





Velocity profiles for impact of the traffic on energy consumption of EVs

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#### Outline



#### Objective



#### **Simulation of Nissan Leaf**



#### **Generation of driving cycles**



#### Conclusion



# 1. objective



#### Context

**SARA** project: acceptability to switch from thermal to eclectic vehicles (driver perception and energy consumption)

**DILAN** project: Driver-In-the-Loop for better analyze of energy consumption





Driving tests cannot separate the different effects: Simulation as a flexible tool

## **Objective of the project**

Coupling 2 softwares to analyze the impact of traffic on the energy consumption of EVs





# 2. Simulation of Nissan Leaf

(Matlab/Simulink ©)



#### **Studied vehicle parameters**





Structural diagram of Nissan Leaf

Autonomy (WLTP): 270 km

maximal velocity: 144 km/h

Weight (empty): 1505 kg

Battery: 40 kWh

Nominal voltage of the battery: 350.4 V

Power of the electric machine: 85kW

## **CUMIN-SARA**







#### **Technical aspects**

- Same trip for more than 120 drivers
- Variation in terms of energy consumption of **21%**
- Impact of traffic ?
- Impact of driver ?



DILAN (Driver-In-the-Loop) and/or simulation of the traffic

### **Model organization**

using the EMR (Energetic Macroscopic Representation) formalism



### **Simulation and validation**







# 3. Generation of driving cycles

(RoadRunner ©)



#### **Road Runner: Example**

Argonne 스



Route-based multi-vehicle simulation tool that focuses on vehicle energy consumption and performance estimation.

·\* =

SPEER LIMIT

510

510

1275 1280 1320

5.55

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0.05

8.33

13.88



A trip of 3km



### Same route with a different traffic

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A 24% difference in energy consumption between a single vehicle on the road and a vehicle in traffic.



Energy consumption (kWh)



# **4.Conclusion**



#### **Conclusion and perspectives**

#### Conclusion

- Matlab/Simulink © model of Nissan leaf for energy consumption
- Model validation by a real driving cycle
- First analysis of Road Runner ©

#### Perspectives

- Generation of velocity profile using Road Runner ©
- Coupling both software packages
- Study the impact of the traffic on energy consumption









Our university as an exciting living lab towards eco-cities through an innovative transdisciplinary framework !



#### **Annex: Road Runner workflow**



Route-based multi-vehicle simulation tool that focuses on vehicle energy consumption and performance estimation.

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