

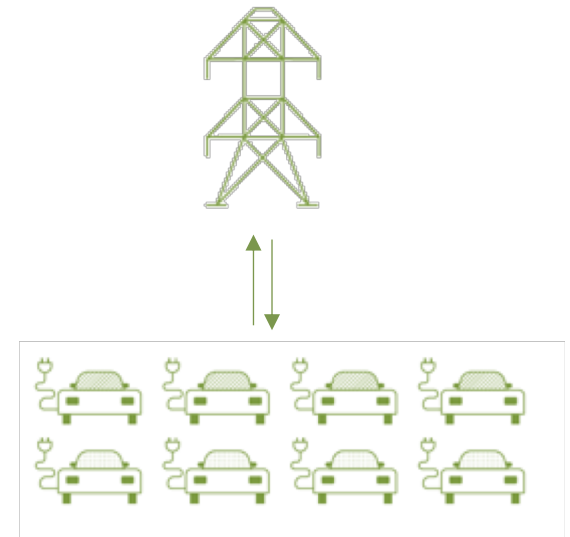


Vehicle to Grid: from
research projects to
commercial offers



Dreev: an EV aggregator

- Dreev **reduces the TCO** of electric vehicles by monetizing their flexibility on the **energy markets**
- Dreev manages the charging / discharging patterns of EVs thanks to Nuvve's patented **Nuvve GIVe™ platform**
- Dreev makes sure that EV drivers **mobility needs** are always met
- The underlying concept, developed by Nuvve, is called **Vehicle-to-Grid** or **V2G**
- This concept also enables a larger **integration of renewables**



Why should we integrate EVs and renewables?

The Problem

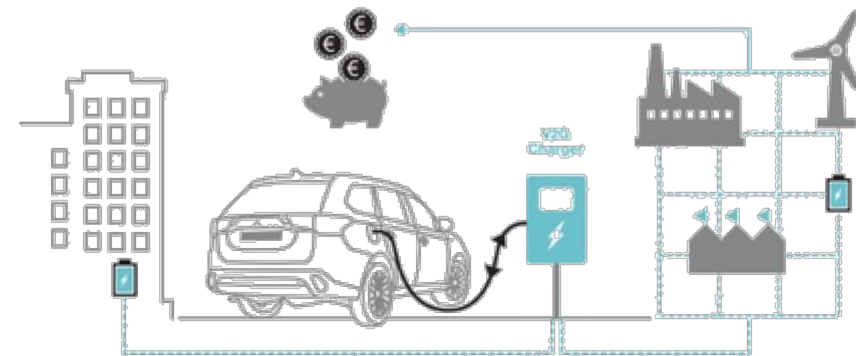
Air pollution and green house gas emissions are mainly driven by the energy and the transport sectors

Today some solutions are proposed to address transport and energy emissions separately, **but there is a lack of common approach to jointly integrate renewables and electric vehicles**

Our Solution

We bridge the gap

We provide solutions to integrate transport and energy by adding up flexibility means for renewables, grid services and EV charge optimization



From lab research to commercial deployments



A first fleet of 10 EVs officially participates in grid services and helps integrating renewables

Nuvve gets financial support from Toyota Tsusho and EDF RE



Nuvve and EDF launch a joint-venture to address the EU market

1996

2012

2015

2017

2018

2019

Professor W. Kempton (Nuvve CTO) develops the concept of V2G and proves its feasibility

Nuvve manages the charging process of 19,000 charging stations in the NL

Nuvve operates projects on the 5 continents



Une joint-venture EDF - Nuvve



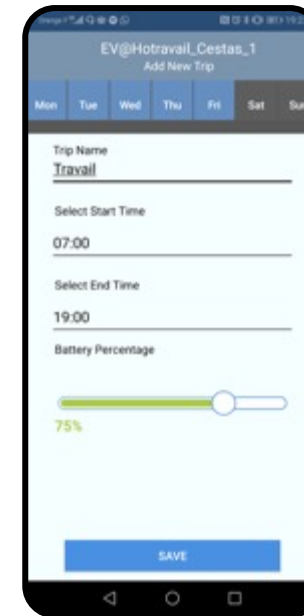
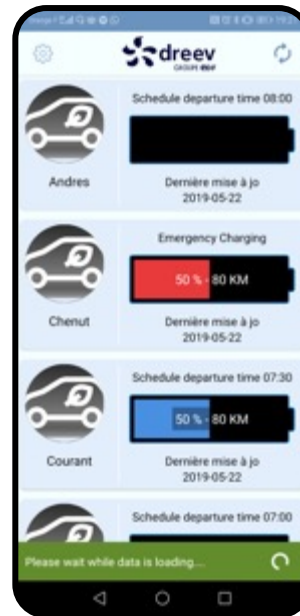
- October 2018: EDF reveals its **e-mobility plan**
- One of the three pillars: becoming the **smart charging European leader**
 - 4,000 smart charging points installed and operated in Europe by 2020
 - Strategic partnerships with innovative actors such as Nuvve
- The JV focuses on the **commercialization of V1G and V2G services**
 - Technology agnostic (hardware, communication means, etc)
 - Relying on Nuvve GIVE™ tested and proven platform
 - Benefiting from a unique relationship with EDF networks

User experience

Drive, plug, we take care of the rest!

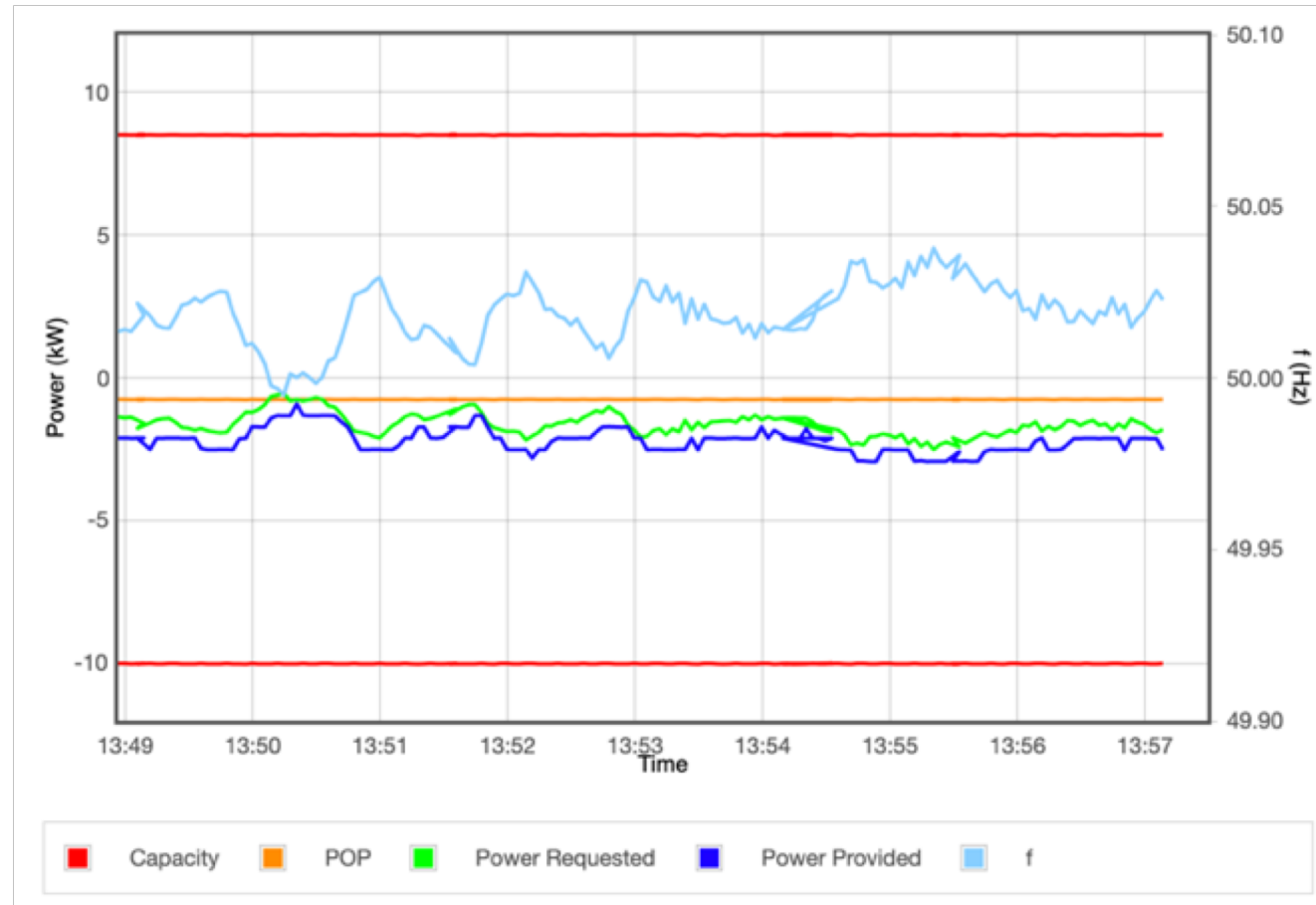


1. Plug your car when parked
2. Schedule your next trips
3. The car is charged according to your preferences
4. Enjoy V2G reward, reducing TCO!



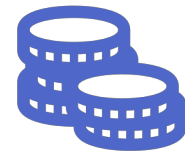
Current business model relies on TSO services

- Providing among others frequency regulation services



Local flexibility needs: a growth driver

- Several grid issues happen at the local scale
 - Consumption peak increase
 - Grid constraint
 - Integration of DERs
 - → need for local flexibilities
- Local flexibility needs could represent a growth driver for flexibility providers
 - For instance they could represent hundreds of MW in UK by 2023
- If the right regulatory frameworks are implemented, local flexibility needs could represent new revenues for flex providers
 - For instance in France, **flexibility value estimated between 20 and 60M€/year**
- → **Local flexibility markets could help solving local issues while ensuring new revenue drivers for aggregators, which will be able to stack the different services**



Mechanisms to procure flexibility

- Market platforms are not the only one!

Framework	Value for flex operator	Example
Rules-based	No value	<i>Reactive Power Compensation by DER/EVs</i>
Network tariffs	Indirect	<i>Time-of-Use/CPP D-LMP</i>
Smart Connection Arrangements		<i>Variable Capacity Connection Interruptible Connections</i>
Market based	Direct	<i>Local flexibility platforms Local Energy Markets (P2P)</i>

Based on CEER, 2018

*32nd Electric Vehicle Symposium (EVS32)
Lyon, France, May 19 - 22, 2019*

**The road toward electric vehicles as flexibility providers
for distribution systems. A techno-economic review.**

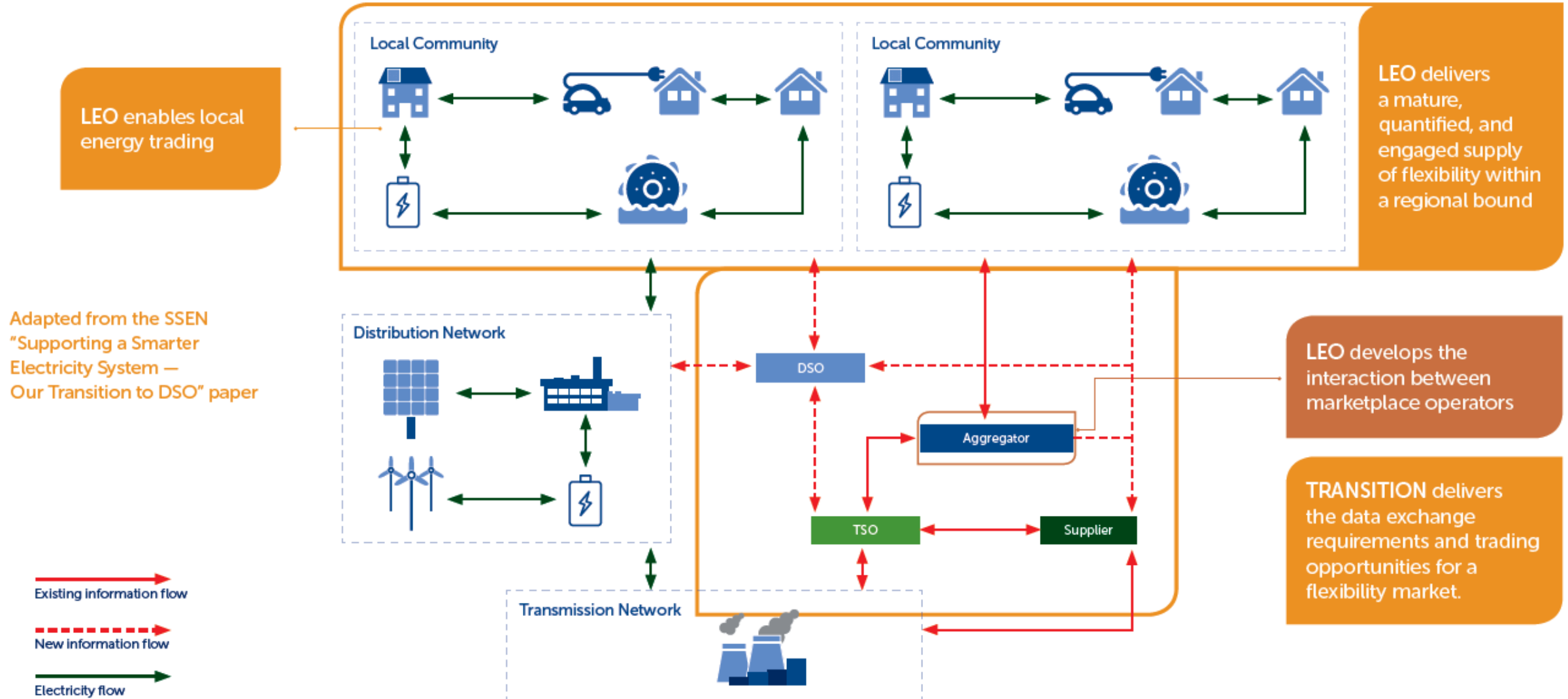
Felipe Gonzalez Venegas^{1,2}, Marc Petit², Yannick Perez^{3,4}

- Dreev can provide flexibility through different mechanisms
 - Including behind-the-meter

Which design for local flexibility platforms?

- Aggregators / flexibility operators should be able to easily participate
 - Low barriers to entry!
- Local markets = reduced size. How to ensure liquidity?
 - Start by “large” areas! (ex. MV grid)
- Local flexibility would be an additional source of revenue
 - Need to be compatible with other flexibility provision (balancing, demand side response)
- Short-term (Day Ahead/ID) vs. long-term (tenders) procurement
 - Mid/Long-term tenders provide a foreseeable revenue for aggregators, but creates constraints on availability (hard for EV aggregators!)
 - Mid/Long-term vision needed for DSO investment planning
 - Short-term platforms reduce uncertainty on flexibility availability (for EV aggregator)
 - Short-term can be useful for renewable congestion management - synergies with EVs!

A concrete example in UK: the LEO project



Conclusion

- Commercial V2G offers already available today, based on system wide services
- Local flexibility services could represent a growth opportunity for flexibility operators
- Several mechanisms to procure flexibility
 - ➔ need for joint approach between theoretical analysis and implementation projects
 - Regulation “sandboxes” could help starting up first projects
- Procurement rules for flexibility platforms:
 - tradeoff between flexibility optimal operational conditions and market / SO needs
 - Test and learn approach!
 - ➔ aVEnir project
 - ➔ NIA project

Thank you

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