

CONSUMERS' HETEROGENEOUS CHARGING PREFERENCES: A CHALLENGE OR AN OPPORTUNITY?

Visions of grid-connected vehicles: what is the goal and how do we get there?

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Nicolò Daina

Imperial College London

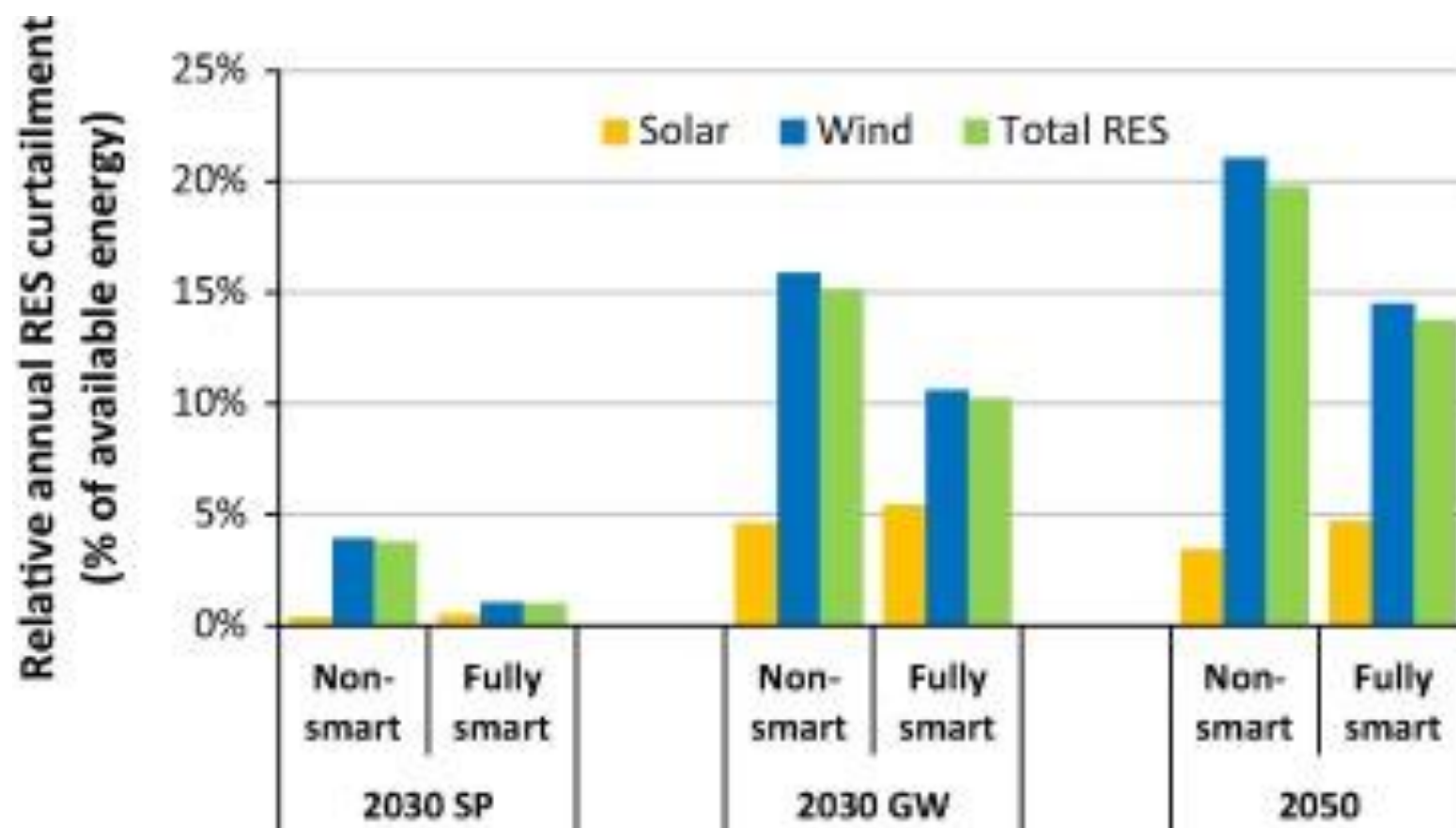
n.daina@imperial.ac.uk



A bit of history on VGI...

- 1997 - Kempton & Letendre conclude: “Electric-drive vehicles have the potential to make major contributions to the electric supply system, as storage or generation resources, or both.”
- 2007 – Tomic & Kempton show: “EDVs can provide regulation of higher quality than currently available ”
- 2017 – What more insights will Prof Kempton share today?
- 20 years of research tell us that VGI benefits include:
 - Cost effective integration of renewable energy into the grid
 - Associated societal impacts: e.g. improvements in air quality and climate sustainability

For example...



Teng F, Aunedi M, Strbac G, 2016, Benefits of flexibility from smart electrified transportation and heating in the future UK electricity system, APPLIED ENERGY, Vol: 167, Pages: 420-431, ISSN: 0306-2619

VGI potential relies on consumers' response

- Understating, acceptance and adoption
- **Charging preferences**
 - For available EV range
 - For effective charging duration



Preferences matter

- Some preferences and associated behaviour may prevent flexible charging and V2G, in absence of incentives...

Right now, somewhere...

Ok... but the car
hasn't charged yet...
I'll be done as fast
as I can... Just
making sure we're
ready to go in case a
tornado strikes
tonight

Honey,
dinner's
ready!!

...Mr Valium ensures his vehicle is charging fast... just in case!

Preferences matter

- Some preferences and associated behaviours may prevent flexible charging and V2G, in absence of incentives...
- Others may be totally compatible, without incentives...

... meanwhile, elsewhere...



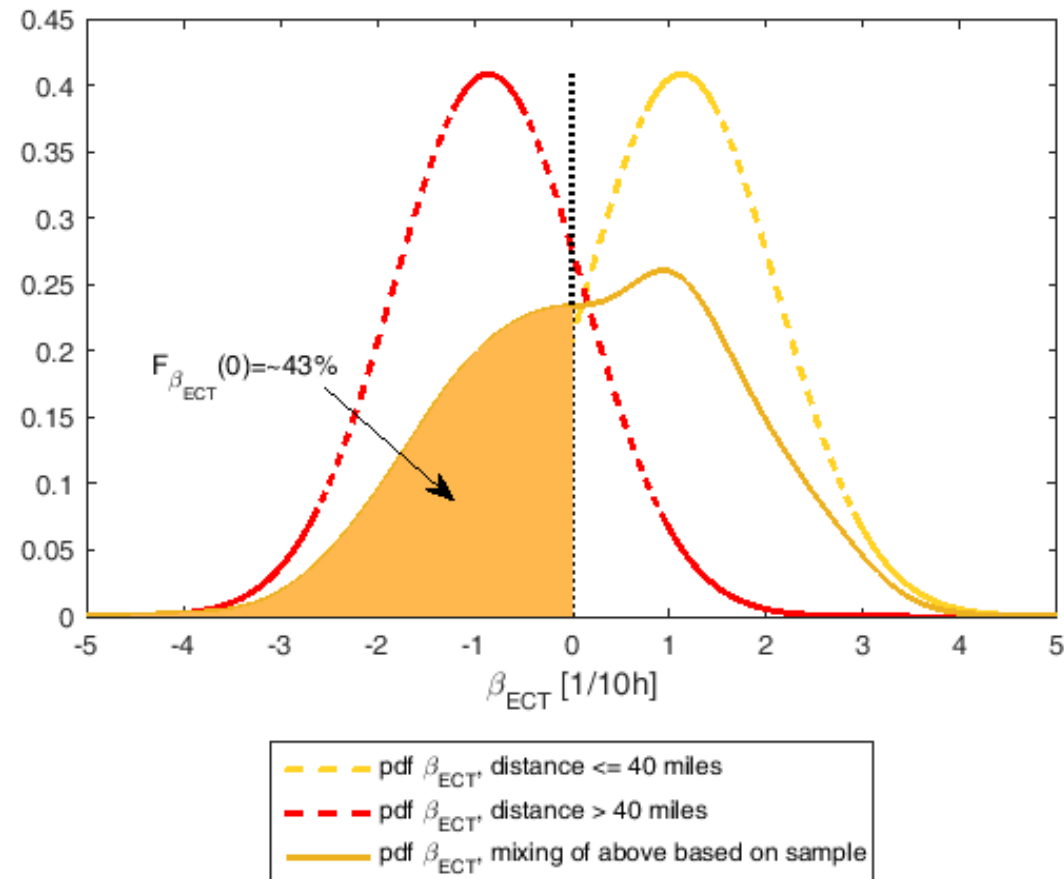
...Mr Coolio has just downloaded the latest app from his smart charging plan...

Preferences matter

- Some preferences and associated behaviours may prevent flexible charging and V2G
- Others may be totally compatible, without incentives...
- In fact preferences and behaviour are heterogeneous amongst drivers


Example

- Distribution of marginal utility for effective charging duration



Exploiting heterogeneity

- Individuals are not all “dumb chargers” by default
- Nor all fully flexible smart charging enthusiasts
- Harnessing user flexibility does not require only fully flexible drivers
- Flexibility can be extracted from heterogeneous populations via:
 - Targeted policies – e.g. price discrimination
 - Preference-based revenue management approaches for charging service providers
 - Recommender systems for EV drivers, based on preference learning



Consumers' heterogeneity
=
opportunity for VGI