



# MECHANISM OF TECHNOLOGY TRANSFER FOR CLIMATE CHANGE MITIGATION

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## Introduction

In the recent era, technology strictly is contemplated as an integral element in the development of human civilization. It refers to the application of science and engineering in regard to studying problems and providing solutions towards overshadowing the physical limitations of human beings.<sup>3</sup> Technological advancement led by scientific developments has constantly been helpful in making life comfortable while providing options and solutions to problems and challenges which mankind has been facing in course of time.

When climate change is going to pose the biggest threat ever faced by mankind<sup>4</sup>, as stated earlier also it is being claimed through different scientific research that having the potential to provide substantial relief in terms of mitigating the causes of climate change and developing adaptation to the effects of climate change, again the use of technology can be the savior. There are availabilities of such technologies and more such technologies may be further developed and can be used towards combatting the crisis of climate change. Such technologies are being christened under different phrases including Environmentally Sound Technologies (ESTs).

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<sup>3</sup>Transfer of Environmentally Sound Technologies for Sustainable Forest Management, Department of Economic and Social Affairs, United Nations Forum on Forests Secretariat, Framework and Applications, December, p. 5, (2005).

<sup>4</sup>Chapter 2, Framing Issues, WGIII, Intergovernmental Panel on Climate Change (IPCC) Report, pp. 148-150, (2007).

Before entering into the details of the process law and policies dealing with such technologies following section of this chapter shall be dealing with the definition and legal status of such technologies being identified as Environmentally Sound Technologies (ESTs) and the transfer of the same.

### **Defining Technology Transfer**

Technology is an important element of human civilization, serving through social and practical uses, surely in form of ESTs has a greater role in climate change mitigation and adaptation where ESTs transcends borders and the use of such technology in one country benefits all others, whereas pollution in one country adversely affects others.<sup>5</sup> Hence, therefore propagation of ESTs through technology transfer is the requirement of mitigation and adaptation efforts. Due to such importance of the issue the technology transfer being the most potent medium for the propagation and use of ESTs, has been an important subject of debates encircled around climate change policy<sup>6</sup> in climate change negotiations in the recent past.<sup>7</sup> Therefore the definition of “transfer of technology”

Rosenberg<sup>8</sup>, described technology in terms of commodity, knowledge, or a socio-economic process<sup>9</sup> where technology as a commodity can be reproduced and transmitted from one place to other. According to this view technology transfer is simple as making copies of any designed document however such a view about technology has further been supplanted by the view of technology as knowledge<sup>10</sup>.

In the context of climate change and ESTs, Intergovernmental Panel on Climate Change (IPCC) has dealt technology inclusive definition, which construes such technologies not only as hardware (actual machinery), but also the softer one associated with it like “know-how”, the capacity to construct, wield, maintain, or adapt technologies.<sup>11</sup> “Sticking with a narrow construction according to the ordinary meaning of the terms of the text, “technology” covers each of these three concerns: hardware, know-how, and design”.<sup>12</sup>

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<sup>5</sup>Andrew Wait, Investment in Clean Technologies as a Public Good: a Discussion Paper Prepared for the Clean Energy Council (2010).

<sup>6</sup>Taishi Sugiyama, Climate Change, Energy and International Environmental Issues, Cooperative Climate, Chapter 1, Cutler J. Cleveland (ed.), Nov. (2008). available at: [http://www.eoearth.org/article/Cooperative\\_Climate:\\_Chapter\\_1](http://www.eoearth.org/article/Cooperative_Climate:_Chapter_1) (Last access on Nov. 4th, 2017).

<sup>7</sup>David Popp, “International Technology Transfer, Climate Change, and the Clean Development Mechanism,” Review of Environmental Economics and Policy 5(1), p. 137-139, (2011).

<sup>8</sup>Nathan Rosenberg, Inside the Black Box: Technology and Economics, p 10-11(1982).

<sup>9</sup>Nathan Rosenberg, Inside the Black Box: Technology and Economics, p 10-11 (1982).

<sup>10</sup>M. Kranzberg, The Technical Elements in International Technology Transfer: Historical perspectives. In the Political Economy of Technology Transfer, J.R McIntyre, & D.S. Papp, (eds.), (1986) and M. N Sharif, The Evolution of Technology Management, Asian Institute of Technology, Bangkok, Thailand (1995).

<sup>11</sup>Bert Metz, (et al.), Methodological and technological issues in technology transfer, A special report of the IPCC Working Group III, (2000). available at: <http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=0>(Last access on 22 Dec., 2018).

<sup>12</sup>Stephen Humphreys, Beyond Technology Transfer Protecting Human Rights in a Climate Constrained World, International Council on Human Rights Policy, (2011).

However, in its simplest form international technology transfer may be understood as the import of such technologies from abroad which is not available in the host country in need, but “in practice, it is difficult to define technology transfer with measurable indicators which could be used to identify, streamline and evaluate the specific performances concerned”.<sup>13</sup> A definition of the transfer of technology that can incorporate concerns and needs in holistic terms has been a subject of quest in negotiations of environment related Multilateral Environmental Agreements (MEAs). Under different MEAs a range of definitions may be found for technology transfer with potential for climate mitigation and adaptation,<sup>14</sup> however, uniformity among them in terms of standard of various stakeholders and comprehensibility among different definitions are missing.<sup>15</sup>

In fact, there are various perspectives and interpretations in regard to the transfer of technology, among those, few are rooted in different statutory and other instruments, however, others have gathered recognition through practice in the field.<sup>16</sup>

In such pursuance range of definitions has been given to technology transfer with potential for climate mitigation and adaptation, but only a few are recognized as a standard term by the various stakeholders or at the operational level.<sup>17</sup>

### **“Transfer of Technology” under Agenda 21**

Agenda 21, which is an outcome of the Earth Summit (UN Conference on Environment and Development) held in Rio de Janeiro, Brazil, in 1992 is a nonbinding action plan of the UN toward achieving the goal of sustainable development, for the UN itself, other multilateral organizations, and individual governments of the world to be executed at local, national, and global levels by them.

Realizing the importance of technology transfer with respect to environmentally sound technology, Agenda 21 has dedicated a chapter i.e., Chapter 34 for the transfer of ESTs under the title of “Transfer of Environmentally Sound Technology, Cooperation, And Capacity-building”<sup>18</sup>

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<sup>13</sup>Zhou Chen, The legal barriers to technology transfer under the UN Framework Convention on climate change: The example of China, Tilburg University, p10, (2013).

<sup>14</sup>There are, for example, the MEA’s definition, such as the Montreal Protocol, the Agenda 21 definition, the IPCC definition, the TNA’s definition, the CDM project design document definition, the WIPO definition, and the GEF definition. In addition, a number of academic definitions have been provided, the best known of which are those of Matthew Littleton, 2008; Collins William, 2007; David Haug, (1999); Gaetan Verhoosel, (1998).

<sup>15</sup>Gaetan Verhoosel, Beyond the Unsustainable Rhetoric of Sustainable Development: Transferring Environmentally Sound Technologies, 11 Georgetown International Environmental Law Review 49, 53,1998-1999, p. 62 (1998).

<sup>16</sup>Zhou Chen, The legal barriers to technology transfer under the UN Framework Convention on climate change: The example of China, Tilburg University, p10, (2013).

<sup>17</sup>As will be discussed below, there are, for example, the MEA’s definition, such as the Montreal Protocol, the Agenda 21 definition, the IPCC definition, the TNA’s definition, the CDM project design document definition, the WIPO definition, and the GEF definition. In addition, a number of academic definitions have been provided, the best known of which are those of Matthew Littleton, (2008); Collins William, (2007); David Haug, (1999); Gaëtan Verhoosel, (1998).

Chapter 34 of Agenda 21 provides a roadmap for the transfer of Environmentally Sound Technology (EST), Cooperation, And Capacity-building which usually is being cited and referred to in the international negotiations associated with environment and development for the purpose of reference for the definition of EST and different aspect of transfer of such technology.<sup>19</sup>

Chapter 34 identifying the need as well as requirements of transfer of technology in regard to ESTs mentions that “there is a need for favorable access to and transfer of environmentally sound technologies, in particular to developing countries, through supportive measures that promote technology cooperation and that should enable the transfer of necessary technological know-how as well as building up of economic, technical, and managerial capabilities for the efficient use and further development of transferred technology”.<sup>20</sup>

The final text of Agenda 21, adopted by the parties outlined activities in pursuance of the promotion of transfer of technology in reference to ESTs under Article 34.18, which governments and international organizations are required to engage.

Article 34.18 under the sub-heading of “Support of and promotion of access to the transfer of technology” directs the Governments and international organizations to take the following actions in such regard:

- “a. Formulation of policies and programs for the effective transfer of environmentally sound technologies that are publicly owned or in the public domain;
- b. Creation of favorable conditions to encourage the private and public sectors to innovate, market, and use environmentally sound technologies;
- c. Examination by Governments and, where appropriate, by relevant organizations of existing policies, including subsidies and tax policies, and regulations to determine whether they encourage or impede the access to, transfer of, and introduction of environmentally sound technologies;

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<sup>18</sup>The Title of the Chapter 34, Agenda 21, United Nations Conference on Environment & Development Rio de Janeiro, Agenda 21 (1992). available at: <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf> (Last access on Nov. 16th, 2017).

<sup>19</sup>Environmentally sound technologies protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes; Chapter 34.3, Environmentally sound technologies are not just individual technologies, but total systems which include know-how, procedures, goods and services, and equipment as well as organizational and managerial procedures. This implies that when discussing transfer of technologies, the human resource development and local capacitybuilding aspects of technology choices, including gender-relevant aspects, should also be addressed. Environmentally sound technologies should be compatible with nationally determined socio-economic, cultural and environmental priorities.

<sup>20</sup>Article 4, Chapter 34, Agenda 21, United Nations Conference on Environment & Development Rio de Janeiro, Agenda 21 (1992). available at: <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf> ( Last access on Nov. 16th, 2017).

d. Addressing, in a framework that fully integrates environment and development, barriers to the transfer of privately owned environmentally sound technologies and adoption of appropriate general measures to reduce such barriers while creating specific incentives, fiscal or otherwise, for the transfer of such technologies;

e. In the case of privately owned technologies, the adoption of the following measures, in particular for developing countries:

i. Creation and enhancement by developed countries, as well as other countries which might be in a position to do so, of appropriate incentives, fiscal or otherwise, to stimulate the transfer of environmentally sound technology by companies, in particular to developing countries, as integral to sustainable development;

ii. Enhancement of the access to and transfer of patent-protected environmentally sound technologies, in particular to developing countries;

iii. Purchase of patents and licenses on commercial terms for their transfer to developing countries on non-commercial terms as part of development cooperation for sustainable development, taking into account the need to protect intellectual property rights;

iv. In compliance with and under the specific circumstances recognized by the relevant international conventions adhered to by States, the undertaking of measures to prevent the abuse of intellectual property rights, including rules with respect to their acquisition through compulsory licensing, with the provision of equitable and adequate compensation;

v. Provision of financial resources to acquire environmentally sound technologies in order to enable in particular developing countries to implement measures to promote sustainable development that would entail a special or abnormal burden to them;

f. Development of mechanisms for the access to and transfer of environmentally sound technologies, in particular to developing countries, while taking into account development in the process of negotiating an international code of conduct on the transfer of technology, as decided by UNCTAD at its eighth session, held at Cartagena de India's, Colombia, in February 1992.”<sup>21</sup>

It is worthy to note that however any particular definition of the “Transfer of Technology” is missing in Agenda 21, but it provides a guiding light including all ingredients and characteristics to be included in the drafting of any definition and development of a mechanism of the same. It also provides a guiding light for developed countries in regard to activities expected from them in multilateral environmental

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<sup>21</sup>United Nations Conference on Trade and Development Eighth session Cartagena de Indias, Colombia 8 Agenda item 8, Feb. (1992). available at: [http://unctad.org/en/Docs/tdviiimisc4\\_en.pdf](http://unctad.org/en/Docs/tdviiimisc4_en.pdf) (Last access on Nov. 12th, 2017).



agreements (MEAs) where they bargain with developing countries for their cooperation in exchange for the offer of technology transfer by developed countries.<sup>22</sup>

### **What is Environmentally Sound Technologies (ESTs)?**

The imminence of the effects of climate change, calls for access to such technologies, in particular in many developing countries including South Asian countries where these impacts are likely to create immense disturbance in regard to habitant's livelihoods, dwelling places, and food and water sources, and economic systems. Considering the enormity of likely effects, which have already started to affect the region, where adaptation to the effect of climate change requires priority, mitigation of the causes of climate change is also necessary at the global level to combat the crisis as being one of the most populous regions of the world. In such regard, there are different sets of technologies that can help in mitigating the cause and adaption to the effects of climate change. Such technologies have been referred to through various expressions in different places which may include "Green technology"<sup>23</sup>, "Clean technology"<sup>24</sup>, "Environmental technology,"<sup>25</sup> "Climate-related technology"<sup>26</sup>, "mitigation and adaptation technologies,"<sup>27</sup>, "Climate sound technologies", "Climate Responsive Technology", and "Environmentally Sound Technology", few of which interchangeably have been used under IPCC reports also.<sup>28</sup>

However, there are a few minor differences among them in terms of meaning and coverage of technologies covered under them for example all green technologies need not be clean technology also, like nuclear energy being a green technology may not be a clean technology also.

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<sup>22</sup>Dalinyebo Shabalala, *Climate Change, Technology Transfer and Intellectual Property: Options for Action at the UNFCCC*, Maastricht University, (2014).

<sup>23</sup>Technology whose use is intended to mitigate or reverse the effects of human activity on the environment.

<sup>24</sup>The term "sustainable technology" is not preferred as it suggests that the technology itself is sustainable rather than the technology being used to achieve sustainability.

<sup>25</sup>Jonathan M.W.W. Chu, *Developing and Diffusing Green Technologies: The Impact of Intellectual Property Rights and their Justification*, 4 WASH. & LEE J. Energy, Climate, & Environment 53 (2013). available at: <http://law2.wlu.edu/deptimages/Journal%20of%20Energy,%20Climate,%20and%20the%20Environment/7-Chu.pdf> (Last access on July 12, 2017)

<sup>26</sup>Jonathan M.W.W. Chu, *Developing and Diffusing Green Technologies: The Impact of Intellectual Property Rights and their Justification*, 4 WASH. & LEE J. Energy, Climate, & Environment 53 (2013). available at: <http://law2.wlu.edu/deptimages/Journal%20of%20Energy,%20Climate,%20and%20the%20Environment/7-Chu.pdf> (Last access on July 12, 2017)

<sup>27</sup>Ahmed Abdel Latif (et al.), *Overcoming the impasse on intellectual property and climate change at the UNFCCC: A call for a reasonable and balanced approach int'l ctr. for trade & sustainable Development.*, (2011), available at <https://www.ictsd.org/downloads/2012/02/overcoming-the-impasse-on-intellectual-property-andclimate-change-at-the-unfccc-a-way-forward.pdf> (Last access on Aug. 2, 2018)

<sup>28</sup>Bert Metz, (et al.), *Methodological and technological issues in technology transfer, A special report of the IPCC Working Group III*, (2000). available at: <http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=0> (Last access on 22 Dec., 2018).

Some of such nomenclatures cover only such technologies which are helpful in regard to mitigation of climate change and do not cover adaptation-related technology, however under the UNFCCC mechanism at a later stage adaptation also has been considered for the subject of the action. Considering all such factors, “Environmentally Sound Technology (EST)” seems to be a broader and more suitable term under which all kinds of such technologies which may be conducive to mitigation and adaptation efforts of climate change may be covered under one umbrella, to which this research work has to address.

However, the IPCC report 2000 notes that “Climate-friendly technologies may not necessarily always be environmentally sound too. For instance, technologies for large hydroelectric plants are climate-friendly but could affect the environment where they are deployed. Conversely, the catalytic processing of exhaust gases from automobile tailpipes may be environmentally sound but may not be climate-friendly.”<sup>29</sup> As IPCC Report, 2000 has also “assumed that both mitigation and adaptation technologies will be applied in such a way that they are environmentally sound”, this research work will also assume the same.<sup>30</sup>

In general terms, Environmentally Sound Technologies (ESTs) may be referred as such technologies and techniques which have the potential to significantly mitigate the causes of climate change aiming to reduce Green House Gases (GHGs) emissions or are helpful in developing adaptations toward combating the impact in event of climate change.

The Conference of Parties (COP3) Report of the United Nations Framework Convention on Climate Change (UNFCCC) identifies Environmentally Sound Technologies (ESTs) in terms of “Environmentally sound and economically viable technologies and know-how conducive to mitigating emissions of greenhouse gases and adapting to climate change”<sup>31</sup>

Agenda 21<sup>32</sup>, which is a non-binding action agenda of the United Nations for sustainable development and a product of the Earth Summit held in Rio de Janeiro, Brazil, in 1992 has defined Environmentally Sound Technology (EST) under Article 34.1, stating that “Environmentally sound technologies protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their

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<sup>29</sup>Bert Metz, (et al.), Methodological and technological issues in technology transfer, A special report of the IPCC Working Group III, (2000).

available at: <http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=0> (Last access on 22 Dec., 2018).

<sup>30</sup>Bert Metz, (et al.), Methodological and technological issues in technology transfer, A special report of the IPCC Working Group III, (2000). available at: <http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=0> (Last access on 22 Dec., 2018).

<sup>31</sup>Decision 9/CP.3, Report of the conference of the parties on its third session, held at Kyoto Dec.(1-11) 1997,(1998) available at: <https://unfccc.int/resource/docs/cop3/07a01.pdf> (Last access on July 12, 2017)

<sup>32</sup>Agenda 21, the Rio Declaration on Environment and Development, and the Statement of principles for the Sustainable Management of Forests were adopted by more than 178 Governments at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, 3 to 14 June (1992).

wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes”<sup>33</sup>

Gill Wilkins, writer of the book, “Technology Transfer for Renewable Energy: Overcoming Barriers in Developing Countries”<sup>34</sup>, in an inclusive definition identifies “technologies ‘which protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, handle residual wastes in a more acceptable manner than technologies for which they were substitutes, and are compatible with nationally determined socio-economic, cultural and environmental priorities” as Environmentally sound technologies.<sup>35</sup>

However, without specifying what constitutes an Environmentally Sound Technology (EST), the IPCC adopts EST as a term of general reference in the IPCC, 2001 report.<sup>36</sup> Zhou Chen from Tilburg University, in his published doctoral research work, “The legal barriers to technology transfer under the UN Framework Convention on climate change: The example of China” claims that it may “be fair to say that climate mitigation and adaptation technologies are, to a large extent, environmentally sound”.<sup>37</sup>

### **Environmentally Sound Technology: Legal status**

Before entering into legal and policy-related analysis encircled around EST and the transfer of the same, the legal connotation of such expression itself requires to be analyzed. International bodies, states, and their respective policymakers are in process of addressing climate change through various legal and statutory measures towards effecting mitigation and adaptation of the same, which has a major role to play, the expression EST has gathered legal significance. In such pursuance, it requires a legal definition that must identify the required characters accepted to be enshrined into it. However, a straitjacket definition of the term EST under any international instrument having any legal force is missing but a few terms of similar nature may be identified under different international legal instruments which may help in construing a legal definition of the same with a wider acceptance.

Article 1(3) of “The Vienna Convention for the Protection of the Ozone Layer” defines ‘environmental technology’ as “technologies or equipment the use of which makes it possible to reduce or effectively eliminate emissions of substances which have or are likely to have adverse effects on the ozone layer”.<sup>38</sup> It is to be noted that this rare definition in any Multilateral Environmental Agreement (MEA) is

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<sup>33</sup>Article 34.1, United Nations Conference on Environment & Development Rio de Janeiro, Agenda 21 (1992). available at: <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf> (Last access on Sept. 2, 2017)

<sup>34</sup>Gill Wilkins, Technology Transfer for renewable energy: Overcoming Barriers in Developing Countries, p 47 (2002)

<sup>35</sup>Gill Wilkins, Technology Transfer for renewable energy: Overcoming Barriers in Developing Countries, (2002)

<sup>36</sup>Chapter 1.2, Basic Concepts, Intergovernmental Panel on Climate (IPCC) Report, WGIII, , (2001).

<sup>37</sup>Zhou Chen, The legal barriers to technology transfer under the UN Framework Convention on climate change: The example of China, Tilburg University, p 13, (2013).

<sup>38</sup>Vienna Convention for the Protection of the Ozone Layer, 1513 U.N.T.S. 293, Article 1(3), March, 22 (1985).



however open with respect to technical aspects but consideration for such is limited only to the purpose of the Convention, which is regarding the ozone layer.<sup>39</sup>

Chapter 34 of Agenda 21 gives a very broad and inclusive definition that identifies “Environmentally sound technologies are not just individual technologies, but total systems which include know-how, procedures, goods and services, and equipment as well as organizational and managerial procedures. This implies that when discussing the transfer of technologies, the human resource development and local capacity-building aspects of technology choices, including gender-relevant aspects, should also be addressed. Environmentally sound technologies should be compatible with nationally determined socio-economic, cultural and environmental priorities”.<sup>40</sup>

The Special Report on technology transfer, 2000 by IPCC<sup>41</sup>, highlights that the “technology for mitigating and adapting to climate change should be environmentally sound technology and should support sustainable development”.<sup>42</sup> The report identifies Environmental technologies as those “technologies that protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes and are compatible with nationally determined socio-economic, cultural and environmental priorities”.<sup>43</sup>

The special report also acknowledges that there is “no simple definition” of environmental technologies and that “technologies that may be suitable in each of such contexts may differ considerably”<sup>44</sup> which makes it inclusive. Stephanie Chuffart from the Centre of Climate Change Law, Columbia Law School, highlights that the IPCC definition “is equally centered on an individual assessment of each technology”.<sup>45</sup>

In World Trade Organization (WTO) negotiations on Environmental Goods and Services (EGS) two kinds of distinction may be identified which are, environmental goods and services, i.e. traditional

<sup>39</sup>Vienna Convention for the Protection of the Ozone Layer, 1513 U.N.T.S. 293, Article 1(3), March, 22 (1985).

<sup>40</sup>United Nations, Economic and Social Development, Division for Sustainable Development, Rio Earth Summit, Agenda 21, Reproduced in U.N. Doc. A/CONF.151/26/Rev.1 (Vol.1), Section IV, § 34.3, (1992).

<sup>41</sup>Bert Metz, (et al.), Methodological and technological issues in technology transfer, A special report of the IPCC Working Group III, (2000). available at: <http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=0> (Last access on 22 Dec., 2018).

<sup>42</sup>Bert Metz, (et al.), Methodological and technological issues in technology transfer, A special report of the IPCC Working Group III, (2000). available at: <http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=0> (Last access on 22 Dec., 2018).

<sup>43</sup>Bert Metz, (et al.), Methodological and technological issues in technology transfer, A special report of the IPCC Working Group III, (2000). available at: <http://www.ipcc.ch/ipccreports/sres/tectran/index.php?idp=0> (Last access on 22 Dec., 2018).

<sup>44</sup>Stéphanie Chuffart, Technology transfer and dissemination under the UNFCCC: Achievements and new perspectives, Columbia Law School Centre for Climate Change Law (2013). available at: <http://wordpress.ei.columbia.edu/climate-change-law/files/2016/06/Chuffart-2013-05-Technology-TransferDissemination-Under-UNFCCC.pdf> (Last access on May 12, 2017)

<sup>45</sup>Stéphanie Chuffart, Technology transfer and dissemination under the UNFCCC: Achievements and new perspectives, Columbia Law School Centre for Climate Change Law (2013).

available at: <http://wordpress.ei.columbia.edu/climate-change-law/files/2016/06/Chuffart-2013-05-Technology-TransferDissemination-Under-UNFCCC.pdf> (Last access on May 12, 2017)

environmental goods and services (or established environmental technologies, EET) and environmentally preferable products (EPP) and services. However, distinction, introduced by UNCTAD in 1995<sup>46</sup>, focuses on the product's purposes.<sup>47</sup>EPPs on the other hand, is a broader category, encompassing goods and services whose rationale is based on comparative terms i.e., which are more environmentally friendly than alternative products.<sup>48</sup>

According to the "Initial report on an inventory and assessment of technologies to mitigate" of UNFCCC<sup>49</sup>, the term "technologies and know-how" encompasses 'soft technologies' and 'hard technologies'. Where, "examples of 'soft' technologies include capacity building, information networks, training and research, examples for 'hard technologies' may include equipment and products to control, reduce or prevent anthropogenic emissions of greenhouse gases in the energy, transportation, forestry, agriculture, industry, and waste management sectors, to enhance removals by sinks, and to facilitate adaptation".

With these above-mentioned illustrative definitions under different legal instruments of different terms but similar in nature and akin to EST, it may be observed that where uniformity is missing, heterogeneity among them is quite glaring. Except for the WTO's distinction between traditional environmental goods and Environmentally Preferable Products (EPPs), the definitions nevertheless converge in that they follow an inclusive approach, i.e. they tend to be open to as many technologies as possible. Considering the complexity in regard to addressing the issue of climate change, no unique or typical technology may be able to address such challenges. Stéphanie Chuffart also opines that ESTs should be able to adapt specificities of local population and situation, "hence it is required to concentrate on comparatively the best available techniques and best environmental practices available in each specific situation and assess the value of a technology on the case-to-case basis".<sup>50</sup>

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<sup>46</sup>UNCTAD, Environmentally Preferable Products (EPPs) as a Trade Opportunity for Developing Countries, Doc. UNCTAD/COM/70, December, 19 (1995).

<sup>47</sup>On the concerns about 'dual' or 'multiple' uses, e.g., WTO, Committee on Trade and Environment, An Alternative Approach for Negotiations under Paragraph 31(III) – Submission by India, Doc. TN/TE/W/51, June, 3, (2005) and WTO, Committee on Trade and Environment, Communication from the Republic of Cuba, Doc. TN/TE/W/55, July, 5, (2005).

<sup>48</sup>Stéphanie Chuffart, Technology transfer and dissemination under the UNFCCC: Achievements and new perspectives, Columbia Law School Centre for Climate Change Law (2013). available at: <http://wordpress.ei.columbia.edu/climate-change-law/files/2016/06/Chuffart-2013-05-Technology-TransferDissemination-Under-UNFCCC.pdf> (Last access on May 12, 2017)

<sup>49</sup>Initial report on an inventory and assessment of technologies to mitigate, FCCC/SBSTA/1996/4, (1996). <http://unfccc.int/cop3/resource/docs/1996/sbsta/04.htm> (Last access on Oct. 12, 2018)

<sup>50</sup>Stéphanie Chuffart, Technology transfer and dissemination under the UNFCCC: Achievements and new perspectives, Columbia Law School Centre for Climate Change Law (2013). available at: <http://wordpress.ei.columbia.edu/climate-change-law/files/2016/06/Chuffart-2013-05-Technology-TransferDissemination-Under-UNFCCC.pdf> (Last access on May 10, 2017).

## Importance of Technology Transfer

The objective of Article 2 of the UNFCCC is to stabilize GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interferences with the climate system.<sup>51</sup> The accomplishment of this objective would require technological innovations, including the development of know-how for mitigation of greenhouse gas (GHG) emissions and adaptation to climate change that needs to be diffused rapidly and widely.<sup>52</sup> International negotiations too, therefore, have stressed the need for technology transfer.

## UNFCCC and Other Relevant Conventions and Agreements

UNFCCC includes provisions for the development and transfer of technology in Articles 4.5 and 4.7. Article 4.5 states that the developed country parties in Annex I and II should take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of or access to environmentally sound technologies and knowhow to other parties, particularly developing country parties, to enable them to implement the provisions of the Convention. Article 4.7 underlines the dependence of developing countries on the availability of financial resources and the transfer of technologies to implement the convention commitments effectively. A set of agreements – the Marrakech Accords – reached at the Conference of Parties (COP) 7 (Marrakech) held in 2001, decided to adopt a framework for meaningful and effective actions to enhance the implementation of Article 4.5 of the convention and to establish an expert group on technology transfer.<sup>53</sup> Negotiations for the mechanism started at COP 13 (Bali, 2007) in the hope that the process would eventually lead to a formal decision or understanding at COP 15 (Copenhagen, 2009). The Global Environment Facility (GEF) at COP 14 (Poznan, 2008) was entrusted with the task of developing a strategic program aimed at scaling up technology transfers to developing nations.<sup>54</sup>

## Mitigation Technology

Where, mitigation of climate change refers to “efforts of cutting or preventing the emission of greenhouse gases, which encompass attempts to remove greenhouse gases from the atmosphere,”<sup>55</sup> those technologies which are conducive in such regard are known as mitigation technologies. Mitigation technologies reduce the amount of GHGs from a given baseline, for example, which may include

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<sup>51</sup> UNFCCC- Article 2, Objective of the convention: <https://unfccc.int/resource/docs/convkp/conveng.pdf> accessed on March 08, 2018

<sup>52</sup> IPCC – Special Report- Methodological and Technological Issues in Technology Transfer <https://www.ipcc.ch/pdf/special-reports/spm/srtt-en.pdf> accessed on March 08, 2018

<sup>53</sup> UNFCCC- Relevant Conventions: [https://unfccc.int/files/meetings/workshops/other\\_meetings/application/pdf/wanna.pdf](https://unfccc.int/files/meetings/workshops/other_meetings/application/pdf/wanna.pdf) accessed on March 08, 2018

<sup>54</sup> CSE note on Technology Transfer: <http://www.cseindia.org/userfiles/Technology%20transfer.pdf> accessed on March 08, 2018

<sup>55</sup>What is Climate change Mitigation? BBC News, April, 13 (2014). available at: <http://www.bbc.com/news/science-environment-26980837> (Last access on Nov. 12, 2018).

technologies related to clean energy production, transport, waste management, urban planning, and housing design.<sup>56</sup>

An illustrative list of a few such technologies corresponding to different needs with respect to the adaptation of climate may be observed in a table form in the following sub-section, however, such technologies with their brief descriptions have been dealt with in another chapter.

### **Approach to combat climate change: Mitigation**

As stated earlier too, combatting the threat of climate change is a twofold approach, in which Mitigation of climate change addresses the causes which are responsible for such likely event by reducing greenhouse gas emissions, whereas adaptation seeks to lower the risks posed by the consequences of climatic changes. On the basis of this two-fold approach adopted to combat the threat of climate change, ESTs, helpful in such process also may be identified as Mitigation Technology and Adaptation Technology.

A UNFCCC technical paper notes in 1998 only that “Environmentally sound technologies (ESTs) and know-how, in the climate change context can be divided into two categories: mitigation technologies to reduce emissions by sources or to enhance removals by sinks of greenhouse gases and adaptation technologies to reduce the adverse impacts of climate change.”<sup>57</sup> Further, initially considering only mitigation technology later adaptation technology was also made part of the effort towards combatting climate change during various COP meetings under UNFCCC.

It is highly recommended by different sections of stakeholders including scientists and policymakers that both “approaches will be necessary because even if emissions are dramatically decreased in the next decade, adaptation will still be needed to deal with the global changes that have already been set in motion”.<sup>58</sup> IPCC report refers that “to deal with the global challenge of climate change both adaptation and mitigation measures are important”.<sup>59</sup> Neither the Adaptation<sup>60</sup> in isolation nor the mitigation alone is

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<sup>56</sup>Stephen Humphreys, Beyond Technology Transfer Protecting Human Rights in a Climate Constrained World, International Council on Human Rights Policy, (2011).

<sup>57</sup>Extracts from the secretariat’s technical paper on Barriers and opportunities related to the transfer of technology, FCCC/TP/1998/1, (1998). available at: [https://unfccc.int/files/documentation/workshops\\_documentation/application/pdf/asextrac.pdf](https://unfccc.int/files/documentation/workshops_documentation/application/pdf/asextrac.pdf) (Last access on May 10, 2017).

<sup>58</sup>What is Climate Change Adaptation?, The Guardian, International Edition. available at: <https://www.theguardian.com/environment/2012/feb/27/climate-change-adaptation> (Last access on Nov. 10, 2018).

<sup>59</sup>The Intergovernmental Panel on Climate Change (IPCC) in its Fourth Assessment Report, came to the conclusion that “There is high confidence that neither adaptation nor mitigation alone can avoid all climate change impacts; however, they can complement each other and together can significantly reduce the risks of climate change.” For more details, IPCC. Summary for Policymakers. In: Climate Change: Synthesis Report, R.K. Pachauri & A. Reisinger,(edited) Geneva: IPCC, p.19 (2007). available at: [https://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4\\_syr\\_full\\_report.pdf](https://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_full_report.pdf) (Last access on April 10, 2017).

<sup>60</sup>According to IPCC, adaptation means “Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic

being considered as enough major in such regard. Dale Jamieson, even notes that “a policy of adaptation without mitigation, the one we may be slouching toward, runs serious practical and moral risks. The practical risk, which itself has moral dimensions, is that a greenhouse gas (GHG) forcing may quite suddenly drive the climate system into some unanticipated, radically different state to which it is virtually impossible to adapt.”<sup>61</sup> Therefore, mitigation seems to be essential whereas adaptation is inevitable.<sup>62</sup>

Based on their functions with respect to climate change mitigation and adaptation, Environmentally Sound Technologies (ESTs) also may be identified in two sets, which are Mitigation technologies and Adaptation technologies. Mitigation technologies are helpful in the mitigation of climate change however, such technologies which are conducive to the adaptation of the effects of climate change are Adaptation technologies. However, there are some cases in which one technology can perform function towards, both mitigation and adaptation (e.g., some agricultural techniques<sup>63</sup>), but in general, the distinction holds.<sup>64</sup>




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stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.” IPCC, (2001). Appendix II: Glossary in Climate Change (2001): Working Group III: Mitigation. available at: [http://www.grida.no/publications/other/ipcc\\_tar/?src=/climate/ipcc\\_tar/wg3/454.htm](http://www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar/wg3/454.htm) also: IPCC, Climate Change: Working Group II: Impacts, Adaptation and Vulnerability, (2007). available at: [http://www.ipcc.ch/publications\\_and\\_data/ar4/wg2/en/annexessglossary-e-o.html](http://www.ipcc.ch/publications_and_data/ar4/wg2/en/annexessglossary-e-o.html) (Last access on May 10, 2017).

<sup>61</sup>Ethical Principles for Climate Change: Adaptation and Mitigation Report of COMEST, (2015). available at: <http://unesdoc.unesco.org/images/0023/002345/234529e.pdf> (Last access on May 11, 2017).

<sup>62</sup>Technologies for Adaptation to Climate Change, Adaptation, Technology and Science Program of the UNFCCC Secretariat, Climate Change Secretariat of UNFCCC, Bonn, (2006).

<sup>63</sup>Frances Seymour in Humphreys (ed.), Human Rights and Climate Change, CUP (2008).

<sup>64</sup>Stephen Humphreys, Beyond Technology Transfer Protecting Human Rights in a Climate Constrained World, International Council on Human Rights Policy, (2011).