO sees its role in the energy and climate change field as a catalyst for scaling up investments in clean energy solutions, strengthening policy frameworks to create an enabling environment and to secure funding for increased market penetration of renewable energy, energy efficient and low carbon technologies that promote sustainable industrial growth. With its activities, UNIDO contributes particularly to the cross-cutting area of SDG 7 on Sustainable Energy, SDG 9 on sustainable industrial development, and SDG 13 on Climate Action.”

Li Yong
UNIDO Director General

Introduction

Industrialization has lifted millions out of poverty, created jobs, advanced technology and increased social prosperity in countries around the world. However, industry is also one of the largest emitter of greenhouse gases (GHG), representing almost 30% of global emissions. Undeniably, it is essential that conventional industrial development patterns be transformed to become more climate resilient.

Historically, industrial and energy revolutions have gone hand in hand, producing multiple inventions that significantly altered the global industrial landscape. The first industrial revolution, powered by steam and coal, made it easier and faster to produce textile products, drove down printing costs, enabled the spread of the written word and created railways that bridged nations and continents. The second industrial revolution powered by oil, enabled mass production, individual mobility, and the division of labour. Nevertheless, rapid economic growth over the last 250 years, especially energy production, consumption and industrial development of agriculture and technology, has unmistakably changed some key processes and systems on Earth. The use of fossil fuels as the prime energy supply underpinned this rapid industrial growth producing GHG emissions and causing climate change. The impacts of such activities on the environment are exceeding the Earth's carrying capacity, overstepping the safe limits of the planetary boundaries.

Historically, industrial and energy revolutions have gone hand in hand, producing multiple inventions that significantly altered the global industrial landscape.

2015 marks a milestone for international commitment to sustainable development and the fight against climate change. Three major events of the year will shape the future of global efforts to achieve levels of prosperity that are not harmful to the natural environment and climate. The Addis Ababa Financing for Development conference provided this new agenda with a set of means of implementation that will enable progress towards the Sustainable Development Goals. Secondly, the UN General Assembly session adopted the 2030 Agenda for Sustainable Development (the 2030 Agenda), including 17 SDGs. Thirdly, the 21st United Nations Climate Change Conference (COP21) could herald a new climate agreement on effectively reducing emissions in the coming years, which would need to be mainstreamed into the SDGs implementation framework. Together, these events and agreements will give humanity an opportunity to propel forward the development agenda for decades to come. Highlighting economically, socially and environmentally sound ways for development – as well as transforming conventional industrial models – is essential for the benefit of future generations.



The role of industry is rightly recognized by the 2030 Agenda, and particularly by SDG 9: “Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation”. Additionally, shifting to low emission and climate resilient pathways falls neatly within SDG 13: “Take urgent action to combat climate change and its impacts”. This emphasizes the need to transform industry to become climate resilient. Inclusive and sustainable industrialization has strong ramifications for most, if not all, other SDGs. The interrelated nature of the SDGs makes it imperative to promote industrialization patterns that are socially inclusive and reduce pollution and GHG emissions compared to traditional technologies and practices. In line with the renewed mandates given to both UNIDO and the United Nations development system, UNIDO’s vision to address the most pressing challenges is enshrined in the Organization’s pursuit of Inclusive and Sustainable Industrial Development (ISID). Consistent with this mandate, UNIDO’s programmatic approach is guided by three interrelated thematic priorities: creating shared prosperity, advancing economic competitiveness and safeguarding the environment. Over the past few years, the international community has made a quantum leap in advancing new approaches to accelerate progress and pave the way for more ambitious and inclusive industrial development. The SDGs framed the 2030 Agenda with the vision and ambition to achieve both a balance among the three dimensions of sustainable development – environmental, social and economic – and to integrate them into a universal framework for global cooperation and action. Addressing the profound interrelation between the 2030 Agenda for Sustainable Development and the climate challenge will define the unique contribution industrialization brings to continued development within the safe operating space of the Earth’s system. Failure to address these inter-linkages in a timely manner would be a missed opportunity to end poverty and create shared prosperity.

Nevertheless, not all countries have the capacity to address climate change in a sustainable way. Enhancing capacity building and knowledge management for climate action helps to increase the ability of individuals, organizations and countries to minimize the impact of climate change for industry. This

underlies the logical framework UNIDO sets in building blocks to optimize pathways for climate resilient industrialization. Firstly, technology transfer and deployment at a scale are essential for cleaner and more efficient industrial production. Secondly, fostering innovation and entrepreneurship is critical in developing new industrial capacities for wealth creation, whilst safeguarding the environment. Thirdly, bolstering partnerships with state and non-state actors, including cities, business and regional-level networks, to attract investment and implement industrial best practice is crucial. These building blocks apply to all fields of work UNIDO is involved in for promoting climate resilient industry, which, among others, include advancing agro-industrial production for increased food security; improving energy efficiency; deploying renewable energy solutions; increasing green jobs; and simultaneously approaching different resource constraints and environmental impacts in an integrated manner. UNIDO strives to promote climate resilient industry that ensures economic growth in a socially inclusive and environmentally sustainable manner.

With this publication, UNIDO highlights the importance of promoting climate resilient industry. It takes stock of industry's contribution to economic growth and social prosperity whilst recognizing its impact on global GHG emissions. Following this, it proposes climate resilient industry as a means for achieving both the global sustainable development and climate agenda. This entails recognizing the extensive potential of synergizing mitigation and adaptation measures in industry. Taking a synergetic approach would not only maximize value for money and enhance competitiveness of industry, but also reduce trade-offs and amplify benefits that may not have been achieved if addressed separately. Key priorities for its implementation are distilled through the building blocks of technology transfer, fostering innovation and entrepreneurship and bolstering partnerships, among others.

Promoting climate resilient industry within safe planetary boundaries

Significant climatic impacts on geo-physical and biological systems, as well as human activities, are already occurring. Temperature data calculated over the period 1880 to 2012 indicates a global temperature rise of 0.85°C. Additional magnitudes of warming will only increase the risk of severe, pervasive and irreversible impacts. The climate agenda highlights the importance of limiting global warming to below 2°C, which would significantly reduce the projected high risks of a 'business as usual' approach, which would lead to 4°C of warming. Unprecedented technological advancements, alongside a growing understanding of the urgency of addressing environmental concerns, have meant that a restructuring of conventional industrial patterns is emerging. Professor Jeremy Rifkin, an economic and social theorist, argues that the "third industrial revolution" was brought about by the deployment of new IT solutions and renewable technologies. The third industrial revolution, he stated, focuses on the efficient and climate-friendly use of resources, producing smart energy systems and integrated resource management to enable industrial and economic growth, while simultaneously safeguarding the environment for future generations. Differing from the previous revolutions in terms of scale and speed, a new wave of industrial revolution represented by Industry 4.0 focusses on Internet of Things (IoT). The IoT revolution has the potential to pave the way for a technological and social revolution that can significantly alter the entire sustainable industrialization landscape.



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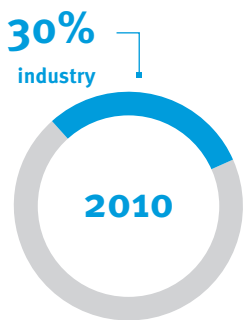
Industry and climate change

Climate resilient industry builds on cleaner and resource-efficient production technologies and practices that de-couple economic growth from unsustainable resource consumption and environmental degradation. Pathways for climate resilient industry must ensure that climate change and actions to combat it do not jeopardize the development of countries or the welfare of their citizens. UNIDO, through its projects and programmes, focuses on identifying and scaling up means to mutually reinforce the climate resilience and economic development of countries.

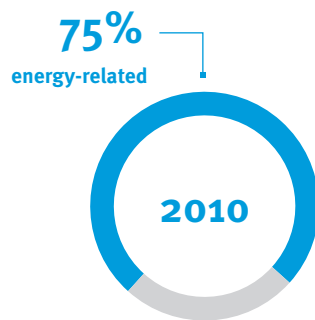
GHG emissions from industry

Greenhouse gas (GHG) emissions from industry represented almost 30%¹ of global GHG emissions in 2010 and around 75% of that is energy-related.

GLOBAL GHG EMISSIONS



GHG EMISSIONS FROM INDUSTRY



According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014b), GHG emissions from industry in 2010 amounted to 13.99 billion metric tons of CO₂ equivalent (GtCO₂eq), out of which 5.27 GtCO₂eq came from direct consumption of fuels for energy and another 5.25 GtCO₂eq from electricity and heat consumption. Total process CO₂ emissions were 2.59 GtCO₂eq, out of which 1.35 GtCO₂eq came from cement production. Non-CO₂ GHGs made up 0.89 GtCO₂eq and major emission sources included HCFC-22 production (HFC-23, 0.20 GtCO₂eq), adipic and nitric acid production (N₂O, 0.10 GtCO₂eq) and aluminum production (PFC, 0.05 GtCO₂eq).

The potential for industry to reduce its GHG emissions is significant, particularly because of its use of fossil fuels as its primary energy supply. Industry is also the largest sector in terms of energy consumption. According to the International Energy Agency (2015), total final consumption of energy by industry amounted to 2702.44 million tonnes of oil equivalent (Mtoe) in 2012, equivalent to 28.3% of the total consumption by all sectors.

Industrial energy efficiency remains one of the key strategic mitigation actions. The IPCC argues that the energy intensity of the sector could be reduced by approximately 25% through energy efficiency measures, such as wide-scale upgrading, replacement and deployment of best available technologies. A further 20% reduction would require broader and more innovative approaches. Such approaches may include, among others, change of product design, processes and input at plant level to collective approaches through sharing of infrastructure and exchange of materials, energy, water and by-products. The need for industry to move towards low emission modes of production is becoming increasingly evident.

¹ These figures exclude emissions associated with landfill, waste incineration, wastewater treatment and other emissions related to waste-management.

Climate change implications for industry

“Fit-for-the-future” technologies and approaches are needed to build climate resilient industry.

Climate resilient industrial development involves continued efforts to mitigate changes in the climate while at the same time prepare industry to adapt to its impacts. Apart from those related to extreme weather events, the impacts of climate variation in industry are not always obvious. Considering the heavy dependence of industry on various natural resources and raw materials, the productive capacity of manufacturing industry could be severely affected by climate change if not addressed appropriately in a timely manner. It is becoming increasingly evident that certain mitigation measures could aggravate vulnerability in another location, while other approaches have clear mutual benefits towards improving resilience. Similarly, many adaptation measures would result in additional GHG emissions from industry, for example, from increased extraction of global resources for construction materials and energy, among others. Effective solutions to climate change require a holistic approach that recognizes the interlinkages and potential trade-offs of different approaches, and leverages the synergies between mitigation and adaptation measures. This can also bring additional benefits such as climate financing that could not have been leveraged if addressed separately.



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EXPERT'S VOICE: **Professor John Mathews**

The necessity to align industrial development strategies with climate change mitigation provides a chance to bring a fresh perspective to both issues. Energy has not been a central concern in industrial development strategies in the past. This was for the simple reason that it was always assumed that countries would industrialize using fossil fuels -- in the same way that Western countries had relied on fossil fuels in the 19th and early 20th centuries, followed by East Asian countries as they likewise depended on coal, oil and gas in the second half of the 20th century. But a coal-driven industrial pathway does not look so attractive in the 21st century, especially when being pursued at the scale envisaged by China, India and other industrializing giants.

One fresh perspective is that renewable energy sources can now be factored into development strategies. This was not even feasible just a few years ago because of concerns that costs were greater than those associated with consuming fossil fuels. But as China and other emerging giants have placed more and more emphasis on renewable sources – with a focus on water, wind and sun – so they have driven down the costs, with global repercussions. Renewable sources are now within reach of almost all industrializing countries, or will be so within a few short years. This changes everything.

Countries that elect to pursue industrial development utilizing renewable sources as well as conventional fossil fuels can expect to draw major advantages from such a choice. As opposed to the energy insecurity faced by countries sourcing energy solely from fossil fuels (geopolitical tensions and price instability) countries that raise their reliance on renewables actually enhance their energy security. Renewable energy can be harvested from wind and sun using devices that are the products of manufacturing, which can in principle be performed anywhere. By shifting some of their energy dependence to renewables, countries can raise their involvement in manufacturing (with its skills development and local employment generation), while reducing local particulate pollution and reducing import cost burdens from fossil fuels. Involving themselves in the manufacturing processes that produce renewables devices thereby creates conditions that favour local job creation, encourage exports and facilitate integration in global value chains. It becomes, in other words, an important aspect of their industrial development strategy. ▶



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Such a fresh perspective on industrial development and climate strategy is now feasible because China and other industrializing giants have been driving down the costs, along well understood learning curves, for individual manufactured devices like photovoltaic solar cells and wind turbines. Countries can benefit from the use of renewable energy strategies by importing these devices and shifting their own power generation activities away from fossil fuel dependence towards greater reliance on renewables.

And they can go one or several steps further by becoming involved in the manufacturing activities themselves, as may be seen in the cases of China, India, Brazil and South Africa already.

This fresh perspective reveals a convenient truth. The more that industrializing countries pursue strategies focused on renewables, the more they reduce their own and the world's carbon emissions. There is by now almost universal agreement that mitigation of climate change calls for the substitution of fossil fuels by low-carbon alternatives – as emphasized in successive reports by the Intergovernmental Panel on Climate Change and other scientific bodies.

“The more that industrializing countries pursue strategies focused on renewables, the more they reduce their own and the world's carbon emissions.”

But if renewables are viewed solely as means to reduce carbon emissions, then this brings an emphasis on their costs, and on international negotiations to develop cost-sharing mechanisms. This places developing countries in the position of having to pay for the carbon pollution created by the wealthy countries.

A focus on renewables as means to enhance energy security and resolve local particulate pollution problems by contrast can be viewed as a productive engagement with the global manufacturing economy – and at the same time as a fortunate side-effect a carbon-reducing strategy which will help to mitigate climate change. It is not a strategy viewed solely in cost terms, calling for international strategies of cost burden sharing. Instead it is a national development strategy that makes economic sense in its own right.

The missing factor in traditional industrial development strategies was the utilization of countries' own renewable resources which were considered marginal to the cost-effective mainstream. Now the costs have been brought down to the point that these resources can and should be factored in to development strategies. As countries accordingly shift the leading edge of their strategies away from fossil fuels towards harvesting renewables, they enhance their own prospects and contribute to mitigation of a global problem. This is truly a win-win strategy which has been made possible by cost reduction, achieved through the manufacturing learning curve – itself one of the key targets of UNIDO development goals.

Professor John A. Mathews
MGSM Macquarie University

Reducing industry's greenhouse gas emissions

In order to reduce the environmental footprint of industry, UNIDO supports the development and transfer of best available environmentally sound technologies to mitigate climate change through its programmes and projects.

Sustainable energy solutions

Affordable, reliable and sustainable energy is an essential prerequisite for sustainable economic growth. UNIDO takes a multi-dimensional approach to provide sustainable energy solutions in order to ensure access to modern energy sources, while at the same time taking measures to reduce energy-related GHG emissions from industry. This approach combines energy efficiency improvements, renewable energy solutions and development and transfer of low emission technologies. UNIDO's sustainable energy projects respond to the needs of a broad spectrum of stakeholders by assessing the country's context, priorities, industrial structure and stage of development.

Industrial energy efficiency

Recognizing the potential in reducing energy intensity in industry and its contribution to enhance competitiveness of industry, UNIDO's industrial energy efficiency programme builds on more than three decades of experience in industrial energy efficiency measures and standards. It combines the deployment of low emission technologies with the principles of product quality, sustainability and cost-effectiveness, along with the use of managerial tools based on the ISO 50001 Energy Management Standard and/or relevant national standards. The approach integrates energy efficient measures in the daily management of the company and triggers long-term investment to ensure energy efficient business development.



ArcelorMittal Saldanha Works (South Africa)

ArcelorMittal Saldanha Works (AMSW) is part of the South African steel industry, producing Hot Rolled Coil (HRC) steel products in Saldanha Bay, on the West Coast of South Africa. In recent years, due to rising energy prices, alongside the global and South African economic downturn, it has become critical for the plant to achieve significant reductions in its energy intensity.

In order to realize this objective, AMSW participated in UNIDO's capacity building programmes offered by the 'Industrial Energy Efficiency Improvement in South Africa Project (SA IEE Project)', with subsequent plant managers and engineers attending multiple training workshops on Energy Management Systems (EnMS) and Energy Systems Optimization (ESO). With the new knowledge and skills gained from the training, combined with direct ESO assessment assistance, the plant incorporated these measures in alignment with the requirements of ISO 50001. As a result, the plant saved roughly US\$9.1 million within the 2011 period alone, with virtually no capital investment and with an energy saving of 79.95 GWh. This translated to GHG emission reductions of 77,200 tCO₂eq.

Renewable energy for productive use

Renewable energy sources provide an opportunity for developing countries to embrace a low emission pathway powered by innovative, smart and locally relevant energy solutions. Developing the renewable energy sector reduces dependency on energy imports, creates jobs and mitigates climate change.

UNIDO's Renewable Energy Strategy aims at helping such countries to mainstream the use of renewable energy in industrial applications, in particular in small and medium-sized enterprises (SMEs), to increase their competitiveness and cost-effectiveness. It also supports development of innovative business models to promote renewable energy as a sector, and aims at increasing access to energy through mini-grids, especially in remote areas.

Multiple benefits of sustainable energy solutions

Sustainable energy solutions provide multiple sustainable development benefits, such as poverty reduction, increased food and energy security, improvement of public health and gender equality, reduction of pollutants and improvement of biodiversity, as well as enhanced competitiveness through cost savings. In line with UNIDO's ISID mandate, through its projects and programmes, UNIDO seeks to maximize these multiple benefits and contribute to the achievement of global and country-specific development goals.

Empowering women: Clean Cooking Fuels (CCF) in Africa

UNIDO recognizes the mutually reinforcing goals of fostering gender equality and women's empowerment and sustainable energy. Increased access to affordable, reliable and sustainable forms of energy can reduce the burden of activities typically assigned to women, thus allowing women to engage in productive activities. In turn, gender mainstreamed energy initiatives are more likely to have an effective sustainability impact, as recognition of women's roles in energy use will facilitate more comprehensive and long-term energy solutions for inclusive growth and development.

One fascinating example of UNIDO's work in this area is the Clean Cooking Fuels project in Zanzibar, where over 85% of the population depends on biomass (wood and charcoal) as a primary energy supply for cooking. Indoor air pollution caused by open-fire cooking, using charcoal and fuel wood, is a major concern for the health and wellbeing of women and children in many developing countries and LDCs, including in Africa, causing more than 4 million deaths worldwide.

UNIDO, together with partner institutions, implemented a pilot fuel-switch initiative to bioethanol for cooking in approximately 150 households in Zanzibar. A team of five female surveyors interacted closely with the women in the selected households to obtain information on various factors, including handling and ease of use of the ethanol cooking stoves; efficiency and fuel consumption for preparation of various meals; quality of emissions and cost comparisons for fuel and other types of cooking stoves.



Montreal Protocol and GHG emission reductions

The principal aim of the Montreal Protocol is to protect the ozone layer by taking measures to phase out production and consumption of ozone-depleting substances (ODS).

Ozone-depleting substances, such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), are potent greenhouse gases with a significant impact on global warming: hundreds or thousands of times higher than that of carbon dioxide (CO₂). Preventing releases of ODS to the atmosphere not only contributes to reversing the damage done to the ozone layer, but it has a significant climate change mitigation impact.

ODS are used in a number of industrial sectors, namely: refrigeration and air conditioning; foam manufacturing and solvent use; inhalers for medical purposes; and agriculture. Under the Montreal Protocol, CFCs were phased out in 2010, and HCFCs are currently subject to a phase-out schedule that will lead to their complete elimination by 2040. UNIDO, together with the other implementing agencies of the Protocol, supports these sectors in developing countries in the process of phasing out these substances.

Between 2001 and 2015, UNIDO was ranked as the best implementing agency of the Montreal Protocol in 2014. Successful implementation of over 1,340 Montreal Protocol projects by UNIDO to reduce the use of CFCs, HCFCs and HFCs (hydrofluorocarbons), has resulted so far in the reduction of the annual use of greenhouse gases by over 340 million tCO₂eq.

While it has been demonstrated that these substances can be almost completely replaced globally, the overall potential of the projects implemented under the Montreal Protocol is limited by the contribution of those gases to climate change, which currently represents two per cent of total GHG emissions in the world.

Conversion of Chinese air-conditioning manufacturing company

MIDEA is a manufacturer of air-conditioning systems with one of the most complete and largest production setups in China, producing 200,000 units per year. UNIDO supported the conversion of one of its production lines to replace HCFC-22, used as refrigerant, with propane (R-290) – a hydrocarbon that does not deplete the ozone layer and has a very low climate impact.

This UNIDO project demonstrates not only the use of ozone- and climate-friendly technologies, but also the safe manufacturing, installation and servicing of products using propane as refrigerant.

The contribution of this kind of project to climate change mitigation is both direct, given the curb on GHG emissions, and indirect, due to reduced energy consumption. The new optimized system at MIDEA has improved energy efficiency by 10–15%. Through this project, 240 tons of HCFC-22 were phased-out, with an impact of more than 960,000 tCO₂eq per year.

The conversion at MIDEA serves as an example for many other developing countries, opening a door for further developing South-South cooperation.



Climate resilient industry

The climate agenda has illustrated the urgent need to move towards climate resilient industry. A holistic approach that will harness the synergy between mitigation and adaptation measures and anticipate its potential trade-offs globally is an essential ingredient for climate resilient industry.

Experience has shown that addressing a source of GHG emissions or point of impact in isolation can often result in simply diverting the burden or risk to another point. This often adversely affects the more vulnerable points, which have fewer resources or less capacity to address them, thereby exerting additional pressure on already stressed ecosystems or economies. For example, some industrialized countries in recent decades have succeeded in limiting their increase in resource consumption and consequent environmental impacts. This has been achieved partially through technological advancements, but also by “exporting” the more resource- and pollution-intensive processes abroad. Simply put, consumption and pollution patterns have in some cases merely been shifted to another point: often to developing economies.

The climate is a global public good that is not bound by state borders. As such, the planet must be considered as one system and a holistic approach that considers the world’s material and resource shifts is essential. Climate resilient industry provides a pathway for dealing with GHG emissions and points of impact within the borderless dynamics of our planetary system.

Similarly, mitigation and adaptation are conceptually complementary strategies for addressing climate change impacts. Creating synergies between them reveals cost-effectiveness and multiple benefits that may not be realized if addressed separately. Building on experiences in safeguarding the environment, UNIDO takes a holistic approach to facilitate transformation of industries in developing countries and economies to a low emission and climate resilient future.

Promoting value chain based approach for climate resilient industry

The scarcity of resources and the direct impact of climate-related disasters could result in a “bottleneck” for vulnerable value chains. It is therefore important to assess a whole value chain to understand the impacts of climate change. In UNIDO’s Low Carbon and Climate Resilient Industrial Development projects in Egypt, Kenya, Senegal and South Africa, funded by Japan, local project teams conducted a vulnerability assessment for potential bottlenecks in the value chain of target sectors.

For example, the tea sector in Kenya suffered a serious production loss in 2015 due to a water shortage, which is a key resource in the sector. In Egypt, a heat wave could result in a severe climate disaster for the fresh meat and frozen vegetable sectors, which would create an adaptation need for cold storage and logistics. UNIDO, through this project, aims to promote the use of low emission technologies to address those adaptation needs with minimum additional GHG emissions. Future value chain assessments could go beyond conventional areas, to include access to global markets and micro-finance, as well as insurance, to motivate local industries to produce higher value products at a larger scale, but in sustainable and climate-friendly ways.



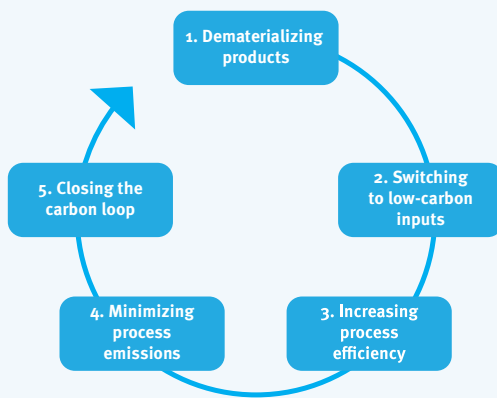
Green Industry for Climate Action



UNIDO's Green Industry initiative, through its two-pronged strategy, places sustainable industrial development in the context of new global sustainable and climate resilient development challenges.

- **Creating green industries** to supply high quality environmental goods and services, for example, renewable energy, waste recycling and resource recovery, and environmental advisory services.
- **Greening of industry** to continuously improve environmental performance of industry through the application of Resource Efficient and Cleaner Production (RECP) practices and technologies.

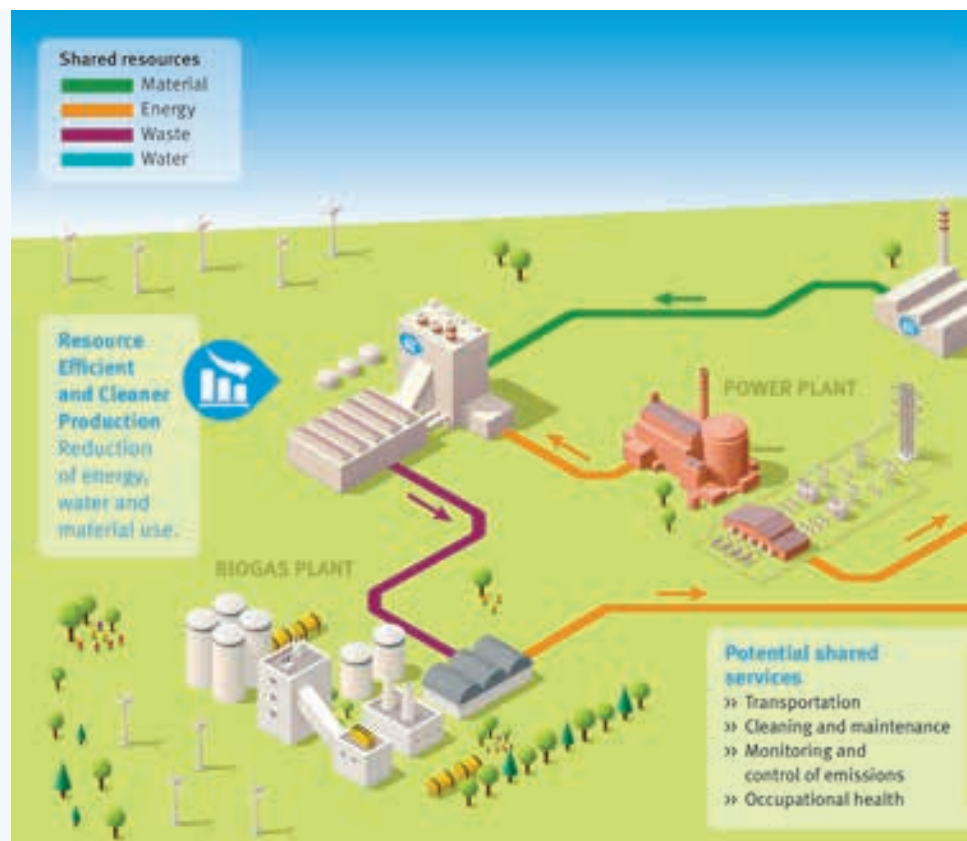
Resource Efficient and Cleaner Production (RECP)



The global UNIDO-UNEP RECP programme provides a comprehensive and strategic framework to scale up and mainstream RECP activities and results nationally, regionally and globally. RECP entails the continuous application of preventive environmental strategies to processes, products and services in order to increase efficiency and reduce risks to humans and the environment, including climate change. This provides a holistic approach that ensures that climate objectives are aligned with, and contribute to, business success measured against traditional indicators for productivity, competitiveness and innovation. Multi-country and regional thematic RECP initiatives encompass eco-industrial parks, innovative chemicals management, and low carbon industrial development, amongst others. In 2015, UNIDO celebrated 20 years of RECP implementation: the first eight NCPCs were established in 1995 to build local

Eco-Industrial Parks

Eco-Industrial Parks (EIPs) present opportunities for scaling up and mainstreaming RECP through a combination of plant-level efficiency measures, collective resource synergies and environmentally sound planning, construction and operation of industrial zones and supporting infrastructures. UNIDO has conducted a global assessment of EIPs to take stock of EIPs and similar developments in developing and emerging economies: assessing the economic, environmental, social and technological benefits. The outcome of the assessment indicated that while challenges remain, EIPs are a valid concept for scaling up green industry in industrial zones in emerging economies.



capacity to implement cleaner production in developing countries and economies in transition. By 2015, additional centres had been set up in 58 countries. Participating NCPCs and partner organizations agreed to establish the Global Network for RECP (RECPnet) at the first global RECP networking meeting in Lucerne, October 2009. The objectives of RECPnet is to catalyze the effective and widespread application of RECP in developing and transition economies.

Greenhouse gas accounting for emission intensive sectors

“Voluntary initiative to promote greenhouse gas accounting and low-carbon production in sectors of Indian Industry” is a project by UNIDO, implemented with the support of the Swiss Government (SECO) and through the Chamber of Indian Industry (CII) – Godrej Green Business Centre. The project contributed to building capacity in small and medium-sized enterprises (SMEs) to conduct GHG accounting in GHG emission intensive sectors. Phase I of the project produced GHG emission inventories in 12 companies in cement and chemicals sectors, clearly identifying areas of opportunity for emission reductions.

For example, the results revealed that over 90% of total emissions from a typical Indian cement plant were direct emissions from energy generation, process or fugitive emissions, 6% indirect emissions from use of electricity and heat and the remaining 3% through the supply chain. In the case of the chemical sector, 68% was scope 1 emissions, 30% from scope 2 and the remaining 2% from the supply chain.

By raising awareness and building capacity of SMEs to keep an inventory of their GHG emissions, the project has contributed to SMEs adopting more sustainable production practices.



Building blocks for climate resilient industry

Creating climate resilient industry represents certain challenges for developing countries and economies in transition. Assisting in capacity building and knowledge management for these countries can help spearhead their efforts in becoming climate resilient. This foundation provides a logical and interrelated framework for UNIDO's building blocks for assisting institutional capacity building in countries to become climate resilient.

These building blocks cover three main areas:

- Firstly, **harnessing the potential of clean technologies and promoting technology transfer** will significantly contribute towards developing climate resilient industry. Empirical evidence reveals that most increases in per capita income stem from advances in technology. Emboldening this knowledge provides increased socio-economic performance with improved climate resilience.
- Secondly, **fostering innovation and strengthening entrepreneurship** provides an opportunity to develop new capacity for wealth creation whilst safeguarding the environment. UNIDO supports small and medium-sized enterprises (SMEs) in identifying business and funding opportunities presented by climate action to spur innovation and entrepreneurship in cleaner technologies and resource efficient production.
- Thirdly, **facilitating international partnerships** reinforces cooperation for climate resilience. UNIDO strives to bolster partnerships with both state and sub-national entities, including cities, businesses and regional level networks to attract investment and implement industrial best practice. Diverse sources of expertise and experience play a crucial role in creating climate resilient industry. Therefore, multi-stakeholder partnerships are vital to attract investment and provide the knowledge and expertise for deploying climate-resilient solutions on the ground.



Climate Technology Centre & Network (CTCN)

The Climate Technology Centre & Network (CTCN), hosted by UNEP in collaboration with UNIDO, fosters technology development and transfers through three core services: (1) technical assistance for mitigation and adaptation projects; (2) scaling up international collaboration through its diverse community of climate technology users; and (3) access to information through its online technology portal. The Centre facilitates a network of national, regional, sectoral and international technology centres and private sector entities. It seeks members from all geographic regions with an array of sectoral experience. Membership benefits include commercial opportunities, visibility and connections with relevant stakeholders and network members.

Technology transfer

Minimizing climate impacts requires the transfer and implementation of environmentally sound technologies. The Cancun Agreements of the United Nations Framework Convention on Climate Change (UNFCCC) confirmed the importance of promoting and enhancing the transfer of technologies to assist developing countries in meeting the climate challenge. UNIDO fosters development and transfer of such technologies in partnership with a broad range of stakeholders.

Traditional development paths followed by many industrialized countries have grave environmental impacts, presenting an inappropriate model for developing countries to follow. However, there is currently an opportune moment for developing countries to embark on low emission pathways. One reason is that these countries have invested less in infrastructure that binds them to environmentally unsound technologies.

Industrialized countries must capitalize on this opportunity to transfer best available technologies to assist developing countries and help them to avoid becoming “locked-in” to socio-technical structures that do not support climate resilient industrial development. Acquiring knowledge from industrialized countries and harnessing technology transfer nurtures innovation and significantly contributes to overcoming barriers to the deployment of climate resilient industry technologies. UNIDO works closely in collaboration with donor countries to transfer best available and environmentally sound technologies to developing countries and economies in transition.

UNIDO-Japan initiative: Low Carbon Low Emission Clean Energy Technology Transfer Programme (LCET)

In order to promote the successful transfer of technologies from Japan to developing countries and countries with economies in transition, UNIDO initiated a collaborative global programme jointly with Japan’s Ministry of Economy, Trade and Industry (METI). The programme sought to disseminate and deploy new low carbon, low emission, clean energy technologies, products, systems and services. In its first phase, the programme focused on LCETs such as micro-hydropower, solar energy, and waste-to-energy technologies in Kenya and Ethiopia. In these countries, two pilot projects focusing on ultra-low head micro hydropower (ULH-MHP) technology were implemented. ULH-MHP systems are easy to maintain and can be installed on existing open canals without the need for extensive civil works. Relevant training exercises were undertaken to build local capacity for maintenance and manufacturing of the ULH-MHP technologies. The implementation of these pilot projects contributed to local industrial and social development, while also fulfilling local demand for energy access.



Fostering innovation for climate resilient entrepreneurship

Small and medium-sized enterprises (SMEs) represent a large percentage of the global economy and worldwide productive capacity, employing the majority of the private sector's workforce. The biggest challenges in mobilizing SMEs to participate in sustainable energy activities are their lack of financial capital and technical capacity, and lack of incentives to overcome barriers to adopting clean and climate resilient technologies. Fostering innovation and entrepreneurship can help to attract both individuals and SMEs in overcoming these barriers and actively shape new solutions for climate resilient industry. UNIDO, with its breadth of experience and expertise, provides technical assistance to SMEs in order to encourage innovation and entrepreneurship in meeting the climate challenge. UNIDO actively supports the development and implementation of innovative financial instruments to facilitate access to climate finance for the private sector, especially for SMEs.

The Global Cleantech Innovation Programme (GCIP) for small and medium-sized enterprises (SMEs)

UNIDO and The Cleantech Open, with the support of GEF, collaborated to launch clean technology platforms and competitions in developing countries and emerging economies, based on The Cleantech Open's proven accelerator platform, which originated in Silicon Valley. The GCIP for SMEs is a far-reaching programme that leverages the power of entrepreneurship to address our most challenging energy, environmental and economic problems. One of 2014's selected winners was Free The Seed, from Malaysia, an innovative enterprise that purchased existing stockpiles of rice husks and rice straw and converted them into biodegradable packaging, using a patented bio-enzymatic technology. This enterprise alone reduced GHG emissions by an estimated 0.6 tCO₂-eq per year.



Partnering for climate action

The IPCC Fifth Assessment Report states that transformation changes the fundamental attributes of a system in response to climate and its effects. Engagement of diverse stakeholders at all levels is needed to achieve the transformation to spur climate action. UNIDO has established strategic partnerships with a broad range of stakeholders to enable research and knowledge sharing, as well as to remove barriers, in order to catalyze action on the ground.

Global forum

In June 2015, UNIDO co-organized the Vienna Energy Forum (VEF) 2015, in partnership with the Federal Ministry for Europe, Integration and Foreign Affairs of Austria, the International Institute for Applied Systems Analysis (IIASA), the Austrian Development Agency (ADA), and the United Nations Secretary-General's Sustainable Energy For All (SE4All) initiative. VEF 2015 built on the outcomes of the previous VEFs held in 2009, 2011 and 2013, and was attended by over sixteen-hundred participants, including Ministers, high-level government officials, civil society and private sector leaders. The Forum provided a platform for leaders, policymakers and practitioners to engage in a multi-stakeholder dialogue on crucial sustainable energy issues and the overarching goals of SE4All connected to inclusive development, including partnerships, finance, policy, technology, capacity building, and knowledge management.

The key messages emerging from the conference reaffirmed the need for holistic solutions for the nexus between climate and energy, transport, food, water, gender, and health: essential contributors to social progress and human well-being. The Forum also reflected the need for strong partnerships and regional cohesion, as well as collaboration between international, national and sub-national actors, in order to maximize actions on climate and development.



Global network of regional hubs

Environmental issues, including climate change, do not respect human-made boundaries. Regional level partnerships are extremely important in nurturing knowledge transfer among countries in similar circumstances, in order to share experiences and explore solutions to overcome barriers to tackling the causes and impacts of climate change. UNIDO coordinates the Global Network of Regional Sustainable Energy Centres (GN-SEC) in cooperation with regional economic communities and organizations. These South-South and triangular partnerships are expanding in Sub-Saharan Africa, North Africa, the Caribbean and the Pacific. The Centres respond to the urgent need for increased regional cooperation and capacities to overcome barriers to renewable energy and energy efficiency investment, markets and industries. The Centres serve to complement and strengthen ongoing national activities across a range of areas, including policy, capacity building, knowledge management, awareness raising, investment and business promotion.

Regional Sustainable Energy Centres: the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)

In 2010, against the backdrop of the looming energy crisis in West Africa, ECREEE was established as a specialized agency of the Economic Community of West African States (ECOWAS), with technical and financial support from UNIDO, the Austrian Development Agency (ADA) and the Spanish Agency for International Development (AECID). The centre aims to lower barriers to create renewable energy and energy efficiency sector in 15 ECOWAS Member States. ECREEE supports the development and implementation of regional renewable energy and energy efficiency policies, train the trainer programmes, technology programmes (e.g. improved cook-stoves, small hydro,) and a grant facility for small and medium-sized projects.



UNIDO provides key technical services for the establishment and operation of such regional Centres. With the network, UNIDO responds to the increasing demand for innovative partnerships, multi-level and integrated solutions to address simultaneously the challenges of energy, climate and development.

Programme for Country Partnership

While many of the challenges are common to all, there remain many country-specific barriers, depending on economic factors, as well as cultural and historical backgrounds. The Programme for Country Partnership (PCP) is a comprehensive bespoke partnership formula established to assist beneficiary countries to meet Inclusive and Sustainable Industrial Development (ISID) objectives while enabling them to maintain ownership, in line with respective national industrialization priorities and development plans. The PCP continues to be embedded into national resource mobilization strategies, and remains open to partnerships for upscaling technical cooperation services and leveraging additional resources. The first ISID Programme for Country Partnerships (ISID-PCPs) are being piloted in Africa, the region currently most in need of ISID assistance.

Programme for Country Partnership (PCP), Senegal

Senegal is classified as a least developed country (LDC) under the UN's official classification system. However, its recent development has shown strong potential for it to become an emerging economy, mostly due to economic and political reforms and a firm commitment to industrialization. The energy component of this PCP has promoted integration of sustainable energy technologies and efficient energy systems management in agro-poles, industrial parks and mining hubs of Senegal. The initiative has contributed to the deployment of renewable energy options and increased efficient energy systems management, the establishment of sustainable cities and eco-industrial parks – a strong Green Industry initiative – and 40,000 new jobs.



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Non-state actors

Non-state actors such as businesses, cities, states and regions, are vital entities in catalyzing the successful implementation of climate-friendly industrial solutions. The groundswell of action from non-state actors, as shown, for example, through UNIDO's work on Sustainable Cities, holds real potential in galvanizing and accelerating climate change mitigation and resilient development.

Sustainable Cities

More than half of the global population today lives in cities. By 2050, this is expected to increase to two-thirds. The trend of urban growth is particularly strong in developing countries and emerging economies, where the infrastructural systems are not sufficient to support it. Furthermore, industries increasingly locate closer to cities, exerting pressure on urban infrastructure and the local ecosystem. The concentration of population and resources in cities make them more vulnerable to climate disasters including floods and heat waves, while at the same time these urban areas act as major sources of GHG emissions.

GEF launched the Sustainable Cities Integrated Approach Pilot (SC-IAP) to help cities address the challenges of environmental degradation caused by rapid urbanization and population growth. Solely or with partners, UNIDO is implementing SC-IAP projects in Senegal, Malaysia, Cote d'Ivoire, China and India.



Way forward

The industrial revolutions of previous centuries spurred unprecedented levels of economic growth, social development and technology advancement. The effect of industrialization's environmental footprint, however, cannot be ignored. Past industrial development patterns have used up natural resources unsustainably, whilst breaching safe planetary boundaries. However, the answer is not simply a binary choice between industrial growth and sustainability. Rather, climate resilient industrial development presents a prosperous way forward.

UNIDO's pursuit of Inclusive and Sustainable Industrial Development is fully in line with the 2030 Agenda for Sustainable Development, as exemplified, among others, by SDG 9 and SDG 13. Through economic growth, social prosperity and environmental safeguards, the promotion of climate resilient industry has the unique potential to concurrently contribute to addressing the 2030 Agenda and the climate challenge.

The impact industrialization has on poverty eradication, environmental sustainability and social equity is ultimately defined by the development pathway that countries choose to follow. Hence, a comprehensive long-term strategy is required that puts in place a framework of stable economic, legal and political conditions for promoting inclusive and sustainable industrial development. This allows for the creation of policies that incentivize investment in sustainable energy solutions and efficient resource-use, which are fundamental for climate resilient industrial development in the country.

Promoting climate resilient industry presents certain challenges for countries, organizations and individuals. Assisting countries in building local capacity and knowledge management is imperative in enhancing their chances of becoming climate resilient. On this basis, UNIDO has laid the foundation, through building blocks to optimize pathways for climate resilient industry. These building blocks, among others include technology transfer and deployment, fostering innovation and entrepreneurship that creates capacity for wealth creation whilst safeguarding the environment as well as bolstering partnerships with both state and non-state entities to implement industrial best practice.

According to the World Energy Investment Outlook Report (2014), US\$130 billion was invested in 2013 to improve energy efficiency and US\$250 billion in renewable sources of energy. Nevertheless, the UNFCCC synthesis report (2015) on Intended Nationally Determined Contributions (INDCs) states that the estimated aggregate annual global emission levels resulting from the implementation of the INDCs do not fall within least-cost emission trajectory of staying below the 2°C scenario. In the New Policies Scenario explored in the World Energy Outlook (2015), full implementation of the unconditional pledges made for COP21 by more than 150 countries would require cumulative investment of US\$13.5 trillion in low carbon technologies and energy efficiency until 2030. These figures represent an increased imperative to commit to sustainable production patterns: making business sense and increasing competitiveness through climate resilient industry. UNIDO's approach in addressing various resource constraints and environmental impacts in an integrated manner supports an optimum solution for efficient resource allocation and greater policy coherence for promoting climate resilient industry.

Effectively and sustainably eradicating poverty within the next generation will require a significant reorientation of our current industrial patterns. The real question about promoting climate resilient industry is not *whether* it should be a development priority. The question is *what kind of industrialization should be prioritized* to maximize the synergies between climate resilient industry, inclusive growth, and prosperity for all. UNIDO embraces this challenge by working with partners and stakeholders in realizing the benefits of this global vision for the next era of sustainable industrial development.

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