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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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...

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…
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!!

Right now, somewhere...

...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…
Dear, look on this app! We’re charging using only wind power! Isn’t it cool?

Hey mom, hey dad? Can we go now? I am late for school!

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

... meanwhile, elsewhere...
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 divers, based on preference learning
Consumers’ heterogeneity = opportunity for VGI