

## ANNEX

“Consumers” or “users” as the group of agent in this model are the operators of the equipment that use or provide the energy and thus causes the GHG emissions. The hardware or service they use should be substituted by a sustainable energy service, i.e. be more energy efficient or based on renewable energy. Consumers encounter several barriers to behaving more climate-friendly, such as the following:

- They do not know that they are causing GHG emissions. Or if they do they are causing GHG emissions, they do not know an alternative to their behavior (**ignorance**)
- They do not mind that they emit GHG, or the sustainable alternative is unattractive for another reason, e.g. perceived as too risky, or not comfortable in operation (**lack of interest/motivation**)
- They know the alternative but they cannot operate it (**lack of expertise**)
- It might not be available to them (**lack of access**)
- Or it might actually not be affordable at all, for a variety of reasons (**lack of affordability**).
- The alternative behavior would be more expensive (**lack of cost-effectiveness**)

If there is sufficiently large demand from consumers / users of a technology or service, most of the time service and hardware providers will try to build up a supply chain that provides that (sustainable) technology or service. However, even if the supply chain would “like” to serve that demand, it might encounter its own set of barriers:

- They do not know the alternative, or they might underestimate the market or the technology (**ignorance**)
- They know the alternative but they cannot handle it (**lack of expertise**)
- It might not be available to them, for example because it has to be imported (**lack of access**)
- They might not have sufficient working capital to add another line of business (**lack of affordability**)
- They might not be interested or able to expand their business to the sustainable energy application, mostly because they have sufficiently profitable other products on which they focus their attention (**lack of cost-effectiveness**).
- They might not know how to offer the new technology or service in such a way that they can generate revenue and cover their own costs with it (**lack of business model**)

If market development is not driven by demand but by another force (e.g. policy) most of these barriers will still apply for the supply chain.

In most cases, changes towards more sustainable energy systems are supported or hampered by policies. In fact, many of the barriers that are encountered by either users / consumers or the supply chain have to do with the lack of an enabling policy framework. Therefore policy makers are an important group in the market development for sustainable energy applications. Policy makers, too, encounter a number of barriers when trying to enhance the policy frameworks:

- They have insufficient knowledge about GHG emissions, where they come from and how to avoid them, or they do not care (**lack of motivation**)

- They do not trust the alternatives in terms of technical performance, local availability of (fuel) resources, scale, costs or other aspects (**ignorance / lack of proper information**)
- They do not know what policies would work or they know the alternative but they cannot design it (**lack of expertise**)
- The policies would be fiscally unaffordable (e.g. in the case of large-scale subsidy programs) (**lack of affordability**)

Financiers are important as they would sometimes show biases for financing conventional alternatives which are known to them. Of course in many situations banking systems suffer from a number of other issues. But even if the financing sector works very well in providing liquidity for economic activity, barriers to energy efficiency-supporting behavior of banks in their financing behavior are seen in

- Lack of information and misconceptions about the technical risks and financial benefits of energy conservation. (**ignorance**)
- Lack of financial and technical expertise for appraisal and risk assessment (**lack of expertise**)
- Additional transaction costs as compared to standard lending products, e.g. in appraisal/consideration and monitoring (**lack of cost-effectiveness**).
- Lending terms that they would be able to give (e.g. in terms of tenors) would not be appropriate for cash flow structure of sustainable energy technology (**lack of business model**).

Each of these barriers is addressed with a limited set of strategies, and some strategies exist that are used to abate more than one barrier at the same time. For example, if the strategy is to train investment officers of local financial intermediaries in understanding and assessing technologies like CHP for multifamily residences, the first and second barriers are abated with one tool.

Some of these barriers have been given similar names for different agent groups, but are substantially different. For example, the lack of a business model for financing is different in substance from the lack of a business model for delivering an energy service, but it is comparable in structure: in both cases, the agents would have to do their own business a little differently which requires thought and adaptation. As the substance of the barrier is different, the barrier removal strategy needs to approach both barriers differently. On the other side there are some barriers which are almost exactly the same between different groups of actors, for example when policy makers and financiers do not trust the technologies in terms of their technical performance. Here, the same barrier removal strategy, and sometimes even the same activity can be used for removing both barriers.