Hidden Barriers to Efficiency

The Treatment of Discount Rates and Energy Efficiency Costs in EU Policy Scenarios

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Introduction and Overview

In the energy field, we often face choices between, on the one hand, resources whose investment costs are largely known and fixed and whose running costs over time are low (e.g., solar photovoltaic (PV) panels or energy efficiency upgrades) and, on the other hand, those for which most of the costs will be paid out year-on-year into the future (e.g., fossil power generation). When comparing such options, the discount rates used in policy analysis can have a dramatic impact on the calculation of costs and benefits. In the case of energy efficiency (EE), an inappropriately high discount rate can mislead decision-makers by undervaluing the future benefits of today's efficiency investments, while discounting too heavily the future costs of fossil fuel and operations for supply-side alternatives.

The Commission's January 2014 Impacts Analysis Communication uses unusually high discount rates for programmatic EE (17.5 percent). Based on the market impacts of efficiency initiatives in many countries, and the impact assessment practices in leading jurisdictions, we conclude that the proper discount rate for EE investments in the household sector should be much lower—closer to 4 percent. Using a more accurate number for the cost of capital will remove a hidden barrier to efficiency solutions in European policymaking today.

With particular reference to the January 2014 Impact Analysis Communication, this policy brief discusses the treatment of EE investment costs in the Communication, offers alternatives to the European Commission's treatment of energy efficiency in policy impact assessment modeling exercises, and provides examples of better approaches from other analyses.[2] One of the Communication's main conclusions is that scenarios with relatively ambitious EE policies require higher investment expenditures, and higher overall total system costs, compared to scenarios that achieve the same overall emissions reductions with alternative policies. Observers have noted that this outcome is rooted in the high 'discount rate' used by the Commission for EE investments, relative to lower discount rates chosen for alternative investments, such as new power plants.[3] In fact, the text of the Communication itself acknowledges this issue.

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[2] European Commission (2014). *Impact Assessment* Accompanying the document *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A policy framework for climate and energy in the period from 2020 up to 2030* (SWD(2014) 15 final). Brussels, Belgium: European Commission. Retrieved from http://ec.europa.eu/energy/en/topics/energy-strategy/2030-energy-strategy.

[3] Riley, B. (2014). *Commission 'fixes' data to rubbish 2030 efficiency scenarios*. European Council for an Energy Efficient Economy. Retrieved from http://www.eceee.org/all-news/columnists/Brook-Riley/commission-fixes-data

This discussion is based on RAP's long history with analysis of EE policies and EE investments in the EU and in other countries.[4] We do not claim to have detailed experience with the PRIMES model, on which the key parts of the Communication are based, and we have no additional information beyond what is available in the Communication text. However, the key problems with the Communication, in our view, are readily apparent and not specific to the choice of model.

In business, economics, and policy analysis, the term 'discount rate' is used in many different contexts. We follow the main thread of the Communication and focus on the discount rate as the determinate of the cost of capital for investments. Our main points are straightforward:

- Well-designed EE policies can overcome barriers to EE investments, including the relatively high cost of capital (i.e., the high "implicit" business-as-usual discount rate) for EE investments, including in the household sector.
- The Commission itself, in the Communication, makes the case that well-designed EE policies can overcome high discount rates and other barriers to EE investment. However, without clear justification, the Commission assumes that the cost of capital (discount rate) is very high, even in scenarios with ambitious and rapidly-implemented EE policies. This is not justified. Instead, when modeling ambitious EE policy scenarios, the Commission should follow common practice and use a low, policy-driven discount rate from the start, for the entire duration of the ambitious EE policy scenarios (that is, including for near-term investments).

In support of these points, we summarize examples of other analyses, including detailed discussion of discount rates from the United States Department of Energy.

Cost of Capital for Energy Efficiency in the Commission's Analysis

The Communication presents estimates that investing in EE measures under strengthened EE policies would come at a relatively high cost, compared to other options. In particular, the investment expenditure associated with the "concrete EE measures" (i.e., strengthened EE policies) scenario are significantly higher than the investment expenditures under the alternative scenario (the "carbon values" scenario, which has weaker EE polices and relies more heavily on emissions trading). In other words, the Communication evaluates the same overall greenhouse gas reduction (for example, 40 percent by 2030) under the two scenarios, and concludes that "concrete EE measures" requires:

- Higher average annual energy sector investment expenditures (which includes the costs of retrofits and other end-use EE investments, as well as power plants and grid expansion); and
- Lower average annual energy purchases.

However, as calculated, the increased investment costs are significantly larger than the savings in fuel costs, yielding higher expected overall system costs.[5]

The annual average investment expenditure is influenced by both the amount of capital needed and the cost of capital. The cost of capital is the focus of this paper.[6] The cost of capital is closely related to the

[4] RAP has detailed experience in energy policy, regulation, and efficiency programmes in more than 50 nations, states, and provinces globally.

[5] European Commission, p. 78, Table 14.

[6] The Commission's approach to calculating the *amount* of capital needed for EE under various scenarios is very important and would also be worth investigating in more detail, but is beyond the scope of the present paper.

concept of the discount rate.[7] As noted in one of the consultants' reports cited in the Communication, "the rate of return required by investors [is] often called the discount rate."[8] This leads to the question of how to assess the cost of capital for different types of investments in different types of projects. When considering, for example, investment by a firm in proposed power generation projects, the analysis is conceptually straightforward: the firm must decide what rate of return is necessary to make each project worthwhile. However, much of energy efficiency potential is in lighting, refrigeration, heating, and other *residential* uses.[9] This raises the questions of what actor plays the role of the conceptual "investor" and what rate of return (discount rate) that investor will require. The Communication addresses this issue essentially by treating the private consumer as the investor for prospective residential EE investments.[10] This, in turn, raises the question of how households assess investments.

The Communication briefly addresses this question, noting that "the discount rate for household consumers [is] assumed to be at 17.5 percent under business-as-usual conditions following extensive literature review on discount rates of private consumers."[11] Although the Communication does not offer detailed explanation or citation for the literature review, there is no particular reason to doubt this result under "business as usual," where "business as usual" means weak EE policies. In other words, households tend to be generally myopic and doubtful about payoffs (or costs) that may occur in the future. In fact, some studies, as we will see, use even higher discount rates when modeling "business as usual" household behavior.[12]

Although households tend to have high discount rates under "business-as-usual conditions," there is extensive real-world experience and documentation of the use of policies to overcome these high discount rates when it comes to EE investments.[13] This point is also acknowledged in the

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[7] The Communication refers to the average annual investment expenditure as 'annuity payments' on p. 27, in footnote 43. It may be more intuitive for the reader to think of this annual expenditure as the required payments for loans that are used to fund investments in the energy system (including energy efficiency measures and power plants). The annual investment expenditure depends on the terms of those conceptual loans – including the interest rates associated with those loans.

[8] Poyry Management Consulting (2013). *Technology Supply Curves for Low-Carbon Power Generation: A Report to the Committee on Climate Change*. p. 55.Retrieved from http://www.theccc.org.uk/wp-content/uploads/2013/05/325_Technology-supply-curves-v5.pdf.

[9] Our main focus in this paper is residential investment in EE, because that is the sector where the Commission's analysis clearly uses inappropriate discount rates. However, in general, our main points hold for the commercial and industrial sectors as well – including the point that well-designed EE policies can overcome barriers and mobilize capital for EE investments at low cost of capital.

[10] There are other possible perspectives, including the social perspective, but this is largely outside of the scope of this paper. For additional information, see the discussion in footnote 19, below. Also see http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf and http://www.nwcouncil.org/media/6332/SixthPowerPlan_Appendix_N.pdf

[11] European Commission, p. 164.

[12] Again, the behaviors of commercial and industrial decision-makers are also important. However, we focus here on the household case as it is likely that changes here would make the largest difference in the Commission's analysis. In any case, the issues are very similar for industrial and commercial EE. There are thousands of case examples among the programs delivered by utilities and ESCOs under efficiency programs in dozens of jurisdictions.

[13] See International Energy Agency (2014). *Capturing the Multiple Benefits of Energy Efficiency*. Retrieved from http://www.iea.org/bookshop/475-Capturing_the_Multiple_Benefits_of_Energy_Efficiency and Regulatory Assistance Project (2012). *Best Practices in Designing and Implementing Energy Efficiency Obligation Schemes* (Task

Communication, which says, "[s]cenarios with more ambitious EE policies have even lower discount rates."[14] The Communication goes on to argue this point in terms that we think are quite reasonable, saying, "[w]ell-designed, specific, energy savings measures addressing non-price barriers such as split incentives, high private discount rates, limited access to finance or imperfect information are complementary to price signals."[15]

In the scenarios with ambitious EE policies (presumably including the "concrete EE measures" scenario), it appears that the Communication analysis uses a very high discount rate for households of 17.5 percent to calculate the investment expenditure (and total energy system) costs.[16] Meanwhile, the Commission notes that, "[r]ecent estimates of long-term and current discount rates currently employed for low-carbon power generation range from 9.1% - 9.6% for onshore wind, 10 to 11% for nuclear and 10 to 15% for CCS, which reflect the risks still associated with such investments."[17] So, the household discount rate used by the Commission is substantially higher than the discount rates that the Commission appears to use for alternative investment choices.

In short, the Commission recognizes that well-designed EE policies can drive the discount rate (and thus the cost of capital) for EE investments down.[18] However, the Commission does not follow through in choosing an appropriate discount rate when calculating costs for scenarios with strong EE policies. The effect of the Commission's assumptions is to treat EE investments – which have a long history of reliably displacing the need for large numbers of power plants and other energy sector investments – as inherently more risky than even carbon capture and sequestration (CCS), a technology that has yet to be deployed anywhere in the world at significant scale.[19] This high EE cost of capital is an inappropriate assumption and likely has a significant effect on the scenario outcomes, given that many investment decisions will be in the near term, and the benefits will accrue over time. In fact, strengthened EE policies can be implemented quite quickly, with rapid effect. Again, the Commission recognizes this (in the context of discussion of discount rates), saying "[w]ith energy efficiency policies increasingly changing energy markets by addressing market failures and imperfections, it appears appropriate to

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XXII of the International Energy Agency Demand Side Management Programme). Retrieved from http://www.raponline.org/document/download/id/5003.

[14] European Commission, p. 164.

[15] European Commission, p. 179.

[16] European Commission, p. 164 and 167. Note also that p. 76 says, "So far, reduced discount rates in the context of economic decision making of agents, following from energy efficiency policies, have not been applied in the same way to calculate the capital cost and direct energy efficiency investment component of energy system costs." See also p. 33 of European Commission SWD(2014) 255 final, Brussels, 23.7.2014. .

[17] European Commission, p. 188.

[18] A lower cost of capital would tend to make EE investments look quite attractive, in the context of the Commission's modeling, given that EE investments also reduce energy expenditures and do not require accompanying grid infrastructure. For a detailed discussion of the multiple benefits associated with energy efficiency, see Lazar, J. and Colburn, K. (2013). *Recognizing the Full Value of Energy Efficiency*. Montpelier, VT: Regulatory Assistance Project. Retrieved from www.raponline.org/document/download/id/6739*.* Also see International Energy Agency (2014). *Capturing the Multiple Benefits of Energy Efficiency*. Retrieved from http://www.iea.org/bookshop/475-Capturing_the_Multiple_Benefits_of_Energy_Efficiency.

[19] While comparing resource choices, we can observe that the 10 to 15 percent discount rate assigned to nuclear and CCS is not a pure "private" discount rate, but reflects substantial governmental assistance and risk-reduction measures for those resources. Similarly, the discount rate assigned to efficiency investments should reflect the impact of EE programmes and policies that break through market barriers, lower the cost of capital, and lead to greater EE investments by households and other end-users.

revisit this issue in future analyses."[20] As this impact assessment provides the bases for setting the ambition of energy efficiency policy as far out to 2030, the consequence of this erroneous assumption could be a significant missed opportunity.

Cost of Capital for Energy Efficiency in Other Analyses

The preceding section emphasized common ground with part of the Commission's broad conceptual approach to EE discount rates and cost of capital. That is, we are in agreement that well-designed EE policy can overcome high "business-as-usual" discount rates. However, there is reason to be skeptical about the details of the Commission's assumptions, particularly the assumption of high discount rates for households when calculating investment expenditures.

There are many different uses of terminology and differences in calculating discount rates and cost of capital, and these technicalities can unnecessarily cloud important conclusions. The major studies that we review below are based on the idea that EE policies can be implemented quickly with fast effects in terms of discount rates.

United States Department of Energy (DOE)

DOE has a long history of modeling energy efficiency investments, including related discount rates and cost of capital. A recently issued Technical Support Document provides details of DOE's current approach.[21] For residential EE, DOE calculates a discount rate based on the "consumer's opportunity cost of funds."[22] DOE considers the rate of return that households earn on a typical portfolio of investments (including stocks, bonds, savings accounts, etc.) and also the average interest rate on a typical household's debt (home mortgages, credit card debt, lines of credit, etc.). The calculation is based on the shares of these various assets and debt instruments in the average household's portfolio. The result is an estimated average real effective discount rate of 4.49 percent.

The DOE document includes useful discussion of the "true" discount rate and the "implicit" discount rate for energy consumers. According to DOE, "[a]n implicit discount rate refers to a rate than can be inferred from observed consumer behavior with regard to future operating cost savings realized from more-efficient appliances. An implicit discount rate is not a true discount rate because the observed consumer behavior is affected by lack of information, high transaction costs, and other market barriers. However, implicit discount rates can predict consumer purchase behavior with respect to energy efficient appliances."[23] To put this in terms similar to our discussion above, the *implicit* discount rate describes the cost of capital under "business-as-usual" conditions where consumers lack information and suffer from other barriers to investment in EE. In contrast, a *true* discount rate reflects the true opportunity cost of capital – that is the returns that households could realistically earn on alternative investments, such as the stocks and savings accounts mentioned above. This true discount rate is appropriate for situations where EE policies have overcome information problems and other barriers.

[20] European Commission, p. 76.

[21] United States Department of Energy (DOE). (2015). *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial And Industrial Equipment: Residential Boilers*. Washington, DC: Office of Energy Efficiency and Renewable Energy. Retrieved from: http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/72.

[22] DOE, section 8.2.2.6, p. 8-24.

[23] DOE, p. 9-11.

According to DOE, implicit discount rates are much higher than the true discount rate (which is estimated at 4.49 percent).

The difference between DOE's approach and the approach used by the Commission boils down to when to use the (low) true discount rate as the cost of capital and when to use the (high) implicit discount rate. DOE's approach is to use the true discount rate for modeling policy scenarios. The Commission seems to agree with this approach, but uses a very slow and gradual transition (over decades) from an implicit discount rate to a true discount rate (although the Commission does not use the terminology of "true" and "implicit"). DOE's approach calls for using the true discount rate as soon as policies are implemented.[24]

ECN and Cambridge Econometrics

The Energy-Environment-Economy Model for Europe (E3ME) is a well-known model that was used as part of the analysis presented in the Communication. However, the Commission used the E3ME to address employment effects of various scenarios; the investment expenditure results (as discussed above) appear to be based on the PRIMES model. Nevertheless, E3ME has been used in other instances to analyze investment expenditure costs in a manner broadly similar to the analysis presented in the Communication. Here, we refer to a 2013 analysis prepared by ECN and Cambridge Econometrics.[25] The 2013 analysis looks at different policy scenarios, including scenarios with strengthened EE policies. A discount rate for households of 8 percent is used for the "market (low EE policy intensity)" scenario (roughly analogous to the "business-as-usual" case in the preceding section). In comparison, a "high policy intensity" scenario features household discount rates of 4 percent from the start, with no gradual adjustment from business as usual. The 2013 analysis does discuss the possibility of "correction for late start of implementation" of EE policy, however these considerations do not affect the assumptions about discount rates and, in any case, only countenance delays before 2020. Delays in implementation with substantial effects as late as the 2030s would be inconsistent with the ambitious ("high intensity") scenarios in this study.

Conclusion

This paper has discussed the Commission's treatment of EE in policy impact assessment modeling. We have identified broad areas of common agreement with the Commission's analysis, including the following points:

- In the *absence* of strong policies to support EE (that is, under "business-as-usual" conditions), well known barriers to EE mean that energy consumers tend to be uninformed and unreasonably skeptical (or myopic) about the benefits of EE – that is, they exhibit high discount rates. These high business-as-usual discount rates are often also called 'implicit' discount rates.

[24] The DOE document also touches on the issue of social discount versus private discount rates. As mentioned above, we have not included these issues in the scope of the present paper, because 1) each perspective argues for a lower (and similar) near-term discount rate, as opposed to what is used by the Commission; and 2) use of private discount rates (as long as they are the 'true' not 'implicit' rate) maps most closely to the approach chosen by the Commission. DOE presents a national impact analysis and uses social discount rates of 3 percent and 7 percent, with reference to analysis by the Interagency Working Group on Social Cost of Carbon. See: https://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf.

[25] Sijm, J.P.M., et. al. (2013). *Investing EU ETS auction revenues into energy savings.* ECN and Cambridge Econometrics. Retrieved from http://www.ecn.nl/docs/library/report/2013/e13033.pdf.

- Strong policies to support EE **can overcome household myopia and can overcome financing problems and deliver EE investments at low cost**. In other words, scenarios that consider strong EE policies should assume low discount rates. These lower discount rates are sometimes called 'true' discount rates because they reflect the true opportunity cost of capital (relative to other types of investments).

Although the Communication acknowledges these points, the modeling assumes an inappropriately high discount rate for household consumers. The Communication provides little justification for this and we argue that low 'true' discount rates should be used instead. We point to analyses from the DOE and other sources that more accurately model the costs and benefits of investments made under EE programs and policies. The standard approach is to apply a low "true" discount rate from the start, for the entire duration of the ambitious EE policy scenarios (including for near-term investments). The Commission should follow that approach in order to properly value the costs and long-term benefits of efficiency investments across Europe.