Annex A*:*

*What are climate technologies?*

Climate technologies are technologies used to address climate change. Technologies that reduce greenhouse gas emissions include wind energy, solar power and hydropower. To adapt to the adverse effects of climate change, technologies such as drought-resistant crops, early warning systems and sea walls are used. “Soft” technologies, such as energy-efficient practices or training for using equipment also qualify. In general, a climate technology is any equipment, technique, practical knowledge or skill to reduce greenhouse gas emissions or adapt to climate change.

Notwithstanding this conceptual definition, there is no universally agreed list of climate technologies. Efforts to operationally define climate technologies include a 2009 report by the Expert Group on Technology Transfer (EGTT)[[1]](#footnote-1), the methodology used by the large multilateral development banks to track their climate finance[[2]](#footnote-2) and research studies on technology transfer.[[3]](#footnote-3) Developing countries identify climate technologies in their NDCs, TNAs and requests to the CTCN.

The emission reductions proposed in current NDCs are not sufficient to achieve the Paris Agreement objective of holding the increase in the global average temperature to well below 2°C above pre-industrial levels.[[4]](#footnote-4) The International Energy Agency (IEA) and other organizations identify technologies needed to achieve that temperature increase objective.

*A.1 Technologies identified in NDCs, TNAs and requests to the CTCN*

Technology features prominently in developing country NDCs. Of the 147 non-Annex I Parties that submitted NDCs (95% of all non-Annex I Parties) 95% mentioned technology.[[5]](#footnote-5) More than 100 of the non-Annex I Parties said they need international support for technology development and transfer to implement their NDC. Since the NDCs cover periods up to 2030, these are technology needs for the next decade. Almost half of the non-Annex I Parties referred to technology R&D or innovation in their NDC. Nearly one-third of the non-Annex I Parties mentioned specific climate technology needs, but present this information in different ways so a list of the technologies mentioned is not available. Almost 20% of the non-Annex I Party NDCs (26 Parties) referred to their TNA.

Developing countries undertake a TNA to determine their national climate technology priorities, so the TNA also provides insights into the technologies they consider to be climate technologies and where they may want to enhance RD&D efforts. To-date 85 developing countries have completed a TNA. The sectors prioritized in TNAs completed by 31 developing countries between 2009 and 2013 are:[[6]](#footnote-6)

* Mitigation:
  + Energy 55%
  + Agriculture, forestry and land use 22%
  + Waste 13%
  + Industrial processes and product use 10%
* Adaptation:
  + Agriculture 37%
  + Water 34%
  + Infrastructure/settlement 14%
  + Climate observation 6%
  + Human health 4%
  + Tourism 1%
  + Energy 1%
  + Other 3%

Developing countries can request technical assistance from the CTCN related to specific technology needs, identification of technologies, technology barriers, technology efficiency, as well as piloting and deployment of technologies thus identifying climate technologies they are interested in. Since it started operation in January 2014, the CTCN has received 59 requests, many involving multiple technologies. As of December 2016, the composition of the requests is as follows:[[7]](#footnote-7)

* Mitigation:
  + Renewable energy 36%
  + Energy efficiency 35%
  + Waste 11%
  + Industry 5%
  + Agriculture 4%
  + Transport 4%
  + Cross-sectoral 5%
* Adaptation:
  + Agriculture and forestry 21%
  + Water 14%
  + Early warning and environmental assessment 11%
  + Coastal zones 7%
  + Infrastructure and urban planning 5%
  + Human health 4%
  + Marine and fisheries 2%
  + Cross-sectoral 36%

Overall, 42% of the requests relate to mitigation technologies, 30% to adaptation technologies and 27% for both adaptation and mitigation.

*A.2 Technologies needed to meet the goal of the Paris Agreement*

The emission reductions proposed in current NDCs are not sufficient to achieve the Paris Agreement objective of holding the increase in the global average temperature to well below 2°C above pre-industrial levels.[[8]](#footnote-8) A few analyses of the technologies needed to limit warming to less than 2°C are available. They focus on mitigation technologies; the adaptation technologies needed to cope with the adverse impacts of such warming receive much less attention.

The IEA publishes an annual report – Tracking Clean Energy Progress (TCEP) – that examines the progress of a variety of clean energy technologies towards interim 2025 targets consistent with limiting the increase in the global average temperature to 2 °C.[[9]](#footnote-9) For each of 18 technologies and sectors, TCEP evaluates progress in the most recent year for which data are available and identifies key policy and technology measures that governments can take to scale up deployment. The sector contributions to 2025 emission reduction targets and associated technologies are:

* Power (25%): renewable power, nuclear power, natural gas-fired power, coal-fired power, carbon capture and storage
* Industry (32%): industry, aluminium
* Transport (21%): transport, electric vehicles, aviation, biofuels
* Buildings (17%): buildings, building envelopes and equipment, appliances and lighting, solar heating
* Other (6%): co-generation and district heating and cooling (DHC), smart grids, and energy storage

Key messages of TCEP 2016 include:

* Clean energy technologies continue to advance as mainstream energy solutions, but policy makers need to remain committed to decarbonisation of the energy system in the face of low fossil fuel prices.
* Adoption of readily available technologies needs to be accelerated to meet long-term climate targets.
* Enhancing international co-operation is a favourable way to achieve and accelerate innovation.

Climate Action Tracker recently published its analysis of The Ten Most Important Short-Term Steps to Limit Warming to 1.5°C.[[10]](#footnote-10) Due to the limited carbon budget for 1.5°C warming, the inertia of energy, transport, industry and building technologies and systems, and the difficulty of reducing emissions in some sectors, global energy models find few pathways to achieve this objective. The ten most important steps that need to be taken in specific sectors are:

1. Electricity: sustain the growth rate of renewables and other zero and low carbon power until 2025 to reach 100% by 2050
2. Coal power: no new coal plants, reduce emissions from coal power by at least 30% by 2025
3. Road transport: last fossil fuel car sold before 2035
4. Aviation and shipping: develop and agree on a 1.5°c compatible vision
5. New buildings: all new buildings fossil-free and near zero energy by 2020
6. Building renovation: increase rates from <1% in 2015 to 5% by 2020
7. Industry: all new installations in emissions-intensive sectors are low-carbon after 2020, maximise material efficiency
8. LULUCF: reduce emissions from forestry and other land use to 95% below 2010 levels by 2030, stop net deforestation by the 2020s
9. Commercial agriculture: keep emissions at or below current levels, establish and disseminate regional best practice, ramp up research
10. CO2 removal: begin research and planning for negative emissions

The analyses supporting these steps identify specific technologies that can achieve the goal.

Regarding international cooperative RD&D, based on current technology status, relative importance for post-2030 emission reductions and potential benefits of international cooperation, a New Climate Economy working paper recommends greater international RD&D collaboration on: (1) agriculture and bioenergy; (2) buildings and construction; (3) electricity networks; (4) transport systems, and; (5) carbon capture, usage and storage.[[11]](#footnote-11)

*A.3 Climate technologies: Summary*

Consensus exists for many mitigation technologies – energy efficiency and renewable energy technologies for example – while disagreement remains on others – such as efficient coal-fired generation. Renewable energy data almost always includes wind, solar, geothermal, small hydro, tidal, wave, and ocean energy technologies but may or may not include large hydro and biofuels. Energy efficiency data may be subsumed in different sectoral categories – buildings, industry, transportation, etc. – or be a single group with sectoral sub-groups.

Defining adaptation technologies is more difficult because of the diversity of possible measures across a wide range of sectors, including agriculture, coastal resources, disaster risk management, infrastructure, public health, and water resources.[[12]](#footnote-12) The same technology, say a water supply system, often will be implemented in a particular location regardless of whether it is or is not adapted to the future climate, although the scale and/or design may differ. Thus there is no definitive list of adaptation technologies, but relevant adaptation technologies are already available in agriculture, water management, human health, forests, natural ecosystems, sea level rise, and other sectors.

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2. ADB, AfDB, EBRD, EIB, IDBG & WBG (2016). 2015 joint report on multilateral development banks’ climate finance. Asian Development Bank. Annexes B and C. Retrieved from: https://www.adb.org/documents/joint-reportmdbs-climate-finance-2015 [↑](#footnote-ref-2)
3. See for example appendices 1 and 5 of Glachant, M. and A. Dechezleprêtre, 2016. What role for climate negotiations on technology transfer?, Climate Policy, DOI: 10.1080/14693062.2016.1222257. [↑](#footnote-ref-3)
4. Rogelj, J., M. den Elzen, N. Höhne, T. Fransen, H. Fekete, H. Winkler, R. Schaeffer, F. Sha, K. Riahi and M. Meinshausen, 2016. Paris Agreement climate proposals need a boost to keep warming well below 2 °C, Nature, v. 534, pp. 631–639. 30 June 2016. DOI:10.1038/nature18307. [↑](#footnote-ref-4)
5. UNFCCC, 2016. INDCS and technology: A synthesis of technology issues contained in intended nationally determined contributions. April 27, 2016. [↑](#footnote-ref-5)
6. http://unfccc.int/ttclear/tna [↑](#footnote-ref-6)
7. https://www.ctc-n.org/technical-assistance/request-visualizations [↑](#footnote-ref-7)
8. Rogelj, J., M. den Elzen, N. Höhne, T. Fransen, H. Fekete, H. Winkler, R. Schaeffer, F. Sha, K. Riahi and M. Meinshausen, 2016. Paris Agreement climate proposals need a boost to keep warming well below 2 °C, Nature, v. 534, pp. 631–639. 30 June 2016. DOI:10.1038/nature18307. [↑](#footnote-ref-8)
9. IEA, Tracking Clean Energy Progress 2016, Paris. [↑](#footnote-ref-9)
10. NewClimate Institute, Ecofys and Climate Analytics, 2016. The Ten Most Important Short-Term Steps to Limit Warming to 1.5°C. Climate Action Tracker, November 2016. Available at: http://climateactiontracker.org/news/268/The-ten-most-important-short-term-steps-to-limit-warming-to-1.5C.html [↑](#footnote-ref-10)
11. Eis, J., Bishop, R. and Gradwell, P. 2016. Galvanising Low-Carbon Innovation. A New Climate Economy working paper for Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate. Retrieved from: http://newclimateeconomy.report/misc/working-papers. [↑](#footnote-ref-11)
12. See, for example, UNFCCC, 2006, “Technologies for adaptation to climate change,” and Asian Development Bank, 2014. Technologies to support climate change adaptation. [↑](#footnote-ref-12)