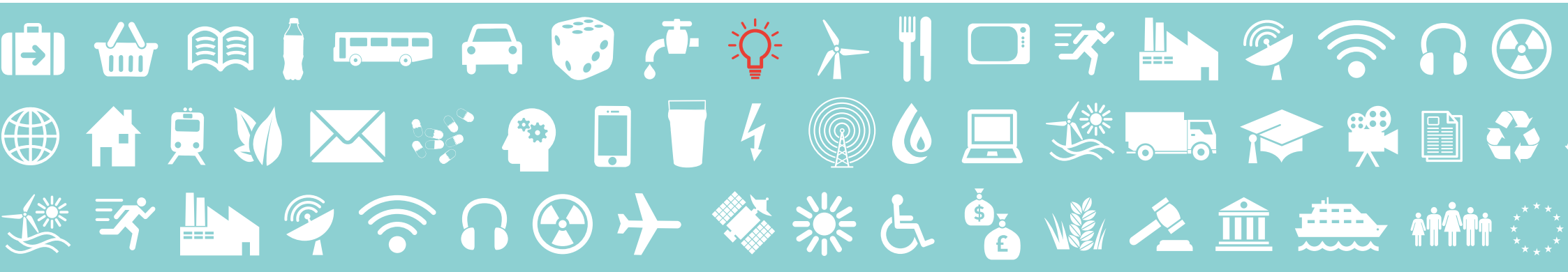
Time to pick-up pace of dynamic electricity pricing

A presentation for the 16th IAEE European Conference

28 August 2019

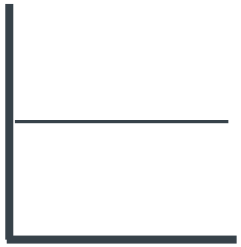


Time of use tariffs can provide cost-reflective price signals to consumers allowing them to adjust their consumption accordingly

1 Fixed (or flat) rate

Provide a fixed price over a defined period of time.

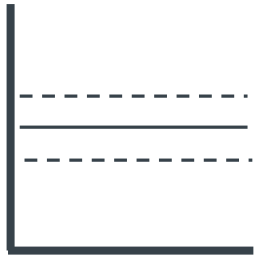
- Consumers pay the same price every hour. No signal provided to the consumer to change their consumption
- Fixed price for certain tariffs with an unlimited term ('evergreen') allowed to change (usually increase) over time



2 Variable rate or tracker tariffs

The energy component is allowed to vary by indexing to average (daily/monthly/ quarterly) market prices

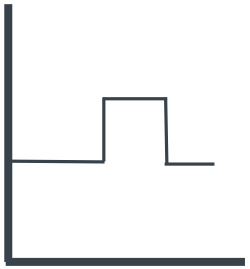
- Consumers are not exposed to hourly price variation but have greater transparency of costs they pay for.
- May provide daily, monthly, or quarterly signals depending on the averaging/indexation approach used.



3 Static time of use

Price varies according to pre-set rates for pre-defined periods of time

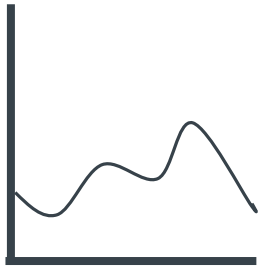
- Simplest example are two-part tariffs with different rates for peak and off-peak periods
- Consumers signalled to shift consumption away from peak period and toward off-peak periods



4 Dynamic time of use

Hourly wholesale prices are passed to consumers who are billed based on metered consumption in each hour

- Consumers are informed typically a day in advance of prices for each hour of the following day allowing them the opportunity to change their consumption in response to prices

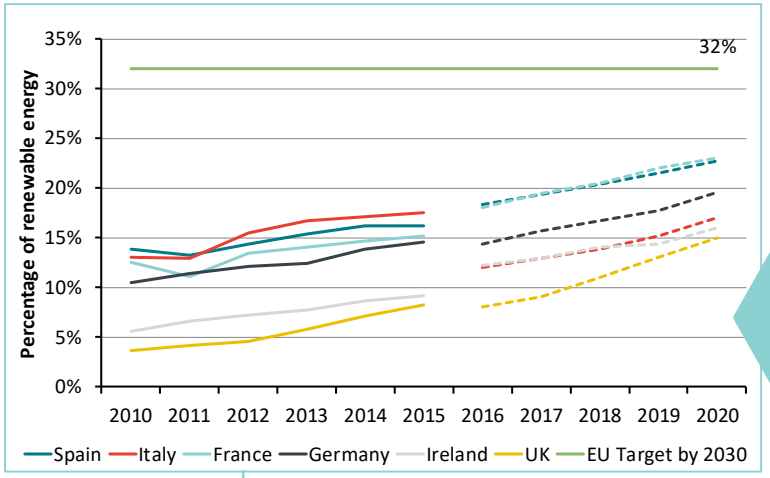


Increasing cost reflectivity and consumer ability to adjust consumption to prices

We looked at retail electricity offerings for a selection of representative European countries

	Fixed or flat rate	Variable or tracker tariffs	Static Time of Use	Dynamic Time of Use
	e.on, entega, LOGO! ENERGIE, VATTENFALL, Grünwelt ENERGIE, eprimo der energiediscounter	ViVi POWER Ihr dynamischer Energietarif	NEXT KRAFTWERKE, meinheizstrom.de, e.on, entega, LOGO! ENERGIE, MAINGAU Energie	aWATTar Energy in sync with nature., NEXT KRAFTWERKE
	octopus energy, iSupply energy, tonik, GREEN NETWORK energy, ENGIE, BRISTOL energy	e.on, ENGIE, octopus energy	British Gas, green energy, ecotricity, octopus energy, good energy, ENGIE	
	holaluz, ecovatios, IBERDROLA, edp, Aura Energia, esfera, endesa	Naturgy	holaluz, ecovatios, lucera, endesa, viesgo solar, som energia, Naturgy, IBERDROLA	i-DE Grupo IBERDROLA, BASER Comercializadora de Referencia, endesa, chc energía, pepeenergy, Naturgy, Teramelcor, lucera, Régsiti, FE
	VATTENFALL, MälarEnergi, e.on, Telinet Energi	Gudbrandsdal Energi, Fjordkraft, AKRAFT, VATTENFALL, Agva, fortum	loiste, HELEN	Gudbrandsdal Energi, e.on, LOS, TrøndelagKraft, HELEN, loiste, VATTENFALL

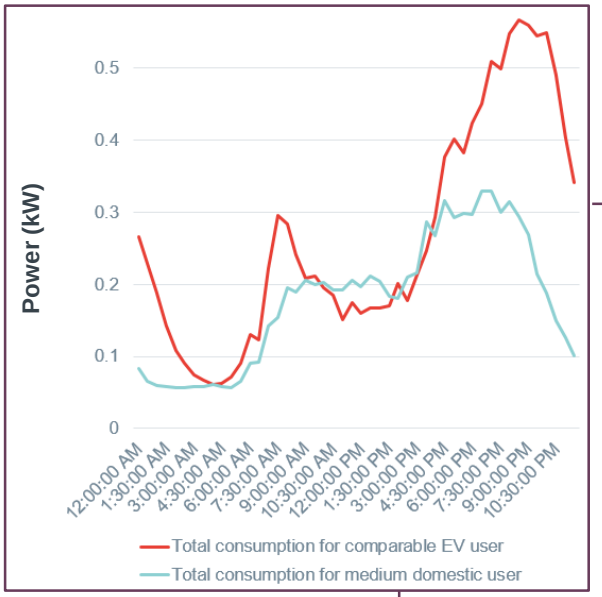
Increasing renewable generation, electrification and digitalisation are unlocking the potential for higher demand flexibility



High penetration of renewable generation

guided by higher RES-E targets

MORE INTERMITTENT GENERATION

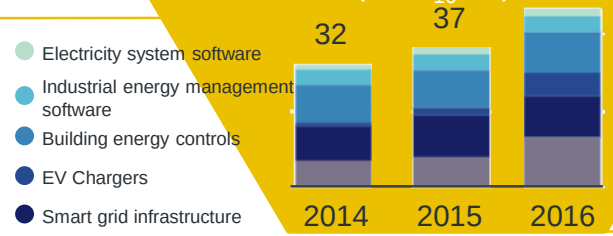


Adoption of **ELECTRIC VEHICLES AND HEATERS** sig. changes consumption level/pattern

FACILITATING RES INTEGRATION

Increasing digitalization

Global investments in digital infrastructure and software (USD_{16} bn)[(2)] 47



UNLOCKING DISTRIBUTED ENERGY

SMART METERS AND APPLICANCES

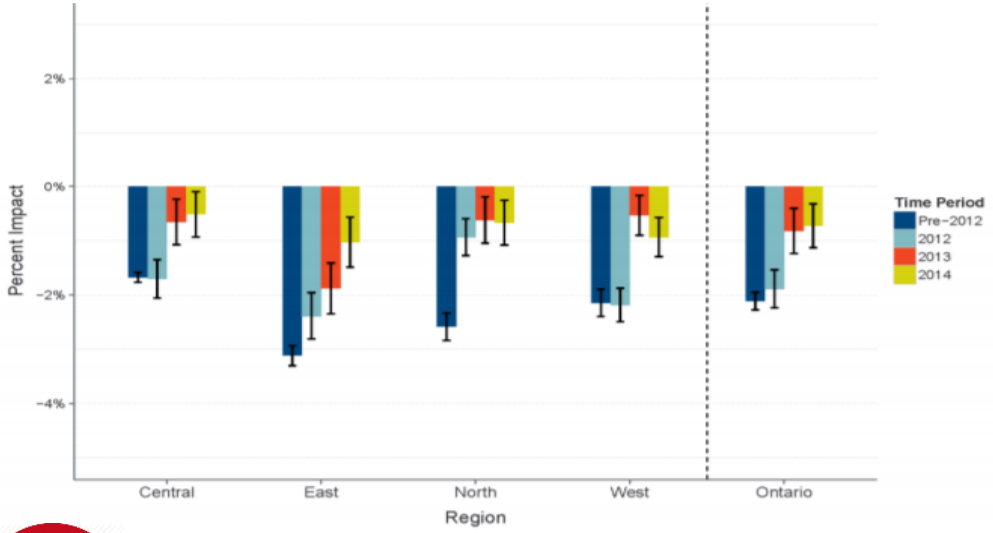
SMART CHARGING/USE of electricity intensive technologies, e.g. electric vehicles and heat pumps

Electrification of heat and transport sectors

(1) Eurostat
(2 & 3) AIE
(4) CERRE (May, 2018) Gas and the Electrification of heating and transport scenarios for 2050

Greater load flexibility can have meaningful system benefits: insights from jurisdictions with significant penetration of TOU tariffs

In Ontario, TOU implementation resulted in statistically significant reduction in summer peak demand



Savings in hedging costs

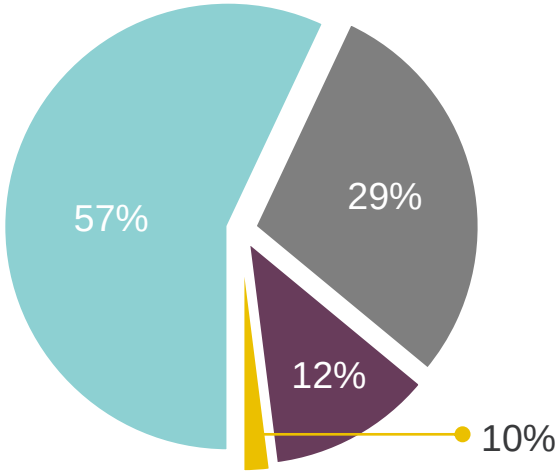
The government introduced this tariff through RD 216/2014, with the objectives of:

- Reducing energy bills by lowering the costs of providing certainty through fixed prices,
- Minimizing regulatory failures by decoupling regulated tariffs from CESUR auctions organized by the government,
- Improving the quality of electricity prices in signalling scarcity.

Peña and Rodriguez (2018) estimate a 7.22% premium on CESUR prices compared to wholesale prices.

Net national savings enabled by load flexibility could exceed $15 billion a year by 2030.

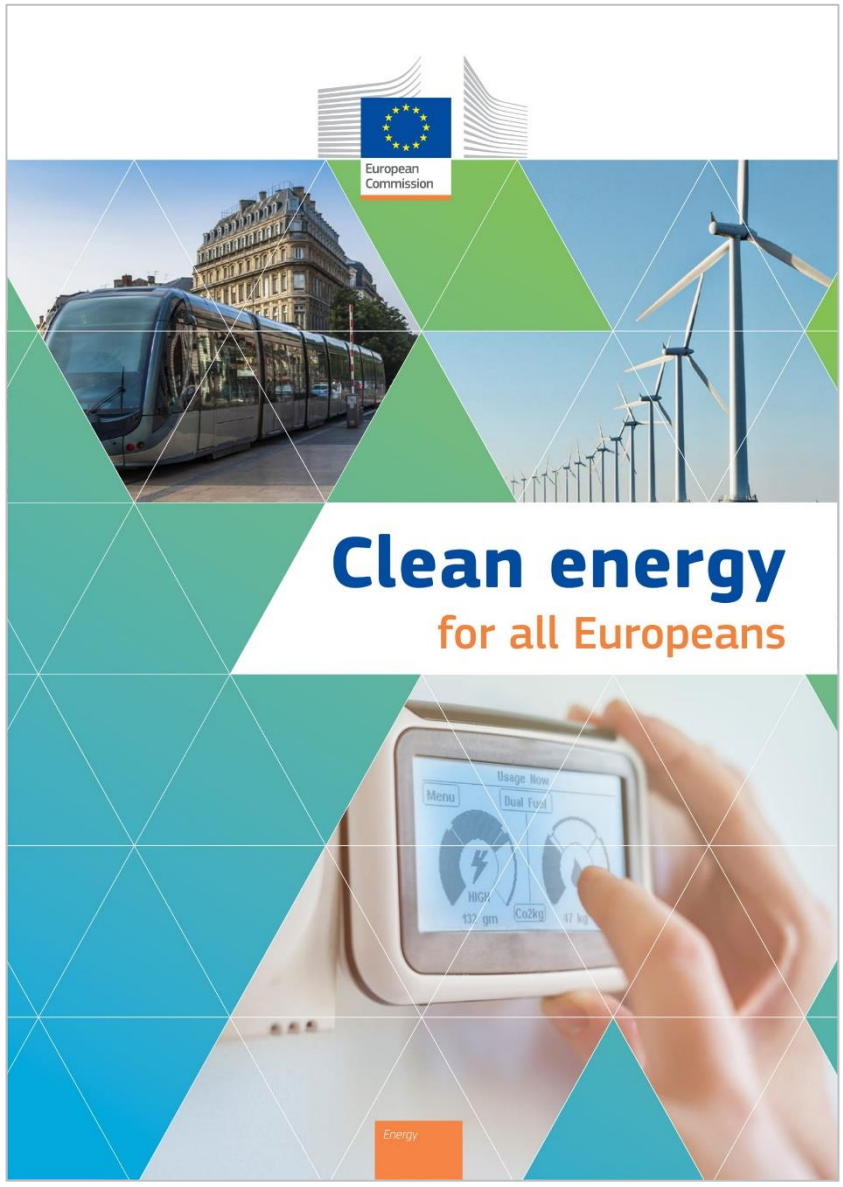
Key driver of savings is potential for reduction in peak demand through which stems a number of benefits:



- Avoided generation capacity
- Avoided energy costs
- Avoided T&D capacity
- Ancillary services

Source: Brattle (June, 2019) The National Potential for Load Flexibility
Utility report filed under California Public Utilities Commission Decision 15-07-11 and rulemaking 13-01-11
Peña, J.I.; Rodríguez, R. (2018) Default supply auctions in electricity markets: Challenges and proposals. Energy Policy 122. 142-151.

European Commissions latest package recommends making dynamic electricity pricing available to all Europeans



Article 11 of Directive (EU) 2019/944

Availability

Member States shall ensure that regulatory framework enables suppliers to offer dynamic electricity price contracts and final customers who have a smart meter installed can request to have a dynamic electricity price contract with at least one supplier and with every supplier that has more than 200,000 final customers.

Information

Suppliers should fully inform customers of the opportunities, costs and risks that dynamic electricity price contracts entail.

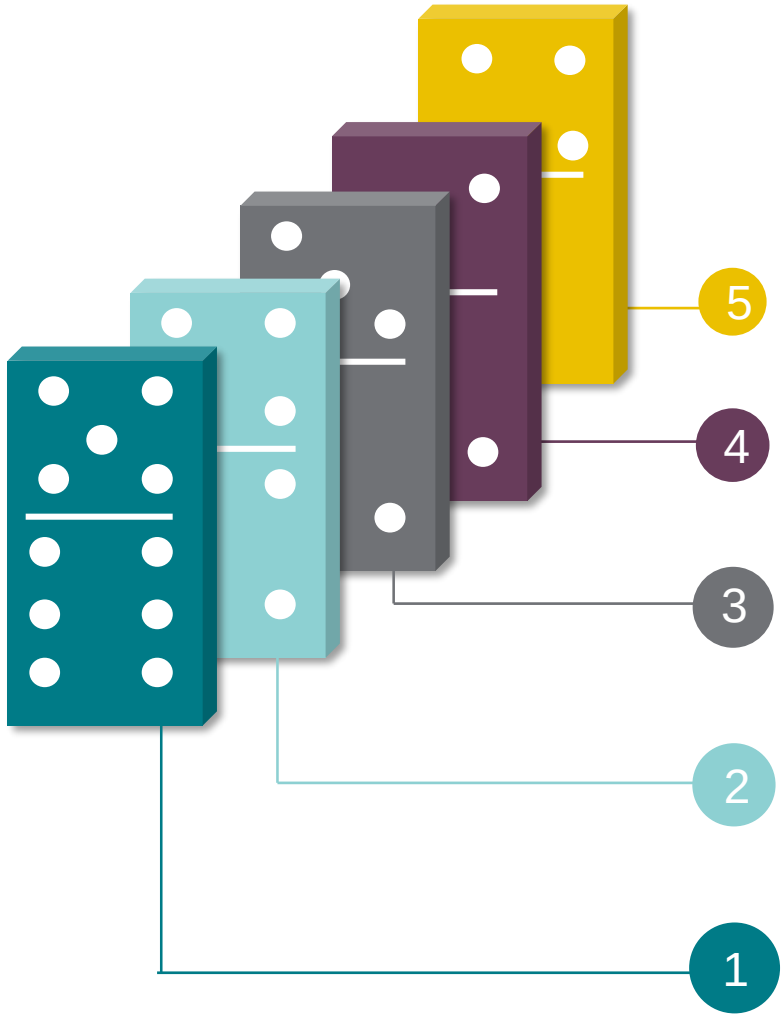
Consent

Suppliers shall obtain each final customer’s consent before that customer is switched to a dynamic price contract.

Monitoring

For at least a ten-year period regulatory authorities shall monitor, and publish an annual report describing market offers, impact on consumers' bills, and level of price volatility.

There are several barriers to wider adoption of dynamic electricity pricing, particularly for households



5 Delay in smart-meter rollout

4 Consumer exposure to wholesale price volatility

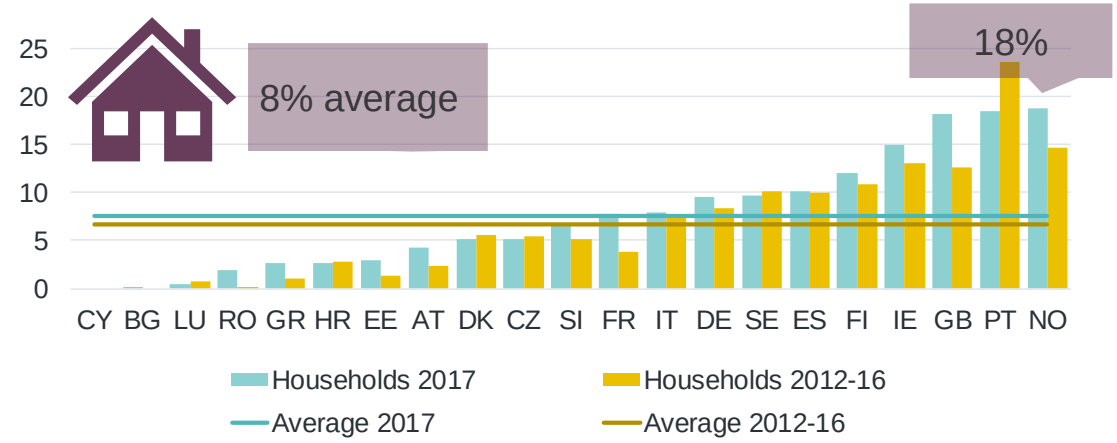
3 Limited saving potential

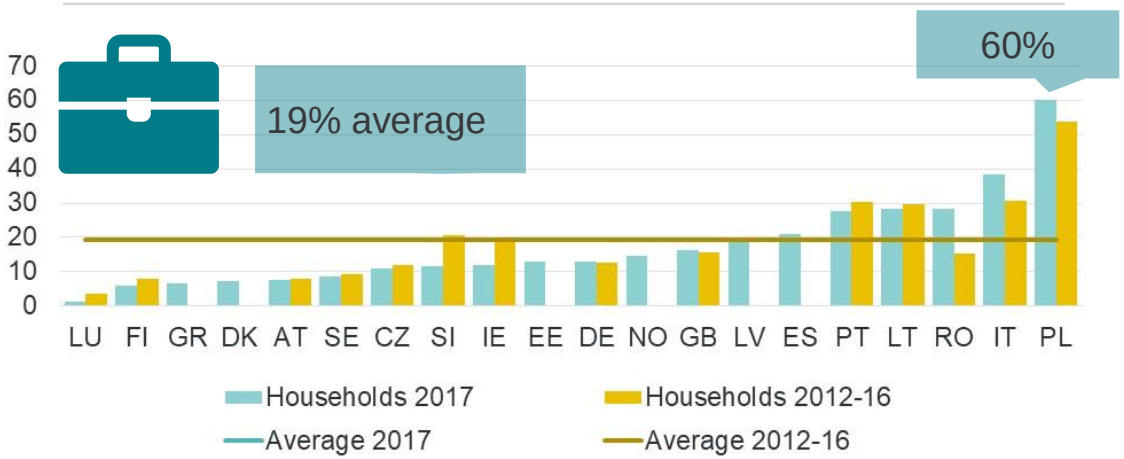
2 Reluctance/difficulty associated with responding to price signals

1 Lack of consumer engagement

Barrier 1: General lack of consumer engagement in the sector …

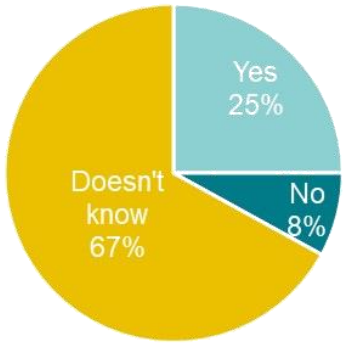
Switching rates in Europe (%)



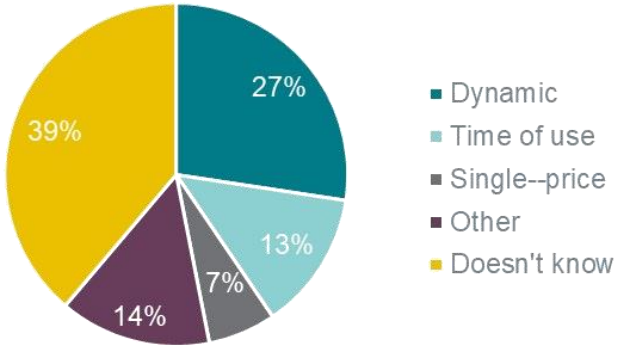


Beyond switching rates

Is your electricity contract regulated?



What type of tariff have you contracted?



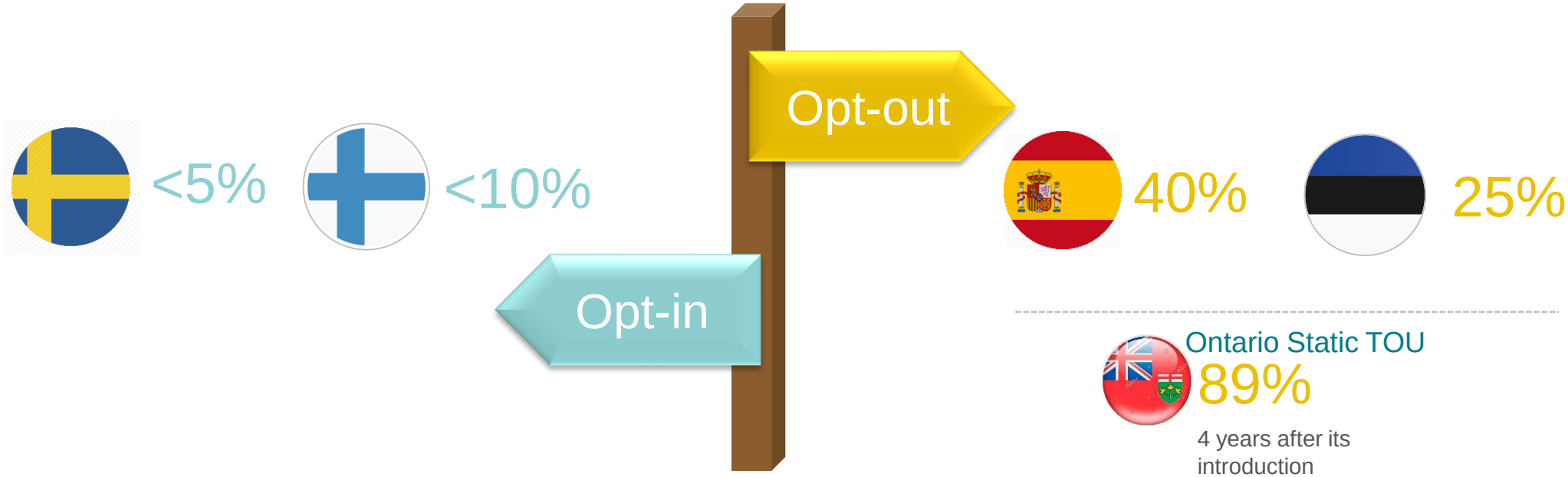
… unwillingness to switch to/respond to TOU tariffs.

Source: CEER (Dec 2018). Performance of European Retail Markets in 2017. CEER Monitoring Report
CNMC (2018) based on the Household Survey (2nd Quarter 2018)

Workaround 1: Dynamic pricing as the default option that users opt out from instead of opt in to (current preference in EU Directive)

Opt-out schemes can ensure high customer enrolment in the tariff scheme …

> Generally, a successful opt-in offering might attract 20% of customers, whereas 80% or more of customers may remain enrolled in a TOU tariff when deployed on an opt-out basis.



… but can be associated with lower effectiveness as customers are more likely to respond to TOU price signal if they choose to be on it

Source: Spain – CNMC and Estonia – Irena
Sweden –Smart – Energy and Finland - Irena
Ontario - Brattle and UCL (2017) Value of TOU Tariffs in GB: Insights for decision makers

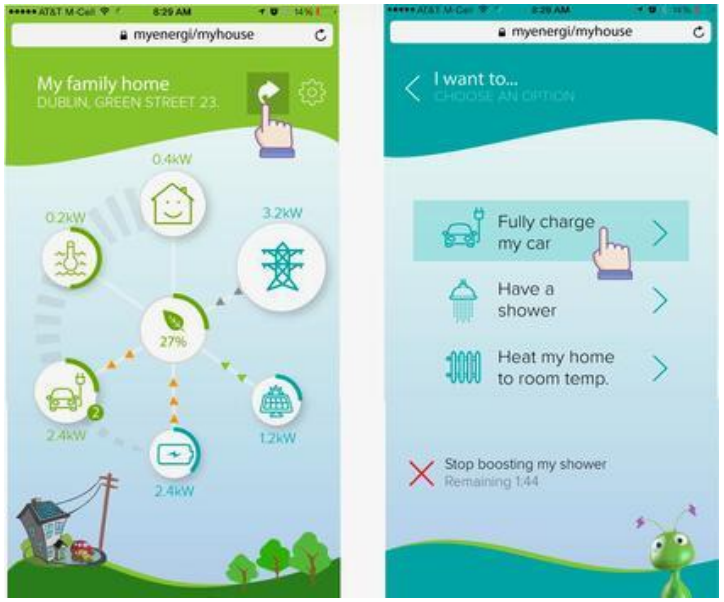
Barrier 2: Expectation that consumers would change consumption in response to hourly price differences may be unrealistic

Workaround 2: Automated appliances and advanced consumer technology to respond to price signals on behalf of consumers…

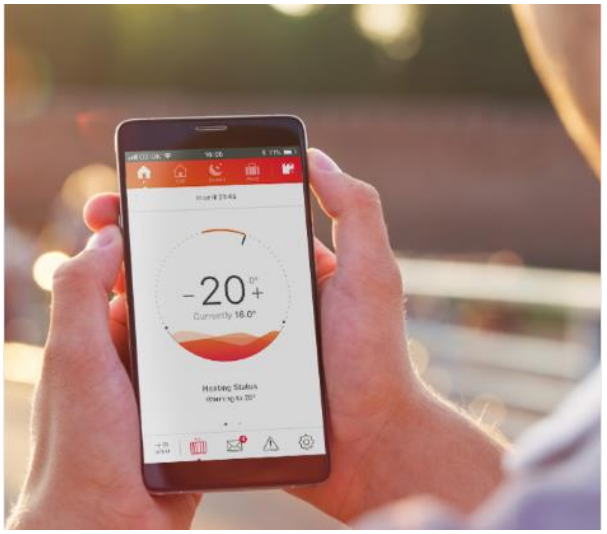
IFTTT

Home connect

… allows users to automatically turn smart devices on or off when the price of energy changes or when the price of energy is expected to fall below a certain level for a certain period of time.



"Alexa, turn on my tumble dryer when it's cheapest/ greenest/ right now"!



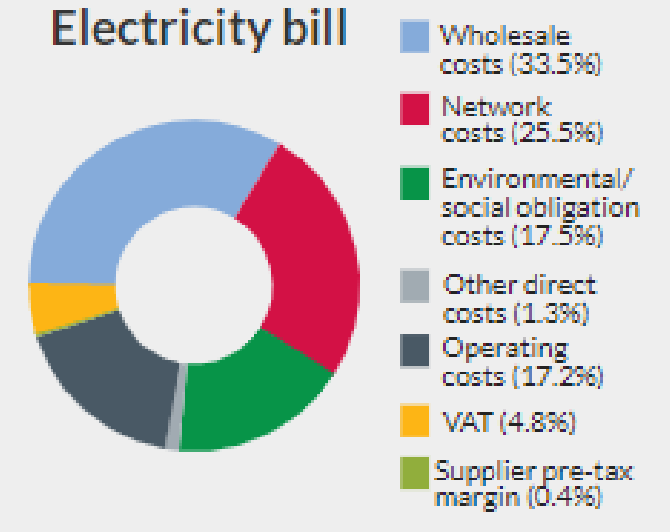
… but costs will need to decrease significantly before these are widely deployed.

Barrier 3: Limited saving potential of switching to dynamic electricity pricing contract

The Spanish experience provides evidence of limited savings for households responding to PVPC.

High % of non-energy costs

Wholesale or energy costs constitute only 33.5% of the electricity bill of an average domestic user in GB. The rest of the costs are direct pass-through to consumers



% wholesale energy costs

19%	
29%	
40%	
45%	

The energy bill amounts to **4%** of the annual revenues of the average UK household

Limited saving potential of changing consumption in response to price signals

Voluntary prices for household consumers (PVPC)

- Since 2014.
- Consumers up to 10 kW capacity and not under a free market contract.
- Default offering for *regulated* operators.
- Reduce bills and improving scarcity signals.
- 99% smart meters as of December 2018.

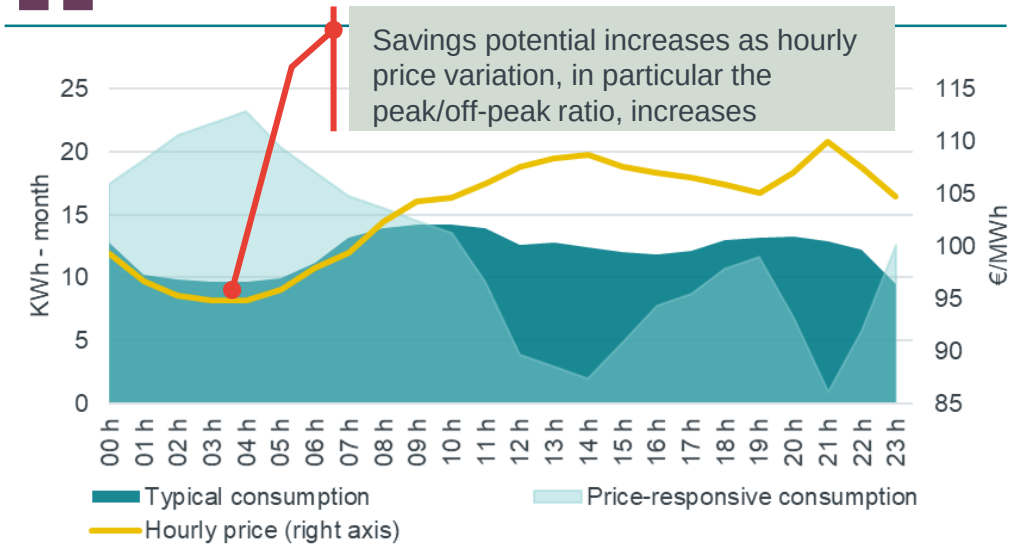
Saving potential: 31 - 70 €/year

Yearly savings that **CNMC** estimates a consumer could have made under a **PVPC** regime compared to the next best offer in the market.

Source: CEER (July, 2019) Implementing Technology that Benefits Consumers in the Clean Energy for All Europeans Package. Ofgem website. Retail statistics.

Workaround 3: Higher savings potential with higher price variation and as consumption increases with adoption of LCT, e.g. EVs …

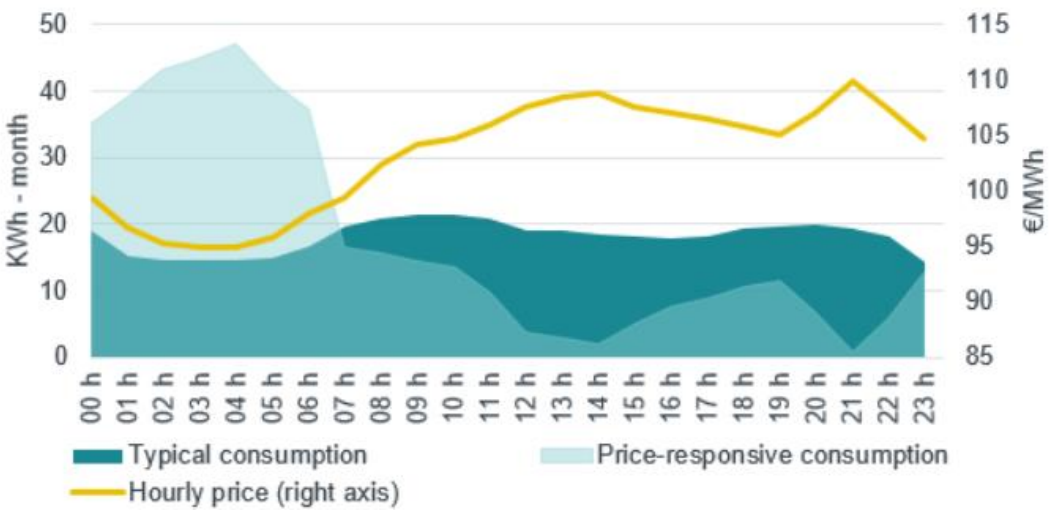
Stylised response of a typical household to PVPC



10 €/year

If hourly consumption is in inverse proportion to hourly prices. Savings will be higher the greater the consumption shift to off-peak periods.

Stylised response of a typical household with an EV to PVPC



22 €/year

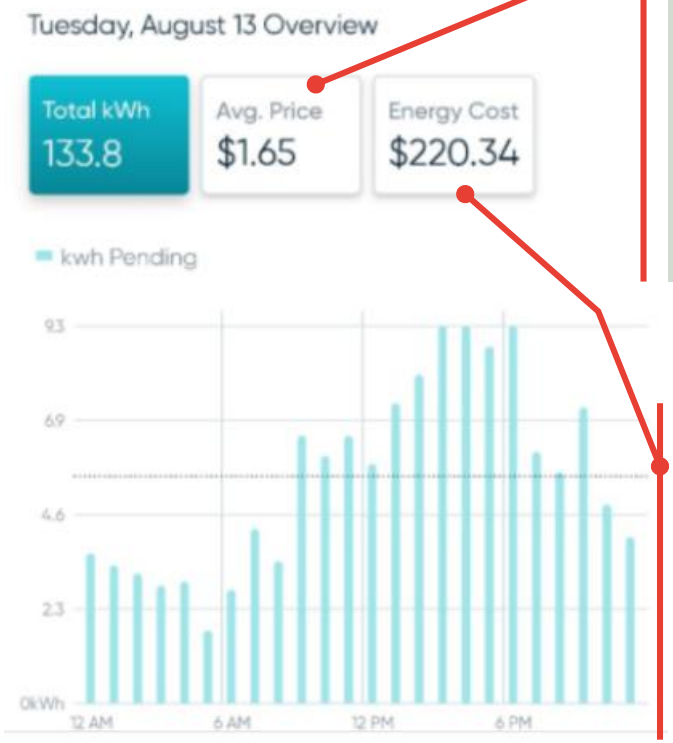
If EV is charged in the hours falling in the lowest quartile of hourly prices for the day and all other consumption is in inverse proportion to hourly prices as before

… and if other portions of the bill can be subject to TOU variation

- TOU variation of network charges provided in some retail offerings in Spain. Network charges typically comprises of two-parts: 1) a variable (€/KWh) part with TOU variation; and 2) quasi-fixed (€/KW/month) part.
- Static TOU charging is used in relation to distribution network charging for half hourly customers in Great Britain. Red/Amber/Green unit rates are intended to discourage/encourage use of the network at particular times.

Barrier 4: Concerns regarding bill stability and consumer vulnerability …

Recent experience in Texas



Average price of $1.65/kWh for the day compares with the $0.11/kWh fixed rate the consumer was previously on

Daily electricity cost twice the average monthly electricity bill in Houston, Texas!

- Few weeks ago, soaring temperatures in in Houston, Texas sent wholesale power prices soaring causing several fold increase in wholesale prices faced by household consumers on dynamic pricing contracts

High efficiency but low bill stability

Policy	Economic efficiency	Equity	Bill stability
Flat rate	✗✗	✗✗	✓✓
Peak time rebates	✓	✗	✓✓
Critical peak pricing	✓	–	–
Static time of use	✓	✓	–
Real time pricing	✓✓	✓✓	✗✗

… can be addressed through smarter regulation and/or tariff design.

Source: Dutta, Krishnendranath (2016) A literature review on dynamic pricing of electricity

Workaround 4: A “cap” on unit rate or ex post rebates offered to certain “vulnerable” consumers …

Min(2.20 x W + P, 33.33)

In this equation,

- 2.20 is a coefficient that provides for network charges, which vary based on where you are in Britain;
- W is the wholesale cost of electricity for a period in pence per kilowatt-hour (p/kWh);
- P is the peak-time premium, and has a value of 12.00 between 4pm and 7pm but is zero otherwise;
- 33.33 is chosen to ensure the price is capped at 35p/kWh once VAT is added.

Introducing “Bill Protection” in California

A customer who has paid more on TOU tariff vs what she would have paid on the tiered rate is entitled to receive the difference as a bill credit at the end of the year.

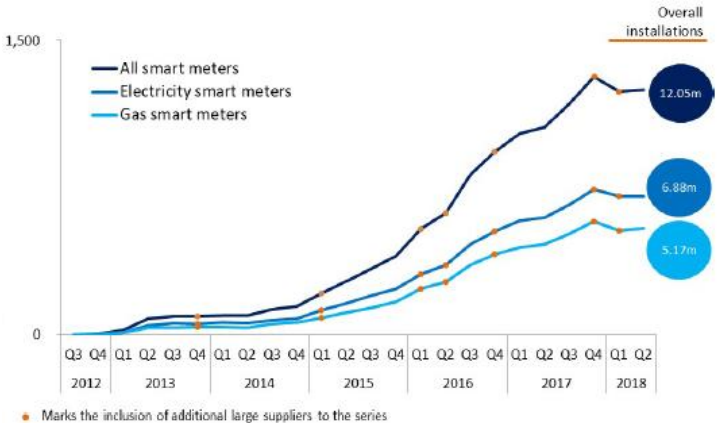
… can ensure that consumers are protected from surges in wholesale prices.

Source: CPUC (2019) Timing Energy Use to Save Money & Help the Planet; Octopus Energy website. About Agile Octopus.

Barrier 5: Roll-out of smart meters has been delayed in several countries

Slow rollout of smart meters

- Smart meters and implementation of half hourly settlement are prerequisites for realizing value of dynamic TOU tariffs
- The UK government is targeting roll-out of smart meters to all domestic and small business customers by 2020
- Only 13.6 million (27%) smart meters installed as of Aug 2018

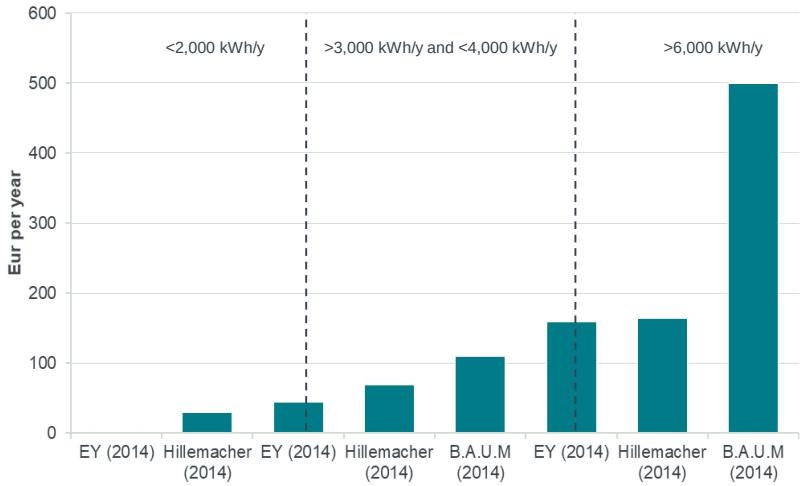


While smart meter installation has accelerated in recent years, it appears unlikely that the 2020 target will be met

Roll-out of smart meters yet to commence

- Pilot studies conducted show investments costs of smart meters out-weigh benefits of dynamic electricity pricing at lower levels of consumption
- The rent of a smart meter costs between 60 and 105 EUR/y (Hillemacher 2014). The German consumer organisation ”Stiftung Warentest” estimates the costs at approx. 100 EUR/y.
- It is therefore not clear whether investments in the necessary technology are economical (B.A.U.M 2014) - an average four-person household could only achieve cost advantages under the most favourable assumptions.

Cost saving potential of TOU tariffs by total consumption



Smart meter roll-out for households at Dec18

starting

~30%

~100%

~100%

~100%

~100%

Source: Forschungsradar (2018): Die Digitalisierung der Energiewende, p.19

Workaround 5: Regulatory policies may help facilitate faster rollout

Breaking-down consumers' inertia….

Opt-in vs opt-out

- Mandating smart meter adoption rather than offering it on voluntary basis

Carrot and stick approach

Allowing and even encouraging suppliers to:

- Bundle smart-meters/appliances and time-of-use tariffs particularly as consumers take up LCTs Or decide to self-generate.
- Charge customers without smart meters more (a higher tariff or a penalty payment like in California).

… whilst managing distributional impacts

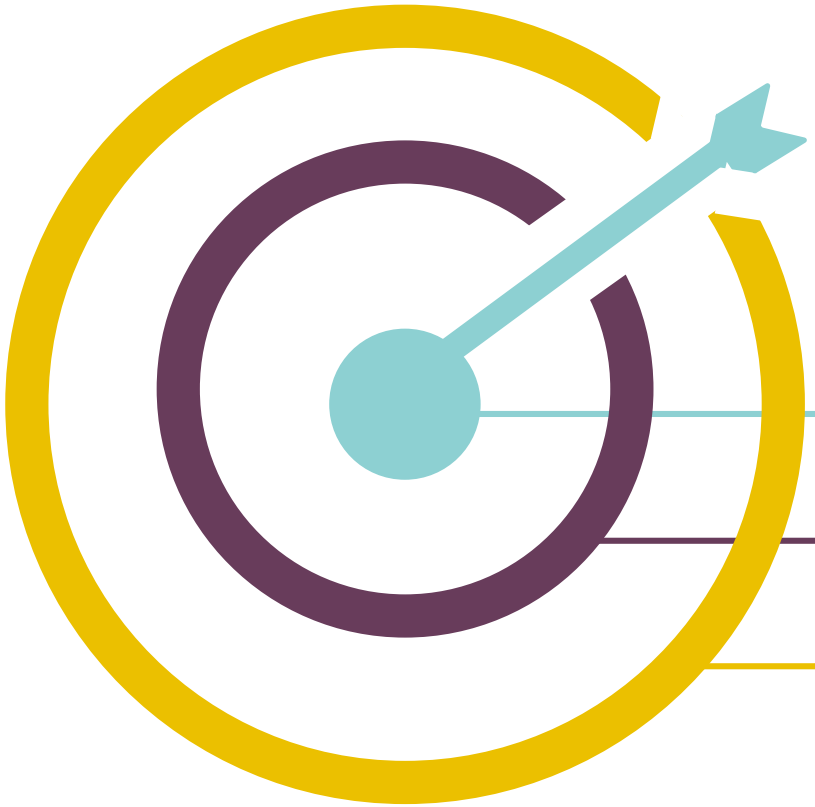
Information

- Providing customers clear and simple information allow them to make the most of their smart meter.

Avoiding cross-subsidization

- Or transfers from customers willing to accept a meter to those who are less willing.
- Consumers may refuse a smart meter early in the roll out if they expect to be paid to take one later on.

Time to pick-up the pace of dynamic electricity pricing



Potential to support the ongoing energy transition

Smarter tariff design / policies can address a number of barriers

Technology is an enabler.

Questions?

Thank you!

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