[*OPTIMAL ENERGY CONSERVATION INCENTIVES*]

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Overview

Energy conservation is since decades on the policy agenda. The recent policy (e.g. in the European Union, EU) sees energy conservation as one of the three pillars to mitigate climate change. This emphasis on conservation is supported by claiming efficiency gaps, i.e., consumers choose energy inefficient appliances. The contribution of this paper is to account for private information and to derive efficient conservation programs. The consequences of private information are not only ignored by and large in the conservation literature but more important also in actual policies such as in utility conservation programs, Joint Implementation (JI), Clean Development Mechanism (CDM), and recently in the EU Directive on energy efficiency. Distortions such as the efficiency gap justify conservation iniatives but private information render them not cheap.

Methods

The external costs of energy consumption (not only of fossil fuels and not only due to environmental damages) are nowadays the major justification for intervening in energy markets. Of course, only market distortions and failures justify interventions like conservation programs and standards which are both part of an EU Directive for 2020. More precisely, economic agents (consumers, firms, including government agencies and regulators) choose appliances that are characterized by too low energy efficiencies. This misallocation, called `efficiency gap', plays a central role in public debates (compare the comprehensive survey Gerarden, Newell and Stavins (2015)) and serves as justification for many policy interventions. A decision maker (consumer, firm) should buy an equipment that maximizes the net present value of benefits over expenditures over the whole lifetime of the equipment using the correct discount rate. However, empirical studies since Hausman (1979) find that consumers use too high implicit discount rates when buying new appliances.

The following framework accounts for the two major sources of the energy efficiency gap: First, boundedly rational consumers apply to low payback times when choosing the (energy) efficiency of an appliance; this is known and called the payback gap. Too short payback times result from consumers using either too high discount rates and/or too short planning horizons. Clearly, any payback time is private information of an individual consumer, because it is unknowable to all outsiders prior to buying an appliance. Second, consumers base their decisions on energy prices that do not incorporate all external costs. Although also labeled a market failure, it is clearly a failure of politics.

The partial equilibrium analysis is based on Wirl (1997, 1999) and assumes that services like thermal comfort, lighting, mobility, etc. matter and not kWhs. In order to keep matters simple, the service is the product of the energy efficiency and energy. Consumers face two potential distortions: they apply too high discount rates and the price of energy does not include all external costs, which both lead to an efficiency gap.

A benevolent, paternalistic but in its pricing policy constrained government maximizes the expected net present value of social surplus (using the socially correct payback time t) by designing a conservation program. The program consists of efficiency upgrades backed up by subsidies, which are necessary and account for the fact that consumers hold private information about their subjective payback time. In short, the theory of mechanism design is applied to this problem. This is done under two scenarios: (i) the government is unable to include the external costs such that conservation is the meanly mean at hand, and (ii) the government applies Pigouvian taxes (in a revenue neutral way) and on top subsidizes conservation. The second case is also of theoretical interest, because the individual incentive depends on aggregate energy consumption ex post, i.e., after the program.

Results

The upshot that the efficiency gap based on distortions (a payback gap and too low energy prices not covering all external costs) provides a reason for correction even under private information and deadweight losses. However, it is never optimal to close the gap entirely. The reason for intervention is severely reduced if external costs are included in the price of energy and entirely eliminated for high costs of public funds, which is presumably the case in the EU with governments taking a share around and above 50%. Subsidies flow disproportionately to those who already use reasonable payback times and who will upgrade only little (and nothing at all if external costs were internalized). This is a consequence of private information as the efficient types must benefit from reporting their higher efficiency type. It also makes economic sense for the government, because giving money to people characterized by low payback times is waste from the perspective of conserving energy.

The above analysis of a benevolent government choosing efficient policies sketches the best what conservation programs can achieve. Introducing intermediaries like the utilities in the past and via white certificates nowadays in the EU can only make matters worse and also more complicated). Unfortunately, past and current energy policies provide little hope that things will turn efficient. And there are precedents of inefficiently designed policies such as Joint Implementation and the Clean Development Mechanism that lead to cheating and even to fraud which anyone familiar with private information could tell ahead (Wirl, Huber and Walker (1998)). Or consider the involvement of utilities in conservation in the past and at present; or the hefty subsidies paid for electric cars (€ 4000 in Germany, even higher ones in Austria, Energiemagazin (2017)), although each additional electricity requirement, here due to an electric car, is 100% fossil fuel based (maybe except for Norway and a few sunny and windy days in Austria).

Conclusions

Energy efficiency investments are promoted as one of the silver bullets to mitigate climate change and it is claimed that they can do so at no cost. This claim will not materialize for a number of reasons. First, due to the rebound effect, which is substantial in all services with high energy demands, i.e., mobility, heating, air conditioning, and lighting; large rebound effects are reported in Frondel, Peters and Vance (2008) for driving and in Saunders (2015) for many services over the course of history. Second, all conservation initiatives face private information, because no outsider can observe or even guess someone's willingness to pay for efficiency that depends on an individual's psychology like discounting and patience, personal plans (to move or not affects the willingness to pay for efficient household appliances like a washing machine) and expectations. These obstacles render regulation questionable and lower the scope of conservation initiatives even assuming a benevolent government and substantial market distortions (although the lack of internalizing external costs is not a market but a policy failure).

Under these idealistic premises of a benevolent and paternalistic government, conservation programs allow to narrow the so much discussed efficiency gap but fail to close it by far. The achieved efficiency improvements come at a high price, because the bulk of the subsidies must go those who upgrade their efficiency only little. The prospects of a conservation program turn even worse if the government exercised its option of internalizing the external cost: First, subsidies must be paid to high types without increasing efficiency at all. Second, no intervention is optimal for high costs of public funds (a likely description in high tax Europe) even if the payback gap is large. Adding the high administrative costs that are unavoidable if dealing with many small consumers like households and the less than perfect record of governments' past energy policies renders such initiatives questionable. However, a policy should be judged by its results and not its intentions (© Milton Friedman) and I think that this emphasis on intentions is a major fault of many environmental policies and in particular in the case of energy conservation.