

A comprehensive analysis of cleaner production policies in Gujarat (India)

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Abstract

The study focuses on the qualitative review of literature on various policies on Cleaner Production in the Gujarat, India. To explore deeper into the characteristics of cleaner production in Gujarat, all the major policies and schemes issued by State Government Departments / Institutions from 1998 to 2020 have been studied. Traditionally, the pollution issues were addressed using the End -of-Pipe Treatment technologies; however it was realized that these technologies were proved to be cost intensive. To change the mindset from pollution control to pollution prevention, since prevention is better than cure, State Government of Gujarat has set up cleaner production centre and introduced various financial incentive schemes, pilot & research projects, CP conditions, skill development and award schemes to promote and propagate the idea of Cleaner Production in MSME's/ Large Scale Sector in Industrial Estates. The financial assistance schemes for CP implementation motivated industries to upgrade their processes and plant that will resulted in water and energy savings, reduction in solid and liquid waste, improved process efficiencies, skill enhancement etc. Cleaner Production helps to achieve United Nations Sustainable Development Goals (SDG's) Goal No: 6, 7, 8, 9, 11, 12 & 13 and Nationally Determined Contributions of India. This paper contributes as important information on cleaner production policies for governments and industries especially in developing countries.

Key words: Cleaner production; Clean Technology; Policies; Centre; Gujarat

Introduction:

Industry continues to be a major cause of environmental problems, both globally and locally. It has a strong influence on both the local environmental situation and quality of life. In recent years, the serious impact of industrial and municipal operations on the state of local environment has attracted attention. Over the past decades, the industrialized nations have responded to pollution and environmental degradation in five characteristic ways: 1. By not recognizing—or ignoring—the problem of environmental pollution; 2. By diluting or dispersing pollution, so that its effects are less harmful or apparent; 3. By seeking to control pollution and wastes (the end-of-pipe or pollution control approach); 4. By trying to develop and improve environmental technology that will help close the loops in material flow streams during the production process, and facilitate reuse and recycling, and 5. Most recently, by implementing Cleaner Production through the prevention of pollution and waste generation at source. (UNIDO 2002). Cleaner Production is recognized as a tool that can contribute to the sustainable forms of economic development, as endorsed in Agenda 21 adopted by the United Nations Conference on Environment and Development (UNCED) (Chapters 20, 30 and 34). CP is a strategy that protects the environment, the consumer and the worker while improving the industrial efficiency, profitability and competitiveness of enterprises. Cleaner production-defined as the continuous use of industrial processes and products to prevent the pollution of air, water and land, reduce wastes at source, and minimize risks to the human (UNEP 1994). Cleaner Production can be achieved in any single, or combination of, the following ways: good housekeeping and operating procedures, materials substitution, technology changes, on-site

recycling and product or service redesign. Pollution and risks to human health and safety are reduced at source, rather than the end of the production process, i.e. at the end-of-pipe stage. The adoption of Cleaner Production typically involves improving maintenance practices, upgrading or introducing new technology, changing production processes and modifying management and quality control procedures (UNIDO 2002).

By mid-1990's, several development partners, including the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP), set out to first demonstrate the applicability of cleaner production and related methods and techniques in developing and transition countries, including: China, India, Poland, Czechoslovakia and elsewhere. The further adaptation and wider adoption of cleaner production, though, required national capacity and expertise. The concept of National Cleaner Production Centres (NCPCs) was born. Initial results and experiences were discussed at UNEP's biennial high-level cleaner production meetings. At the third of such Meetings, held in Warsaw in October 1994, UNIDO and UNEP formally announced their joint programme to establish National Cleaner Production Centres (NCPCs) (UNIDO, UNEP 2015).

The NCPC Programme began in 1994 with eight Centres established in Brazil, China, India, the Czech Republic, Mexico, the Slovak Republic, Tanzania and Zimbabwe. These eight Centres were selected from solicitations received from 39 institutions in 25 countries. In India, the NCPC has helped set up four domestically funded regional Centres in the states of Karnataka, Gujarat, Punjab and West Bengal. (UNEP 2002)

First attempts of NCPCs to engage with their governments resulted in additional cleaner production initiatives, such as for example for Waste Minimization Circles in India and

standardization of cleaner production training in China. Overall though, it was realized that policy change in support of cleaner production required long-term engagement and cooperation with government and business sectors. Moreover, individually, these country demonstrations shed light on specific elements, such as customization of concepts and methodologies (e.g. in India), role of cleaner production in implementation and enforcement of existing environmental policy (e.g. China) and need for capacity building of experts, company staff and regulators.

Moreover, in particular in the largest emerging economies, cleaner production activities were concentrated in regional centres, indeed paving the way for decentralization into sub-national cleaner production centres, either as stand-alone centres (for example in States of Gujarat and Karnataka in India and the Chinese provinces of Liaoning, Shanghai and elsewhere) or as branches of the NCPC (for example in South Africa, Brazil and Mexico). Moreover, industries need further incentives, through policy change consistent across different sectors of government policy and including administrative measures and resources for implementation and enforcement. (UNIDO, UNEP 2015).

To promote and propagate the idea of Cleaner Production (CP) for fostering Inclusive and Sustainable Industrial Development in the state of Gujarat, Gujarat Cleaner Production Centre (GCPC) was set up in the year 1998 with technical support of United Nations Industrial Development Organization (UNIDO) and in the year 2008, GCPC was established by Industries and Mines Department, Government of Gujarat as a registered under Society Act 1860 and Public Trust Act 1950. To demonstrate the technical feasibility, Cleaner production assessment has been carried out in different industrial sectors like ceramic, glass, textile, dairy, recycle paper, bentonite, chemical, cement, polymer, engineering, pharmaceutical etc. (GCPC 2008). In India, at national level, National Cleaner

Production Centre (NCPC) doesn't exist and at regional level, only Gujarat Cleaner Production Centre in Gujarat is alive.

Example: 1. Cleaner production training and cleaner technology assessments were delivered to over 50 key chemical enterprises in Ankleshwar, in close cooperation with the Gujarat Cleaner Production Centre. Technology transfer and adaptation focused in the main on introduction of: (i) continuous process for dyestuff manufacturing; (ii) catalytic oxidation with oxygen to replace benzoic acid oxidation of toluene in dye-intermediate manufacturing; (iii) sulphuric acid recovery; and (iv) plasma-treatment of hazardous organic wastes. Applied in full, these technologies can annually avoid up to 110,000 ton GHG emission and 85,000 ton of hazardous waste. The positive experiences of applying cleaner production in a coordinated and synergistic manner in an industrial estate created renewed interest to integrate cleaner production at the level of industrial estates and thereby contribute to the transition into (eco)-industrial parks. (UNIDO, UNEP 2015).

2. Cleaner Production assessment was carried out in selected Glass industries of Gujarat with technical study of process, we streams etc. After study, Energy conservation, water conversation, solid waste and liquid waste reduction options were successfully implemented. (CTCN 2018).

3. The Department of Forests & Environment Government of Gujarat, India have spurred an initiative for promoting Cleaner Production (CP) as a tool for improving Environment and Economic performance for the Small and Medium Enterprises (SMEs). As a part of this initiative, it is decided to conduct CP Implementation Project in Textile Sector by Gujarat Cleaner Production Centre (GCPC). One of the objectives of the GCPC is to demonstrate industry progress in the area of Cleaner Production and Energy Efficiency, and to share leading edge and best practices. The implementation of CP solutions resulted in both

financial as well as environmental benefits. The unit was able to benefit annually by about INR 10, 14,240 through the implementation of CP solutions, with an investment of INR 6, 57,550. (GP 2013)

4. GCPC has so far conducted more than 500 orientation programmes in industrial estates and academic institutions and successfully completed more than 300 demonstration projects on Cleaner Production and Clean Technologies that had shown huge savings in terms of GHG emissions. (GCPC ENVIS 2015).

With the continuous efforts of GCPC, Cleaner Production has been included as a subject of Diploma and Degree Environment and Chemical Engineering Colleges of Gujarat. The aim of this course is to educate students about 'Cleaner Production Techniques' and its application leading to pollution minimization. Students will acquire knowledge about environmental, economic and technological aspects of Cleaner Production Methods. The student will be exposed to methodology of cleaner production projects, methods of their implementing into industrial establishment and process of pollution prevention and reduction along with operating costs reduction and increase in safety of operation with the help of various case studies. Thus this course deals with an emerging area and hence important for environment engineers. (GTU 2012)

Considering the benefits of the CP, the Forests and Environment Department, Government of Gujarat has built the capacity of the industrial entrepreneurs, environmental consultants, academic institutes for assessment and implementation of the CP. The Government was keen to sustain the CP initiatives and achieve the multiplier effect of the CP in the State. Therefore, it was decided to promote and undertake various activities including the CP clinic cum awareness programme for different industrial and service sectors, intensive training programme, CP database creation, practical demonstration

projects, CP dissemination workshops, etc. It was under consideration to decide a policy for promotion and propagation of the CP through the Gujarat State's budget. After careful consideration, the State Government has introduced the scheme on the Cleaner Production Promotion and Propagation and the financial assistance for beneficiary institute / organization. (F & E Dept. 2005). The Forests and Environment Department, GoG instituted an award namely "Gujarat Cleaner Production Award" vide Government Resolution No: ENV-10.2004-61-P for Small and Medium Scale Industry and Large Scale industry in the year 2004 and 2007 respectively to encourage and appreciate an industry for achieving significant / exemplary environment benefits and increasing the productivity from cleaner production. (F & E Dept. 2004, 2007).

The state Government attaches the highest priority for environmental protection along with industrial development. The state is active for improvement in environmental quality, creating of common effluent facility, introduction of cleaner production processes by industry, tree plantation in industrial areas. While the state government has been extending financial assistance for setting up end of pipe projects, there is a need to encourage industrial units to adopt waste minimization and cleaner production processes with an objective of minimizing the generation of wastes. (IC 2003).

The need to deal with all aspects of environment management has arisen. Also emphasis on pollution prevention at source with issues like rational utilisation of resources and cleaner processes and technologies need to be highlighted. The recent developments like plasma pyrolysis, technologies for convert waste to energy etc., that have taken place in environment management, also needed to be incorporated and the emphasis has to be on green/ clean processes and green/ clean technologies. For sustainable development, it is necessary to introduce substantial changes in the working and practices of the industries. With this

view, an incentive scheme for encouraging green practices is required to be put in place for MSME industrial units. After careful consideration, Government of Gujarat has decided to introduce schemes that endeavor for a total green management in the industries of Gujarat (IC 2009, 2015, 2020)

1. Cleaner Production Centre / Institution

Realizing the importance of Cleaner Production (CP) in the state, Gujarat Cleaner Production Centre (GCPC) was set up in the year 1998 with technical support of United Nations Industrial Development Organization (UNIDO) to promote and propagate the idea of Resource Efficient and Cleaner Production (RECP), to foster Inclusive and Sustainable Industrial Development in the state of Gujarat. In the year 2008, GCPC was established by Industries and Mines Department, Government of Gujarat and registered under Society Act 1860 and Public Trust Act 1950. GCPC has played vital role in framing Industrial Policy, 2004, 2009, 2015 and 2020 for the state of Gujarat and in development of many financial assistance schemes pertaining to Cleaner Production (CP) and Clean Technology (CT) promotion in the state. GCPC has so far conducted more than 500 orientation programmes in industrial estates and academic institutions and successfully completed more than 300 demonstration projects on Cleaner Production and Clean Technologies. (GCPC 2008)

2. Financial Incentive Policies for Cleaner Production:

2.1 Forests and Environment Department, Government of Gujarat

The Forests & Environment Department forms the policy for the conservation of the forest, protection of the Wildlife and the Environment in the State of Gujarat. The Forests & Environment Department in the Government of Gujarat has

environment wing and forest wing. The environment wing of the Department is the apex body in the Gujarat State for implementation of all the environment related matters including Environment (Protection) Act, 1986, which is an umbrella Act on environment in the country. The main mandate of the Department is to achieve the sustainable development in the State and introducing the sound environmental management practices.

The rapid growth of the industries in Gujarat has resulted into the improved industrial production leading to the economic prosperity and improved standard of living in the State. Simultaneously, the rapid industrialization coupled with urbanization has also resulted into numerous environmental issues. Considering this, the Forests and Environment Department in a proactive approach took various initiatives to tackle the industrial pollution through Promotion and Propagation of Cleaner Production, a tool to achieve the Sustainable Development. The benefits of the Cleaner Production (CP) are not only in terms of economic advantages to the industries, but the CP has also helped in reducing the wastes and improving the environmental performance of various industries. The CP has been successful in replacing the end-of-the-pipe treatment besides improving the productivity in many cases. Considering the benefits of the CP, the Department has built the capacity of the industrial entrepreneurs, environmental consultants, academic institutes for assessment and implementation of the CP. The Government is keen to sustain the CP initiatives and achieve the multiplier effect of the CP in the State. The Forests and Environment Department, therefore, decided to promote and undertake various activities including the CP clinic cum awareness programme for different industrial and service sectors, intensive training programme, CP database creation, practical demonstration projects, CP dissemination workshops, etc.

After careful consideration, the State Government has announced the scheme on the Cleaner

Production Promotion and Propagation on 30th November, 2005. The financial assistance is given by the Forests and Environment Department to any institute / organization working in the field of Cleaner Production for more than 5 years in Gujarat State. The institute / organization to qualify for taking up the projects / activities related to cleaner production under this scheme should be run / owned / supported by the State Government or the Central Government or could be an academic institute or research institute or an organization registered with the Forests and Environment Department and having more than 5 years' experience in the field of Cleaner Production. The total amount of project cost is reimbursed to the project proponent in four parts based on the project report and activity submission. Under this, various activities / projects could be considered for financial assistance i.e. 1) Cleaner Production Clinic cum Awareness Programme 2) Intensive Training Programme on Cleaner Production 3) Cleaner Production Practical Demonstration Projects 4) Cleaner Production Database Creation 5) Research and Development work in the field of Cleaner Production 6) Cleaner Production Award 7) Any other project / activity related to Cleaner Production (F & E Dept. 2005)

2.2 Industries and Mines Department, Government of Gujarat

Industries and Mines department plays a key and important role in effective and economic industrial development and focuses on the possibilities to develop fast growth in small medium and Large-scale industries in Gujarat. Every five year, Industries and Mines department, Government of Gujarat is announcing Industrial Policy to provide proactive support for development of industries, value addition on local primary sources and clean environment to increase share of manufacturing in the state Gross Domestic Product (GDP). The Industrial Policies include various financial incentive schemes for Micro, Small, Medium and Large Scale industries and Industrial Clusters /

Estates to enhance their production efficiencies and infrastructures. (I & M, 2003)

2.2.1 Incentive for Cleaner Production in Industrial Policy year 2003

In the year 2003, scheme for assistance for environment protection measures was introduced under industrial policy. The major policy thrust given to the environment protection along with industrial development. Individual industries, industries clusters / associations and professional institutes are eligible to take benefit of the scheme. Financial assistance was given for waste minimization techniques (cleaner production) like recycling, reuse, waste exchange and end of pipe treatment. Under this, the industries employing any waste minimization techniques to reduce waste by attest 25 % from one product shall be reimbursed 25 % of the total cost incurred in the acquiring / developing technology, installing equipment/ instruments in the plant and laboratory with the ceiling of INR 10 lakh (for each plant). Any industries cluster / association want to set up Waste Exchange centre / Demonstration project on Waste Minimization / cleaner production were reimbursed 25 % of the total cost with the ceiling of INR 25 lakh. Adopting Environment Management System in individual industries gets benefited through financial assistance of 50 % of the total cost in obtaining EMS certification with ceiling of INR 2 lakh. For any specific environmental study by industries association or institution, 50 % of cost of consultancy with ceiling of INR 50, 000 per study was reimbursed. In order give importance to water conservation and prevention, 50 % of water audit cost with the maximum of INR 50, 000 was reimbursed to any industry. Also, 50 % of energy audit cost with the maximum of INR 00, 000 was reimbursed to any industry. A cash subsidy at the rate of 50 % of the fees subject to maximum INR 10, 000 was disbursed to units for carrying out assessment of water consumption.

The scheme for assistance for cluster development (cluster means more than 50 units in a same location having same or different products) involves activities like energy and water conservation initiatives, use of cleaner technology, and improvement of productivity among member units in the cluster. Normally, financial assistance was 25 % of the project proposal in the case of training expenditure component, 25 % to 50 % of cost component in other matters. The total quantum of assistance was INR 5 crore per cluster during the policy period of five years. (IC, I & M 2003)

2.2.2 Incentive for Cleaner Production in Industrial Policy year 2009

In 2009, Gujarat Industrial Policy, implementation of Cleaner Production and Clean Technology measure get quantum of assistance per project up to 50 % of cost of plant and machinery with ceiling of INR 10 lakh under scheme of assistance for Environment Protection Measures- MSME's. Substitution and optimization of raw material including catalysts / any other pre identified environment management projects get financial assistance up to 25 % cost of plant & machinery with ceiling of INR 10 lakh per project. (IC, I & M, 2009)

2.2.3 Incentive for Cleaner Production in Industrial Policy year 2015 and 2020

In order to encourage greater compliance with environmental standards and support development of latest sustainable industrial infrastructure the state government has introduced the scheme for assistance for common environment infrastructure where common environmental facility in industrial estates proposed by industrial associations were incentivized. Financial assistance up to 25 % and 40 % (in year 2015 and 2020 respectively) of capital investment with maximum upto INR 50 crore given for common waste management projects, waste recycle, reuse and co processing, plasma thermal destruction /

treatment/waste to energy facility, common solvent/spent recovery plant, use of gypsum / iron sludge / E-waste / hazardous waste / plastic etc.

The scheme also provide need based support maximum upto INR 50 lakh for scientific report / pilot project on cleaner production and technology through reputed universities and institutions. To set up Community Boiler in Industrial Estate, 35 % or maximum INR 2 Crore, if solid fuel used and 50 % of cost maximum INR 2 Crore, if cleaner fuel like CNG, PNG, Bio Fuel is used in the community boiler.

Cleaner Production is one of the parts for the development of an Eco / Green Industrial Estate. An eco-industrial park is a community of businesses located on a common property in which businesses seek to achieve enhanced environmental, economic and social performance through collaboration in managing environmental and resource issues (UNIDO 2017). The Gujarat Government has first time introduced scheme for Development of Green Industrial Estates where 75 % financial assistance maximum up to INR 80 Lakh for preparation of site master planning and 25 % of capital cost or maximum INR 25 crore for setup / relocation / retrofitting of existing polluting units into Eco / Green Industrial Estate were given.

The environmental protection measures scheme of industrial policy 2015 revised the Cleaner Production implementation financial incentive up to 35 % and maximum INR 35 lakh for SME's and up to 10 % and maximum INR 35 lakh for large scale industries. (IC, I & M 2015, 2020)

3. Cleaner Production Award

To motivate the industries for implementation of Cleaner Production, the Forests and Environment Department, Government of Gujarat instituted an award namely "Gujarat Cleaner Production Award" for the small and medium scale sectors & Large Scale Sectors from the year 2004 and 2007

respectively because Gujarat has shown encouraging results in terms of natural resources conservation, pollution control & increase in productivity through CP activity. Even the large-scale industries have taken up Cleaner Production activities and obtained the benefits thereof.

Every year, the award given to one industry in Small & Medium Scale Sector and one industry in Large Scale Sector in the State. The award given to one of the best industries particularly from the angle of adoption and successful implementation of Cleaner Production and showing exemplary work in form of Water and Energy Conservation, Waste Water and Solid Waste Reduction etc during the respective financial year. The Awardees are selected by the committee constituted by the State Government. The winning industries from both categories get Trophy, Cash Prize and Certificate. The first runner up gets Cash Prize and Certificate. The winning industries also eligible to get one year additional consent to operate from State Pollution Control Board. (F & E Dept, 2004, 2007)

4. Cleaner Production Conditions

Ministry of Environment, Forest & Climate Change, Government of India has constituted State Environment Impact Assessment Authority (SEIAA) to grant Environment Clearance to establish any projects and activities based on the spatial extent of potential impacts and potential impacts on human health and natural and manmade resources. Accordingly, SEIAA grant the Environment Clearance with subject to compliance of specific condition in terms like: Water, Air, Hazardous Solid waste, Safety, Noise, Cleaner Production and Waste Minimization, Green Belt and Other Plantation, Other Plantation etc

From 2015 onwards, in many cases, SEIAA Committee directing project proponent to

undertake Cleaner Production Assessment under term and condition no. A. 6. Also, as per A. 8 of other condition, it shall be mandatory for the project management to submit half-yearly compliance report in respect of the stipulated prior environmental clearance terms and conditions in hard and soft copies to the regulatory authority concerned. From year 2015 to 2020, more than thousand industries mandated to conduct Cleaner Production Assessment in their plant in Gujarat. (SEIAA, 2015)

5. Research on Cleaner Production

Gujarat Cleaner Production Centre (GCPC) is promoting 'Research and Development' in the field of Cleaner Production and Clean Technologies by interlinking of Government, Academia and Industries providing a single knowledge sharing platform organizing programme named 'Integration of Research to Industrial Application'. The programme aims on practical application of theoretical research conducted by students on Cleaner Production and Clean Technology. GCPC invite abstracts of dissertation / thesis from Bachelor / Master / Doctorate final year students of Chemical, Environmental Engineering and Environmental Science on subjects like Cleaner Production, Clean Technology, Waste Minimization, Reduction in water, energy and raw material consumption, process change and environmental conservation & select best five abstracts by a Panel of Experts. Cash Prize and Certificates are given to the selected research papers and publish a book inclusive of all abstracts received by GCPC with an objective to disseminate research activities amongst Government Organizations, Industries Associations, Environmental consultants, Individual Industries and Academicians. (GCPC 2014)

6. Data base management system (DBMS) and Environmental Information System (ENVIS) on cleaner production

The Environmental Information System (ENVIS), set up by Ministry of Environment, Forest and Climate Change, Government of India serves as a single-stop web-enabled repository of comprehensive environmental information with collection, collation, storage, retrieval and dissemination of the same through a nationwide network of ENVIS Hubs (hosted by the Environment/ Forest Department of State Governments/ UT Administrations) and ENVIS Resource Partners (RPs) (hosted by environment related governmental and non-governmental organizations/institutes of professional excellence). (ENVIS MoEFCC, GoI, 2017)

Gujarat Cleaner Production Centre (GCPC), Gujarat recognized as an Environmental Information System (ENVIS) Resource Partner (RP) on 'Cleaner Production' (CP) and 'Clean Technology' (CT) since 2017, as per the new mandate of ENVIS, MoEF&CC, GoI. The centre started its activities under ENVIS in the year 2003 as a Node and the Node has been converted to Centre in the year 2005. The centre helps Gujarat State Government in collection, collation, storage, retrieval and dissemination of Cleaner Production and Clean Technology. (GCPC, 2014, Bharat Jain, 2014).

7. Green Skill Development in Cleaner Production

In China, conducting Cleaner Production Assessment is mandatory for selected industrial sectors. In India, it is voluntary. But with the efforts of GCPC, CP Guidelines have been included in Environment Clearance by SEAC, Government of Gujarat. Also, many industries are voluntarily moving forward to conduct Cleaner Production Assessment in Gujarat. There is need to expand this process to industries located across India. To conduct Cleaner Production Assessment, skilled workforce is required who can implement CP as per six step methodology designed by UNIDO. (NQR 2018). "Cleaner Production

Assessor” Green Skill Development Programme started by Gujarat Cleaner Production Centre in the year 2018 in Gujarat under ENVIS, Ministry of Environment, Forest and Climate Change, Government of India. Most vocational training programmes focus on mechanical/technical skills rather than ‘soft’ or ‘green’ skills. The programme provides Skill enhancement and job opportunities in the field of Cleaner Production in Gujarat. The Programme is designed as 30 % classroom and 70 % practical training basis to develop technically sound Cleaner Production Assessor. (GCPC ENVIS 2021).

Conclusions

This paper focuses on exploring what are the Cleaner Production policies in Gujarat and how cleaner production introduced in various Government Schemes, Awards, Research, Skill Development Programmes etc. In absence of National Cleaner Production Centre in India, interlinking of Government, Academics, Consultants, Associations and Industries became the major drivers of Cleaner Production in Gujarat. This shows that Gujarat state is committed to encouraging and promoting cleaner production practices. There is a specific need to establish such centre’s in other states of India to encourage scientific research, technical development and international cooperation to develop cleaner production and to organize the dissemination of information with respect to and to popularize cleaner production and extend the range of cleaner production technologies in India.

CP has been promoted in many countries and deemed as a powerful strategy to improve environmental performance. Cleaner Production mechanism in Gujarat is a voluntary based sustainable model rather than regulatory based model. Unlike the china, where the government is the most important initiator and promoter for CP practices through heavy intervention and regulation to implement Cleaner Production. In order to improve CP practices effectively, well-

adaptive implementation at the local level is necessary. As learnt from the research, the state has started the CP initiatives through Capacity Building and Training at local level to enhance the competitiveness of local government and consultants. The second step involves the CP assessment in different industrial sectors to get more result oriented features in terms of GHG gas emission and environmental and financial savings. Before introducing the Cleaner Production Policies and schemes in place, the state has documented several success stories on CP technical feasibility and financial viability efficient implementation of CP Options and indicators. The achievements and results are used as a showcase for information dissemination and training courses and provide technical foundations for policy advice. The most important element for the success of the CP centre in Gujarat is a close and good relationship with key stakeholders, especially the industries and association. Through policy advice provided by the GCPC to the Government, key measures are promoted by the administrative system in order to enhance CP at local and enterprise level. For future studies, it would be interesting to assess the extent of CP Policy Implementation, results and view of beneficiaries at local level.

As appeared, there is a specific need to replicate the Gujarat CP Model in other states of India. Yet, a challenge of scale remains, as the tons and kilotons of resources saved and emissions avoided at enterprise level, still do not match the necessities to avoid these at the level of mega- and giga-tons. Adoption of CP methods and techniques needs to step up both in pace and scale, to deliver towards the challenges of an inclusive and sustainable future. There does not yet appear a panacea, even though, undoubtedly, working in more scalable models with groups of enterprises, industrial zones, value chains and/or sectors provides valuable starting points, along with greater emphasis for tailored advocacy and enabling policy for and supportive governance of CP in the country.

There is huge scope to club Cleaner Production in Environmental Audit, Startups, Corporate Environmental Responsibility, Extended Producer Responsibility and indicators of SDG's in India.

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