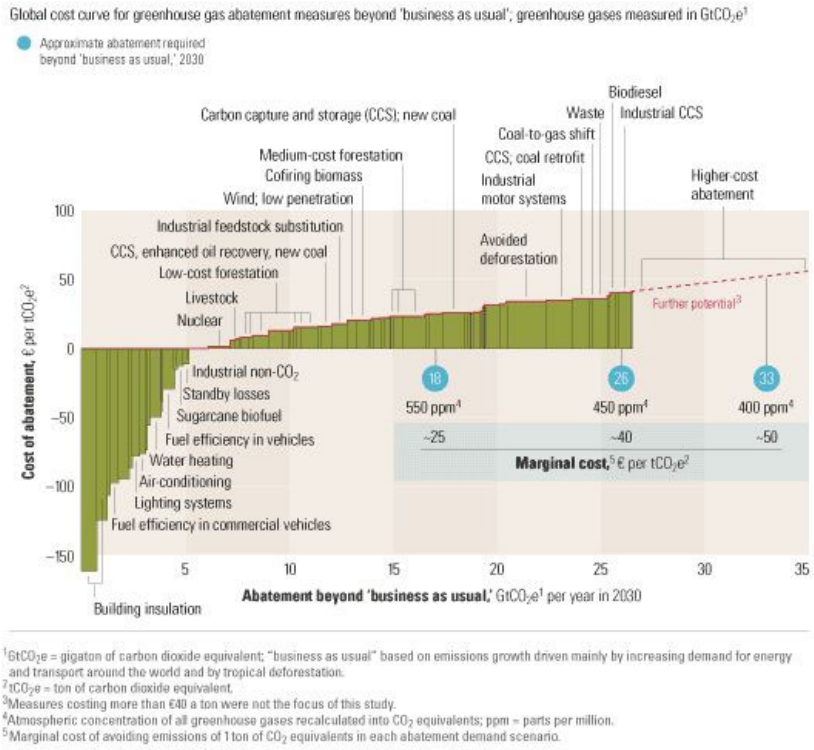
Lecture # 13 – Behavioral Economics and Energy Efficiency

I. Is there an Energy Efficiency Gap?

- Energy efficiency provides an example where government policy plays an important role
    - Many studies find that both consumers and firms underinvest in energy efficiency, even when NPV is positive
    - Energy efficiency is often seen as a low cost way of reducing CO_2 emissions
    - This literature also offers an opportunity to consider lessons from behavioral economics
- Many see energy efficiency as a "win-win" solution.
    - Energy efficiency can save money and reduce pollution.
    - A well-known example in energy policy is McKinsey and Co.'s global abatement cost curve for CO_2.
        - Several suggested technologies have negative costs!



source: McKinsey (2007)

- Energy efficiency gap: the gap between the cost-minimizing level of energy efficiency and the amount actually realized
- Is the energy efficiency gap real?
    - People demand high returns (greater than 30%) to invest in energy efficiency.
        - Demand payback periods of 2-3 years
    - Low energy prices help explain the gap
        - Energy is a small portion of the average household's budget
        - Energy efficiency is higher in counties with higher energy prices.
        - In the U.S., energy consumption in a state is about 7% lower for each cent/kWh by which electricity prices exceed the national average.
    - While engineering studies suggest more energy efficiency is possible, might there be rational reasons for not adopting?
        - Hidden costs
            - Administrative costs or time costs of installation
            - Decreased quality (e.g. lower lighting quality)
        - Consumer heterogeneity
            - Different preferences
                - Purchase a lower-efficient appliance if won't use it much
                - A study found conservatives are less likely to use high-efficient light bulbs
        - Uncertainty
            - Will energy prices fall in the future?
        - Rebound effect
            - Engineering estimates may overestimate potential savings
                - Assume perfect installation and maintenance
                - May ignore potential behavioral changes if energy use becomes cheaper
            - Leads to Jeavons paradox: efficiency improvements lead to more use of a resource, rather than less
    - Thus, a key question is to what extent market failures matter, versus rational decision making that leads to the "energy efficiency gap"

- Example of returns differing from engineering estimates:
    - Fowlie *et al*. (2015, 2018) is an example of such a study
        - Use a randomized control trial of the Federal Weatherization Assistance Program (WAP)
            - Program provides assistance to low income households
                - Average value of retrofits about $5,000
            - Included 30,000 households in Michigan who were eligible for WAP
            - Treatment group given information about WAP and efforts were made to reduce barriers to participation
        - Potential barriers to participation in WAP
            - Application process requires much paperwork (to prevent fraud), including utility bills and documentation of earnings
            - Treatment group received assistance with the application
        - Costs of treatment
            - $50 per targeted household
            - $1,000 per weatherized household
        - Results
            - In treatment group, only 15% applied and only 6% received weatherization
                - But only 2% of control applied, and less than 1% received weatherization
            - Suggests non-monetary costs of participation are high!
            - Who participated
                - Encouraged households had larger incomes, more children, and more likely to have an elderly resident.
        - Their 2018 study suggests that the costs of the program outweigh the benefits
            - Retrofits reduced energy consumption by 10-20%. Upfront costs are twice the realized savings

- What are the market failures that affect adoption of energy efficiency?
    - Note that each has different policy solutions, so understanding which market failures matter is important, and is a question of ongoing research
        - Externalities
            - Some of the benefits of improved energy efficiency (e.g. reduced pollution) are benefits to society as a whole, rather than the potential adopter
            - Early adopters may help raise awareness about a product
        - Imperfect information
            - Buyers and sellers may have different information about potential savings
            - Consumers may be unaware of the energy efficiency of goods (e.g. how energy efficient is the home you are buying)
                - Renters are 1-10% less likely to have Energy Star appliances than homeowners
                - Owner-occupied homes have more insulation
            - Lemons model
                - Because difficult to observe energy efficiency, not willing to pay more for goods that are energy efficient
                    - Because unable to verify true energy efficiency
        - Principal-agent
            - The person installing the technology might not be rewarded for doing so (e.g. landlord/tenant relationship)
        - Credit constraints
            - Investments often have high up–front costs
            - Will need to finance initial investment to reap future savings
        - Learning by using
            - Early users provide positive externality of their experience to future users
        - Regulatory failures
            - Electricity market regulation often means electricity not priced at marginal cost
            - Gillingham and Palmer suggest this is less important, since prices are often above efficient levels

II. Behavioral Economics: A Theory of Internalities

- Recent work in behavioral economics suggests behavioral anomalies may also play a role
    - Behavioral economics combines psychology and economics, and notes cases where observed behavior differs from what traditional economic models predict
    - Systematic biases create a difference between decision utility and experienced utility.
        - Decision utility is the utility consumers maximize at the time of choice
        - Experienced utility is the utility consumers later realize as a result of a prior decision
        - Behavioral anomalies that lead to a difference between decision utility and experienced utility are behavioral failures
    - Note that if preferences are not stable over time, using consumer decisions to infer utility will lead to incorrect estimates
- Energy efficiency is as example of behaviorally motivated policy
    - Involve large costs
    - Federal agencies suggest substantial net benefits from internality reduction
        - Regulatory Impact Analysis for light duty CAFE standards projects social benefits of $629 billion, versus costs of $153 billion.
            - $61 billion of benefits are net externality reductions
            - $475 billion are private benefits.
        - Note that even without internalities, private benefits will be large because of gasoline cost savings
        - But, there must be a non-externality market failure for *net* private benefits to be positive.
            - Otherwise, people would choose more efficient vehicles without regulation.
            - RIA cites behavioral economics as justification. Reasons given include:
                - loss aversion
                - inadequate consumer attention to long-term savings
                - lack of salience of relevant benefits when purchasing
- The behavioral economics motivation for such a policy is internalities
    - Internalities are costs individuals impose on themselves by taking actions not in their own self interest.

- What are examples of behavioral anomalies that might affect energy efficiency?
    - Nonstandard preferences: Preferences that violate standard neoclassical assumptions
        - Self-control problems
            - A behavioral failure
            - Appears as time-inconsistent preferences
                - People often take a long-term view for distant outcomes, but use high discount rates for the near future
        - Reference-dependent preferences
            - Consumer's utility depends on a reference point
            - For example, consumers exhibit loss aversion
                - Decline in utility from a loss is much larger than gain in utility from gaining similar income
                - Consumers will be more concerned with potential bad outcomes (e.g. what if I invest in energy efficiency and fuel prices fall) than in potential savings
            - Not necessarily a behavioral failure (decision utility might not differ from experienced utility)
    - Nonstandard beliefs
        - Systematically incorrect beliefs about the future
        - While people's beliefs about future energy prices may be wrong, it is not clear that they are systematically wrong
    - Nonstandard decision making
        - Decision processes that do not follow neoclassical assumptions
        - All could be behavioral failures
            - Limited attention
                - Follows from bounded rationality (Simon, 1955)
                    - Consumers simplify complex decisions by focusing on only a subset of available information
                - Salience matters here
                    - E.g. sales taxes added at register less salient than taxes added to list price
                    - Paying tolls vs. EZPass
                - Regarding energy efficiency, limited attention may be a reason consumers don't think much about fuel efficiency when buying a car
            - Framing of choices
                - Presentation of information affects choices
                - Important to properly design energy efficiency labels
            - Suboptimal decision heuristics
                - Use of rules of thumb for decision making
                    - E.g. favoring first name on ballot
                - Again, not directly studied in energy efficiency decisions

III. Policy Implications of Behavioral Economics for Energy Efficiency

- Consider two dimensions of policy interventions (Carlsson *et al*. *REEP* 2021)
    - Reason for intervention: Why?
        - Conventional economic problems (e.g., market failures)
        - Behavioral economic problems
    - Type of intervention: How?
        - Conventional economic tools (e.g., emission fees)
        - Behavioral economic tools (e.g., nudges)
- More generally, understanding what failures need to be addressed (e.g. market failures, behavioral failures) is important to target policies correctly
    - Behavioral failures
        - Give people freedom to make choices, but frame choices in ways to lead to good decisions
            - For example, make energy efficiency a default option
            - Aim to improve an individual's welfare by better framing choices
        - Types of nudges
            - Pure nudges: makes it easier to "do the right thing"
                - Designed to counteract inattention or poor self-control
                - Examples
                    - Putting healthy foods at top of menu
                    - Automatically enrolling in a retirement plan
            - Unlike pure nudges, a <u>pure green nudge</u> pushes people towards behavior that is socially desirable but may not be in their best interest
                - E.g. default option is a green tariff on electricity bill
                - Four types of pure green nudges
                    - Defaults: change the default option: e.g. make green energy the default
                    - Provision and simplification of information
                        - Ignoring information is not necessarily irrational, as collecting information takes time and effort.
                        - Therefore, simplifying presentation of information can help.
                        - Consumer product labels are an example

        - Changes to the physical environment
            - Kallbekken and Saelen (2011): providing smaller plates at a buffet reduced food waste by about 20%
        - Reminders
    - Moral nudges: reward people for doing the right thing through psychological utility
        - Self-focused if primarily benefits the induvial, rather than addressing an externality
        - Social proof is an example:
            - "9 out of 10 people in the city pay taxes on time"
        - Moral green nudges promote green behavior. Examples include:
            - Interpersonal motivations and social comparisons
                - E.g., comparing electricity consumption to neighbors
                - Key question: are there long-term effects, or does the effect wear off?
            - Moral suasion
                - E.g. need to avoid strain on system during peak use days
            - Goal setting and commitment
    - **Question:** Who decides what is a "good" choice?
- Potential uses of nudges with conventional policy tools
    - Pigouvian tax
        - Addresses environmental externalities from energy usage
        - Note how nudges can improve outcomes when individuals have heterogeneous preferences
            - E.g. if gasoline taxes don't perfectly target the externality, nudges to reduce traffic in urban areas target places where marginal damages are highest
        - Moral nudges may change norms, making people feel better about being taxed for pollution (e.g. improved experienced utility)
        - Taxes require payments, so likely to have larger distributional effects than nudges
        - Nudges complement taxes in the case of internalities. For instance, if consumers underestimate the future energy costs of a new refrigerator
            - Nudging those with incorrect perceptions avoids needing a higher tax that would punish those with correct perceptions.

- What conventional policy tools can be used to address energy efficiency?
  - Pigouvian tax
    - Addresses environmental externalities from energy usage
  - Subsidies are an alternative
    - Bu must consider costs of raising funds
    - Other limitations
      - By lowering costs, may have rebound effect
      - Benefits may go to higher income households
      - Treat all consumers equally. Taxes make heavy users pay more
      - Doesn't price utilization
  - Command and control: Energy efficiency standards
    - Imposes the "correct" choice on a consumer
    - May be inappropriate for some in the case of heterogeneous preferences
      - Are energy efficiency subsidies and standards a second best approach to correcting investment inefficiencies?
      - Heterogeneity in the internality across users weakens the case for subsidies
        - Thus, *who* is induced to change their behavior matters
      - Should standards apply uniformly
        - Are minimum efficiency standards for air conditioners beneficial to people in colder parts of the US?
      - Most likely to improve welfare if target the largest investment inefficiencies
        - Thus, providing information to heavy energy users (e.g. via smart meters) is more effective
  - Providing information
    - Product labeling is an example
  - Financing programs
    - Some communities fund energy efficient investments and let consumers pay it back through utility bills (e.g. from resulting savings)