Research Summary: Estimating the economic impacts of support schemes for residential PV with detailed net demand profiling

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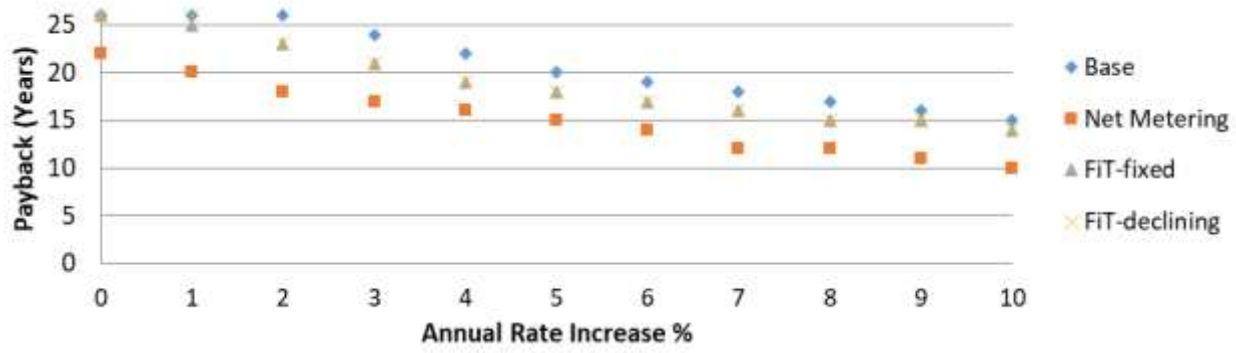
The cost of solar photovoltaic (PV) technology has dropped dramatically in recent years, and deployment is on the rise worldwide. While many EU nations have long offered support programmes to spur solar adoption, Ireland has no scheme in place, and little solar generation systems installed. In the context of government consideration of options for renewable energy support schemes and strategies for meeting EU targets, this analysis examines financial performance of residential solar in a selection of PV system size and electricity demand scenarios, and considers potential policy impacts.

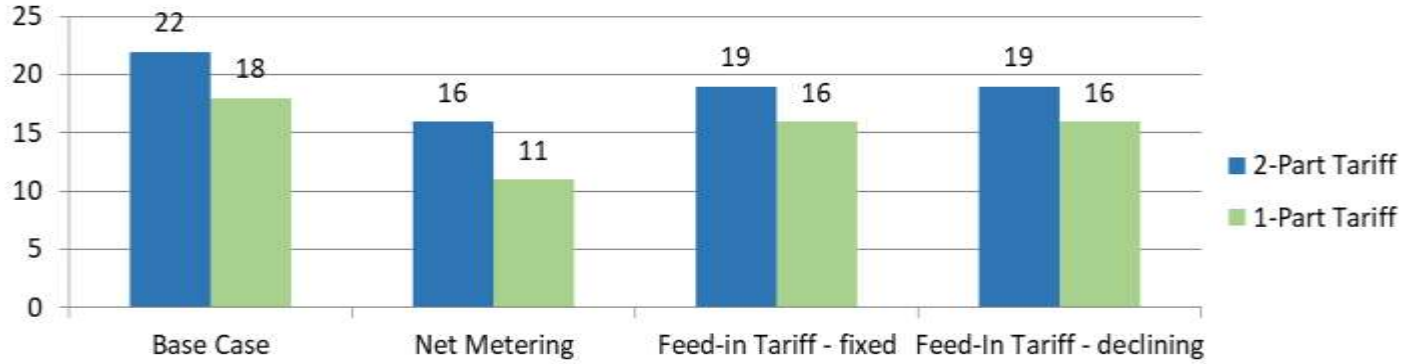
We consider PV installations at a range of sizes and household demand levels, and in particular, focus on the most likely scenario, a 3 kWp PV system with average annual electricity demand (5,200 kWh). Using detailed hourly data for both PV generation and household demand, we estimate how much solar would be generated and how much electricity a household would use in each hour for the system's 25-year lifetime. We are then able to calculate the customer's annual electricity bill without PV, and the annual bill with PV, accounting for fixed charges, taxes, and fees. This difference indicates how much households stand to save by offsetting their electricity bills, and how much additional savings are possible if a net-metering or feed-in tariff scheme were in place. Overall, we find that net-metering offered the highest financial gain and quickest payback for PV households. For a 3 kWp rooftop PV system with average demand, we find payback and internal rate of return (IRR) as follows:

Support Scheme	Payback	IRR
None (base case)	22 years	2.2%
Net Metering	16 years	6.4%
Feed-In Tariff (fixed & declining)	19 years	3.5%

Potential savings are also impacted by retail rates, as this is the cost that system owners offset when they consume electricity from their PV panels. If retail electricity rates rise over the lifetime of the PV project, system owners avoid higher electricity costs, and therefore realise a quicker payback on their initial investment, as in the following results for a 3 kWp system with average demand:



Importantly, in order for savings to accrue to the system owner, retail rate structure must be such that the increases in rates affect the volumetric (per kWh) portion of the electricity bill, rather than fixed costs, as demonstrated in the payback for a 3 kWp system illustrated as follows:



In addition to policy scenarios that pay rooftop PV owners for their generation, we examine how financing with loans or grants impacts the length of time required for PV owners to recover their costs. Debt financing half of the system cost at a 1% interest rate, compared with no interest financing (i.e. 100% cash paid upfront) causes a delay in payback of 1-2 years, while a 5% interest rate adds up to 5 years to the payback period. If public grants are available to homeowners, adding a grant worth 5% of project cost accelerates payback period by 1-2 years.

Key Findings

- Our analysis shows that in some cases, homeowners could receive **positive financial benefits over the full lifetime** of a rooftop PV system even without any support scheme in place.
- However, **payback periods were upwards of 18 years under current conditions** (i.e. no support scheme), depending on percentage of self-consumption, and only improved to 14-16 years under net-metering, the most beneficial programme. While no detailed analysis exists for Irish customer expectations, research from other countries indicates that homeowners require payback in no more than 7-10 years.
- A **higher electricity retail price** leads to **quicker payback.** Future price forecasting is therefore highly relevant to estimating potential financial gains.
- With respect to **remuneration policies**, our analysis shows that for consumers in a **low-irradiance market** such as Ireland, effectiveness of remuneration through **grants compared with net-metering or FiTs can be**

roughly equivalent in terms of delivering a reduction in payback periods. For example, a grant of 30% delivers the same benefit to the consumer as net metering, and a 20% grant provides the same payback period as a FiT, while in higher-irradiance areas, future cash flows from remuneration for excess generation might make net-metering or FiTs more advantageous.

- The way that electricity is billed to customers (i.e. **electricity tariff structure**) can have a **significant impact on financial benefit** of rooftop PV. A household billed only on an energy volume (volumetric) basis would a 3-5 year improvement in PV system payback when compared with a two-part bill, in which only electricity is billed on a per-kWh basis, and other charges like network costs and levies are fixed.

The full version of this paper is available at:
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