**Framework Convention on Climate Change**

**Technology Executive Committee**

30 August 2019

**Nineteenth meeting**

**Bonn, Germany, 16–19 September 2019**

## Concept note on policy and technology options for encouraging behavioural changes to stimulate the uptake of existing clean technology solutions, including indigenous knowledge and technologies

### Concept note

# I. Introduction

## A. Background

1.     In the last decades, the importance of behavioural changes in the context of addressing climate change has gained increasing attention among academia, private sector, the broader public and governments. As reflected in the IPCC special report on the impacts of global warming of 1.5°C, behavioural changes can play an important role in achieving the long-term goal of the Paris Agreement.[1] Effectively responding to climate change might involve a change in everyday behaviour by all actors of society, from individuals and corporations to governments.

2.     A key role in changing behaviour towards more climate friendly behaviour could be played by climate policy and technology. How could technology help, facilitate or increase climate friendly behavior? Which policies and policy incentives could change human or corporate behaviour towards climate resilience and the uptake of climate friendly technologies?[2] Who are the key actors for encouraging a change and how could policy makers support it?

3.     The reviewed literature revealed that emission savings through behavioural change could be potentially significant. According to one study, consumers behavioural change in the European Union (EU) has the potential over the long run to reduce the EUs CO2 footprint by as much as 25 percent in comparison to business as usual, if a wide range of measures would be adopted.[3] Another study estimated that drastic changes in behaviour could amount to 19-36 percent of global emission reduction from 2020-2050.[4] Highest potential assumably lies in energy use reductions, transport and dietary change.

4.     This activity is part of the initial list of activities resulted from plenary and break out group discussions at TEC 18 and that the TEC envisages it will undertake as part of its new rolling workplan for 2019-2022. [5] Following the TEC request to the Chair and Vice-Chair for 2019 to finalize the draft TEC rolling workplan for 2019–2022, the TEC Chair and Vice-Chair decided to

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[1]  de Coninck H, Revi A, Babiker M, Bertoldi P, Buckeridge M, Cartwright A, Dong W, Ford J, et al. (2018). Chapter 4: Strengthening and implementing the global response. In: Global Warming of 1.5 °C an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change. Intergovernmental Panel on Climate Change.

[2]  Steg, L., Shwom, R. and Dietz, T., 2018. What drives energy consumers? Engaging people in a sustainable energy transition. IEEE Power and Energy Magazine, 16(1), pp.20-28.

[3]  Moran, D., Wood, R., Hertwich, E., Mattson, K., Rodriguez, J.F., Schanes, K. and Barrett, J., 2018. Quantifying the potential for consumer-oriented policy to reduce European and foreign carbon emissions. Climate Policy, pp.1-11.

[4]  Williamson, Katie, et al. "Climate Change Needs Behavior Change: Making the case for behavioral solutions to reduce global warming." (2018).

[5]  Outcomes of TEC break out groups are available in TEC 18 meeting page in here.

prepare a concept note to kick off discussion on this matter and seek guidance from the TEC on further work. The preparation of the concept note is currently listed as activity 4 under the area of work Implementation in the draft rolling workplan of the Technology Executive Committee (TEC) for 2019-2022 (document TEC/2019/19/XX).

## B.    Purpose of the concept note

5.    The concept note aims to present an overview of the work that the TEC may undertake on behavioural changes to stimulate the uptake of existing climate technology solutions. It is based on a literature review, expert interviews and an exploration of work in this field. The TEC may decide on the scope of the issues and possible future work on this topic. Provided information includes:

(a)    What behavioural change is and why is it important in the context of climate change;

(b)    Who the key actors are working on behavioural change;

(c)    What work the TEC could undertake on analysing policy and technology options for encouraging behavioural changes;

(d)    Possible next steps.

## C.    Possible action by the Technology Executive Committee

6.    The TEC will be invited to consider the concept note, including the possible activities that it could undertake on policy and technology options for encouraging behavioural changes as listed in sections III below, and provide guidance on further work on this issue.

# II.    Behavioural changes in the context of climate change policy and technology

## A.    Defining behavioural change

7.    One widely used definition of behavioural change at individual level is given by Bandura (1977): "A behavioural change can be a temporary or permanent effect that is considered a change in an individual's behaviour when compared to previous behaviour. (…) . This change is generally characterized by changes in thinking, interpretations, emotions, or relationships. These changes can be either good or bad, depending on which behaviour is being affected."[6] At organizational level, Moorhead (2008) defines behavioural change in and of organizations as: "Organizational behaviour is the study of human behaviour in organizational settings, the interface between human behaviour and the organization, and the organization itself."[7]

8.    Applying these definitions to behaviour in climate technology context, a behavioural change may be interpreted as altering habits of actions in individual everyday life towards climate sustainability. This change may translate in the uptake and use of climate technologies, as well as modifying everyday actions away from resource intensity. For organizations this may convert into more sustainable production processes or organizational cultural change towards climate resilience.

9.    For understanding individuals' and organizational behaviour it is important to engage the full range of the social sciences, including psychology, as they build a scientific basis for understanding the cross-cutting issues regarding practices and decision-making processes of individual and organizational behaviour in relation to climate technologies.

Perspectives on behavioural change

10.    According to the researched literature, one of the prerequisites towards more climate friendly behaviour is to be aware of how individuals and organizations use resources and to know which

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[6]  Bandura, A., 1977. Self-efficacy: toward a unifying theory of behavioral change. Psychological review, 84(2), p.191.

[7]  Moorhead, Gregory, and Ricky W. Griffin. *Organizational behavior managing people and organizations*. Dreamtech Press, 2008.

changes may lead to greater sustainability. Knowledge serves as the basis for further action, giving the ability to change and act on climate change.[8] Likewise, motivational factors assumably play a key role. People would have to be engaged, informed, be willing to participate and change their behaviour for climate change mitigation and adaptation to take place.[9]

11.     Whilst observing the interaction of behavioural change and climate technologies, a distinction could be made between two perspectives. There are persuasive technologies that are stimulating behavioural change and climate technologies that are possibly more frequently used as a result of behavioural change. Both ways might deserve equal attention as they may change behaviour in a climate friendly manner. The perspectives are illustrated in figure 1.

**Figure 1: Perspectives on climate technologies and human behaviour**
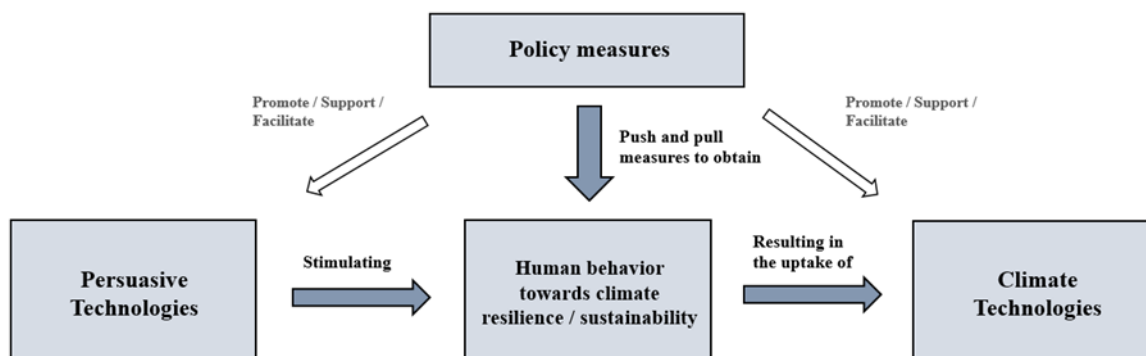


## B.     Behavioural changes partially stimulated by policy and technology

12.     The development of climate friendly technologies may offer the possibility to enable people to engage in climate action more actively.[10] The literature review suggests that well-designed technical environments, systems and products have a great potential for supporting climate friendly and sustainable behaviour. Technology could simultaneously shape behaviour and motivationally stimulate action, through enhancing both the ability and motivation to act.[11]

13.     Persuasive technology, such as electronic appliances that allow the user to set, track or receive conservation goals and feedback (e.g. smart metering; feedback technology) promises a way to make relevant information easier accessible, deliver personally tailored information and stimulate environmental awareness and conservation behaviour for different individual circumstances. According to the literature review, increased knowledge on mitigation and adaptation possibilities is related to higher engagement in mitigation and adaptation actions in some circumstances, such as lowering energy consumption or changing dietary habits.[12] Table 1 and 2 show examples of climate technologies that could be more frequently taken up as a result of human behaviour change.

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[8]   de Coninck H, Revi A, Babiker M, Bertoldi P, Buckeridge M, Cartwright A, Dong W, Ford J, et al. (2018). *Chapter 4: Strengthening and implementing the global response.* In: *Global Warming of 1.5 °C an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change.* Intergovernmental Panel on Climate Change.

[9]   Steg, L., Shwom, R. and Dietz, T., 2018. What drives energy consumers?: Engaging people in a sustainable energy transition. *IEEE Power and Energy Magazine*, *16*(1), pp.20-28.

[10]  de Coninck H, Revi A, Babiker M, Bertoldi P, Buckeridge M, Cartwright A, Dong W, Ford J, et al. (2018). *Chapter 4: Strengthening and implementing the global response.* In: *Global Warming of 1.5 °C an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change.* Intergovernmental Panel on Climate Change.

[11]  Midden, C.J., Kaiser, F.G. and Teddy McCalley, L., 2007. Technology's four roles in understanding individuals' conservation of natural resources. *Journal of Social Issues*, *63*(1), pp.155-174.

[12]  Clayton, S., Devine-Wright, P., Stern, P.C., Whitmarsh, L., Carrico, A., Steg, L., Swim, J. and Bonnes, M., 2015. Psychological research and global climate change. *Nature Climate Change*, *5*(7), p.640.

14. Furthermore, policies could be aimed at rewarding sustainable behaviour (pull measures) or punishing undesired behaviour (push measures).[13] Pull measures may include subsidies or tax exceptions incentivizing individuals or organizations to move towards more climate friendly behaviour. Push measures could come about in form of e.g. regulations, such as building codes.

## C. Technologies and actions to be possibly taken up as a result of behavioural change

15. Behavioural change on both individual and organizational level can be distinguished into short-term, intermediate and long-term changes. Further, households may change their behaviour both directly and indirectly. Directly via e.g. their own energy consumption, indirectly via the embodied energy in the products that they purchase. Embodied energy in this case means the energy needed in the production processes of a certain product. Organizations alike may be seen from the consumption perspective and from the providers perspective, where the latter sheds light on how carbon intense production processes are designed.[14] Table 1 shows possible behavioural changes to reduce fossil fuel consumption on various social and temporal scales.

**Table 1: Changes to reduce fossil fuel consumption at various social and temporal scales**

| Social scales and roles | Temporal scales | | |
|---|---|---|---|
| | Short-term (moments to days; for example changing usage of energy-consuming equipment) | Intermediate (weeks to decades; for example adopting equipment with lower FFC) | Long-term (generational, societal transformation) |
| Households as energy consumers. | Alter indoor temperature. Turn off lights and appliances not in use. Drive more smoothly. Share transportation. Shift to lower-FFC transport modes. | Replace appliances, HVAC (heating, ventilation and air conditioning) systems and motor vehicles with energy-efficient models. Insulate homes. Adopt photovoltaic systems. Choose small, efficient housing units, with proximity to public transit, shopping and work, when relocating. | Demographic transition to lower birth rates. Multi-generational households. |
| Household consumption affecting FFC in supply chains. | Purchase low-carbon-footprint foods and services. | Purchase low-carbon-footprint durable products. | Reverse preferences for large, suburban homes, large cars and distant holidays as expression of well-being. |
| Organizations as energy consumers. | Induce employees to reduce energy use (for instance, in offices, minimize use of task lights, computers, auxiliary heating/cooling devices). Reduce motorized business travel (for example by using video conferencing). Assign staff 'energy champion' responsibilities. Manage production systems in response to real-time price signals. | Make reducing FFC a strategic part of core business operations. Replace lighting and HVAC systems, equipment and motor vehicles with energy-efficient models. When relocating, rent or procure low FFC buildings. Adopt photovoltaic systems. Change work styles to accommodate a broader range of thermal conditions (for example, Japan's Super Cool Biz programme[91]). | Change core business offerings to align with climate challenges (for example BP's short-lived 'beyond petroleum' experiment[89], or Interface Carpet's goal of carbon neutrality[90]). |
| Organizations as providers of goods and services. | Find lower-footprint supply sources. Inform customers on how to use products and services offered in an energy-efficient way. Reduce FFC in the production chain. | Make reducing FFC a strategic part of core business offerings. Support and train staff in systems thinking and sustainability. Redesign products for lower energy requirements. Elect to manufacture, market and service low-FFC products. | Develop lower-carbon industry-wide standards (for instance, carbon labelling schemes for suppliers). |
| Large-scale social systems. | Improve crisis responses to power outages and fuel shortages. | Adopt policies to encourage and assist lower-FFC actions in households and organizations. Create institutions and norms for lower-FFC actions in groups of organizations. | Improve public transport system. Design communities to make non-motorized travel easier. Change norms for socially desirable housing, vehicle types, workstyles and work practices. |

Actions located in different sections of the table are often affected by quite different factors. Here we emphasize actions by households and organizations at short and intermediate timescales.

Source: Stern, P.C., Janda, K.B., Brown, M.A., Steg, L., Vine, E.L. and Lutzenhiser, L., 2016. Opportunities and insights for reducing fossil fuel consumption by households and organizations. Nature Energy, 1(5), p.16043.

16. Table 2 shows examples of which climate friendly technology or action could be implemented by what type of action for mitigation, adaptation and cross-cutting. The type of action indicates what type of behaviour (and technology uptake) would be needed for limiting global temperature rise according to the Paris Agreement.

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[13] Steg, L., Shwom, R. and Dietz, T., 2018. What drives energy consumers?: Engaging people in a sustainable energy transition. *IEEE Power and Energy Magazine*, *16*(1), pp.20-28.

[14] Stern, P.C., Janda, K.B., Brown, M.A., Steg, L., Vine, E.L. and Lutzenhiser, L., 2016. Opportunities and insights for reducing fossil fuel consumption by households and organizations. *Nature Energy*, *1*(5), p.16043.

**Table 2: Examples of mitigation and adaptation behaviors relevant for 1.5 degrees Celsius**

| Climate action | Type of action | Examples |
|---|---|---|
| Mitigation | Implementing resource efficiency in buildings | Insulation<br>Low-carbon building materials |
| | Adopting low-emission innovations | Electric vehicles<br>Heat pumps, district heating and cooling |
| | Adopting energy efficient appliances | Energy-efficient heating or cooling<br>Energy-efficient appliances |
| | Energy-saving behaviour | Walking or cycling rather than drive short distances<br>Using mass transit rather than flying<br>Lower temperature for space heating<br>Line drying of laundry<br>Reducing food waste |
| | Buying products and materials with low GHG emissions during production and transport | Reducing meat and dairy consumption<br>Buying local, seasonal food<br>Replacing aluminium products by low-GHG alternatives |
| | Organisational behaviour | Designing low-emission products and procedures<br>Replacing business travel by videoconferencing |

| Climate action | Type of action | Examples |
|---|---|---|
| Adaptation | Growing different crops and raising different animal varieties | Using crops with higher tolerance for higher temperatures or $CO_2$ elevation |
| | Flood protective behaviour | Elevating barriers between rooms<br>Building elevated storage spaces<br>Building drainage channels outside the home |
| | Heat protective behaviour | Staying hydrated<br>Moving to cooler places<br>Installing green roofs |
| | Efficient water use during water shortage crisis | Rationing water<br>Constructing wells or rainwater tanks |
| Mitigation & adaptation | Adoption of renewable energy sources | Solar PV<br>Solar water heaters |
| | Citizenship behaviour | Engage through civic channels to encourage or support planning for low-carbon climate-resilient development |

Source: de Coninck H, Revi A, Babiker M, Bertoldi P, Buckeridge M, Cartwright A, Dong W, Ford J, et al. (2018). Chapter 4: Strengthening and implementing the global response. In: Global Warming of 1.5 °C an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change. Intergovernmental Panel on Climate Change.

## D.  Why focus on behavioural change in climate change context?

17.     Even though no previous work on the topic of behavioural changes has been undertaken by the TEC, the possible impacts of wide scale behavioural changes on tackling climate change may lead to the conclusion that undertaking work in this field is sensible also for the TEC. Behavioural changes, at a scale large enough to lead towards real impact on climate change, may be achieved through complementary policy and technological support for individuals, corporations and other actors of society. In this context, undertaking further work in this field might proof fruitful. Especially in carbon intense countries a change of consumption behaviour holds a lot of potential to foster mitigation. In addition, the need to change behaviour is especially important in those countries that are most affected by the impacts of climate change. These may induce behavioural change towards adaptation in general and adaptation technologies.

18.     Nevertheless, further work needs to be undertaken to understand what impacts policies and technologies have on behaviour and which behaviours in general are most promising in different circumstances. The impacts on the economy (e.g. changing demand or supply), the environment (e.g. positive, negative or no impact) and society (e.g. altering social norms) would have to be considered. Acknowledging the broad impact that policies and technologies are possibly having to change our behaviour, and their potential contribution to the global response to climate change, it might be relevant and timely that the TEC analyses policy and technology options for encouraging behavioural changes to stimulate the uptake of existing clean technology solutions, including indigenous knowledge and technologies.

## E.  Key actors

19.     Many of the world's global players are considering the role of individual and organizational behaviour and their impact on inter alia climate change. Such actors, and their potential roles, include:

(a) United Nations organizations, which may provide a space for multilateral consideration of the potential benefits and impacts of policies and technologies that encourage behavioural change to stimulate the uptake of existing clean technology solutions. Sustainable development goal (SDG) 13 - Take urgent action to combat climate change and its impacts, highlights that the IPCC emphasizes on behavioural changes as a complementary measure to combat climate change.[15] Similarly, SDG 12 - Ensure sustainable consumption and production patterns, accentuates the need for sustainable business practices and consumer behaviour.[16] Yet, no concrete policies or benefits are named until now;

(b) Intergovernmental and international organizations, which may identify policies and actions, in the context of behavioural changes, that governments may implement to harness the potential benefits and mitigate the potential negative impacts. International organizations, such as the IEA, already organized events in their specific fields to share hands-on experiences and discuss the opportunities for international collaboration on how behavioural sciences can be applied to e.g. energy efficiency policies;[17]

(c) Private sector, which may research, develop and commercialize technologies that stimulate behavioural change towards climate friendliness and sustainability and provide technological solutions for the uptake. The private sector's contribution through innovations in different sectors, such as electric cars, renewable energy technologies etc., already play a key role for behavioural changes and most likely continue to do so;

(d) Academia and research, which lays the scientific basis for further action, the IPCC 1.5° special report of 2018 being one example.[18] Academia and research may develop a more detailed understanding of the potential benefits and impacts of behavioural change in general and policies and technologies that encourage behavioural change;

(e) Governments, which may implement policies to enable and encourage behavioural change and the uptake of existing clean technology solutions and mitigate the potential negative impacts. Policies such as subsidy mechanisms for renewable energy technology uptake or cap-and-trade schemes for emission regulation are partly already in place in order to change behaviour. Nevertheless, a wider range of policies could be implemented and focus on other avenues of behavioural changes;

(f) NGOs, which may raise awareness on the potential benefits and negative impacts of such behavioural changes and existing clean technology solutions, and advocate for policy change in this context. NGOs already engage in awareness raising projects on more effective civil society participation in environmental governance,[19] which could be further accelerated and specified on behavioural changes.

## III.  Possible work of the Technology Executive Committee

20.  As to be seen from the key actors, the role of behavioural changes in the context of climate change can be analysed from many different perspectives. In addition, the rapid development of new technologies offers both opportunity and challenge. The opportunity lies within the potential of technologies to stimulate and encourage climate friendly behaviour, as well as making it easier and more attractive to use. Yet, policy makers and other stakeholders often lack access to knowledge on the positive and negative impacts of behavioural changes, which represents a challenge. Thus, there

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[15] Goal 13: Take urgent action to combat climate change and its impacts; See at: https://www.un.org/sustainabledevelopment/climate-change

[16] Goal 12: Ensure sustainable consumption and production patterns; See at: https://sustainabledevelopment.un.org/sdg12

[17] Behavior Change for Energy Efficiency: Opportunities for International Cooperation in the G20 and beyond. See at: https://www.iea.org/workshops/behavior-change-for-energy-efficiency.html

[18] de Coninck H, Revi A, Babiker M, Bertoldi P, Buckeridge M, Cartwright A, Dong W, Ford J, et al. (2018). *Chapter 4: Strengthening and implementing the global response.* In: *Global Warming of 1.5 °C an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change.* Intergovernmental Panel on Climate Change.

[19] Tschentscher, T. (2016). Promoting sustainable development through more effective civil society participation in environmental governance. *United Nations Development Programme*.

is a need for a trusted source of information on the potential role of behavioural changes and the policies and technologies that would encourage both the change of actions and uptake of existing clean technologies.

21.     The TEC could therefore complement current efforts by collecting existing information produced by key actors to define the probable role of behavioural changes in context of policies and technology in achieving the global transformation to a low-carbon and climate resilient world. The TEC could provide insights on potential positive and negative impacts of behavioural changes, on policies and technologies that encourage behavioural changes and on (climate) technologies that either stimulate behavioural change or that could possibly be up taken as a result of behavioural changes. Noting hereby that these are specific to local, national and regional contexts. This work may be undertaken drawing on inputs from and working in collaboration with, key actors in this space, including those identified in section III above.

22.     TEC work on policy and technology options for encouraging behavioural changes could thus include:

| # | Activities | Timeline |
|---|---|---|
| 1 | Prepare a technical paper on policy and technology options for encouraging behavioural changes, based on existing data and literature. Possible elements of a technical paper could include the following: <br><br> i) Key behavioural changes on different levels of society, key policies and technologies for encouraging behavioural changes and their potential impacts on both mitigation and adaptation to climate change; <br><br> ii) Key policy challenges related to encouraging behavioural change to stimulate the uptake of existing clean technology solutions, including indigenous knowledge and technologies. Noting that many challenges are often dependent on specific local, national or regional circumstances; <br><br> iii) Ways for policy-makers to effectively support encouraging behavioural changes to stimulate the uptake of existing clean technologies. | 2021 |
| 2 | Hold an event on policy and technology options for encouraging behavioural changes (format, location and timing to be decided by the TEC). This event focuses on the three elements of the technical paper listed above. | 2022 |
| 3 | Develop a TEC Brief and recommendations to the COP. | 2022 |
| 4 | Disseminate the TEC brief and recommendations to key stakeholders. | 2022 |