



First ELECON Workshop Towards Efficient European and Brazilian Electricity Markets

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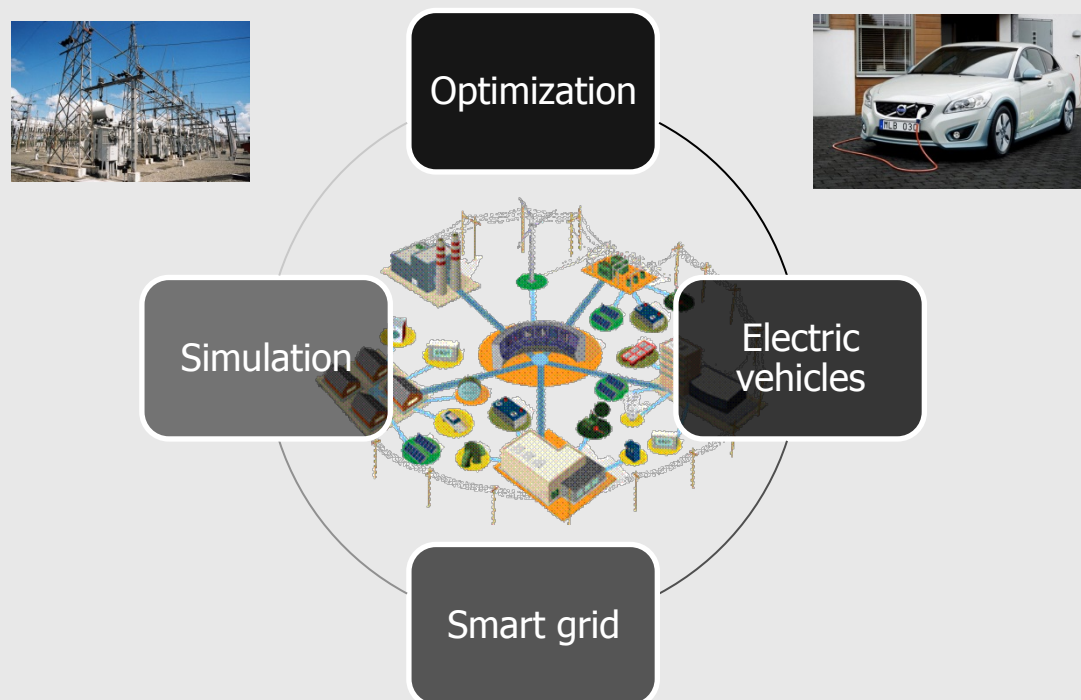
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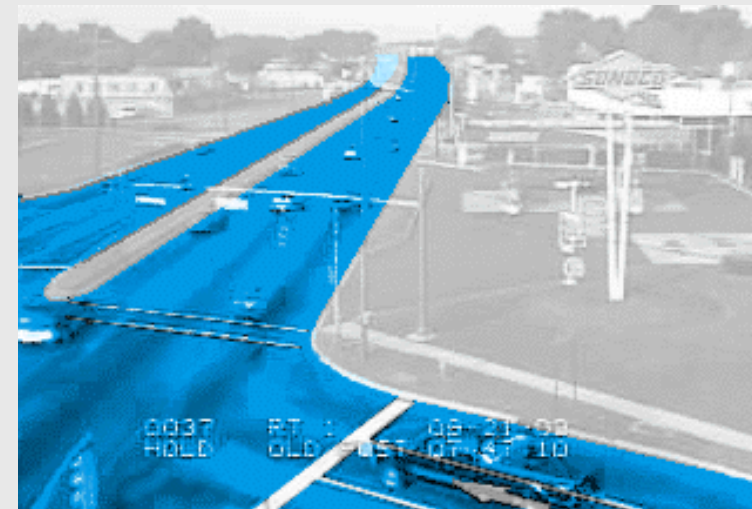




Simulating Electric Vehicles Travels in Distribution Networks







- **Why simulate vehicle travels in power systems field?**
 - Integration of energy and transportation systems (electric vehicles)
 - Develop case studies that include electric vehicles (planning, simulation, optimization)
 - Jointly research with multi-disciplinary fields (traffic engineering, power system simulation, optimization, etc.)



- **When did it started?**
 - 2011
 - Goal: **support the development of realistic case studies for ERM problems that include scenarios with EVs eliminating the need to manually create each individual vehicle profile** (cumbersome process (and erratic) when creating individual profiles manually!)
 - Electric Vehicle Scenario Simulator (EVeSSi)
 - MATLAB, command-line, validation with MILP optimization
 - Fast execution but not easy to use

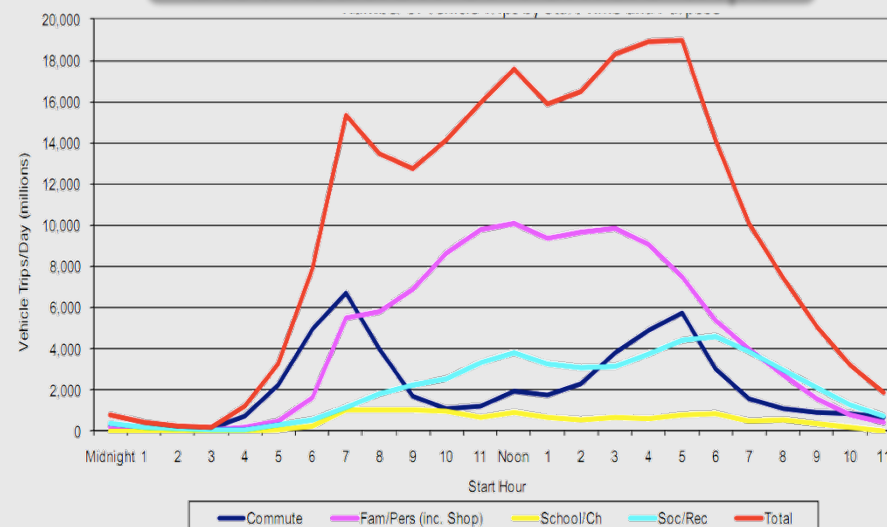
Car classes configuration

L7e	Quadricycles	
M1	Passenger	
N1	Commercial <3500kg	
N2	Commercial >3500kg	

Electric vehicles types

PHEV	Plug-in Hybrid Electric Vehicle
EREV	Extended Range Electric Vehicle
BEV	Battery Electric Vehicle

Distribution of vehicle trips



Definition of models

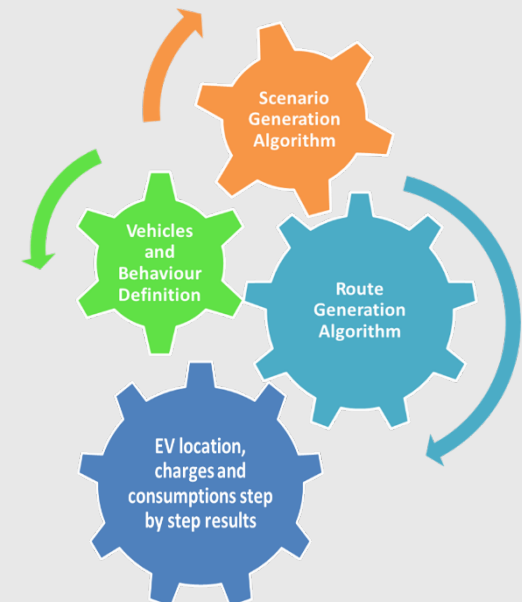
Vehicle class		Battery capacity (kWh)			Charging rates (kW)	
		Max	Mean	Min	Slow charge rate	Fast charge rate
BEV	M1	72	29	10	2–8.8	3–240
	N1	40	23	9.6	1.3–3.3	10–45
	N2	120	85	51	10	35–60
	L7e	15	8.7	3	1–3	3–7.5
PHEV	M1	13.6	8.2	2.2	3	11
	N1	13.6	8.2	2.2	3	11
EREV	M1	22.6	17	12	3–5.3	-
	N1	22.6	17	12	3–5.3	-

- **Weaknesses of previous version**

- **Command line and no interface!**
- **Random allocation of cars to network bus (no explicit logic).**
- **Uniform distance in each trip across the day for the same car independently of the location and randomly assigned bus.**
- **Simulation step length is 1 hour.**
- **No information of roads.**

- **When Cristina joined the project**

- **New version developed in C#;**
- **Flexible simulation step length;**
- **Information of possible connections between bus (Euclidean, fast, eco, shortest connection) -> no uniform distances anymore;**
- **Hybrid fuel consumption consideration**





Scenario Generation

Scenario Settings
Day Settings
Other Settings

ScenarioID: 1
32 Network Scenario (2000)

New
Duplicate
Reset
Delete

Name: 32 Network Scenario (2000)


Description: 32 Network Scenario with 2000 EV's

NetworkID: 1

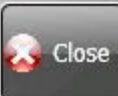
Step Rate: 1
Total Step: 24
Starting Date: 01-05-2012

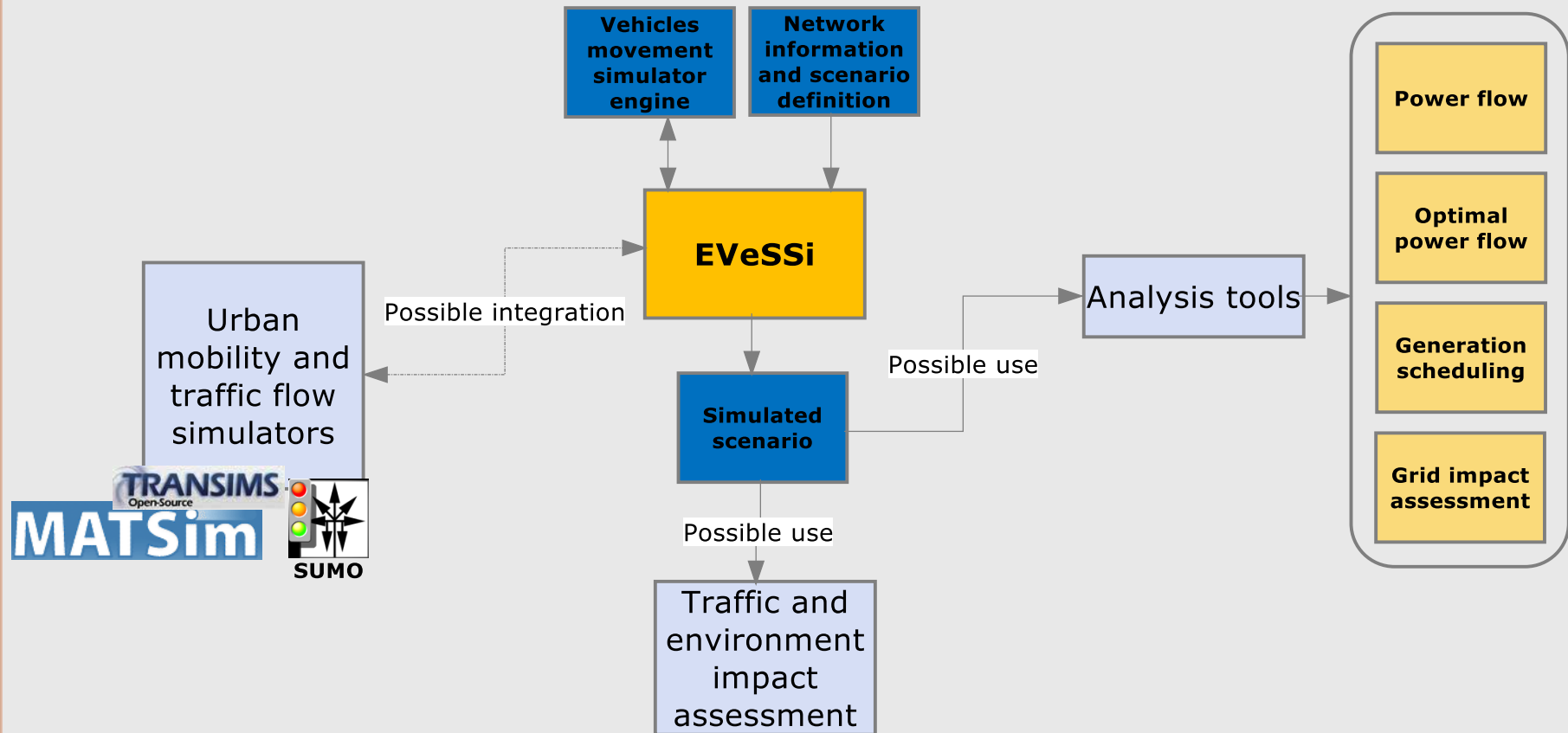
Minimum Depth Of Discharge: 0,3 0..1
☒ Is Initial State Random?

Initial State Of Batteries: 0,7 0..1
Initial State Min: 0,3 0..1
Initial State Max: 1 0..1

 Generation

Save Changes

 Close



Energies **2012**, *5*, 1881-1899; doi:10.3390/en5061881

OPEN ACCESS

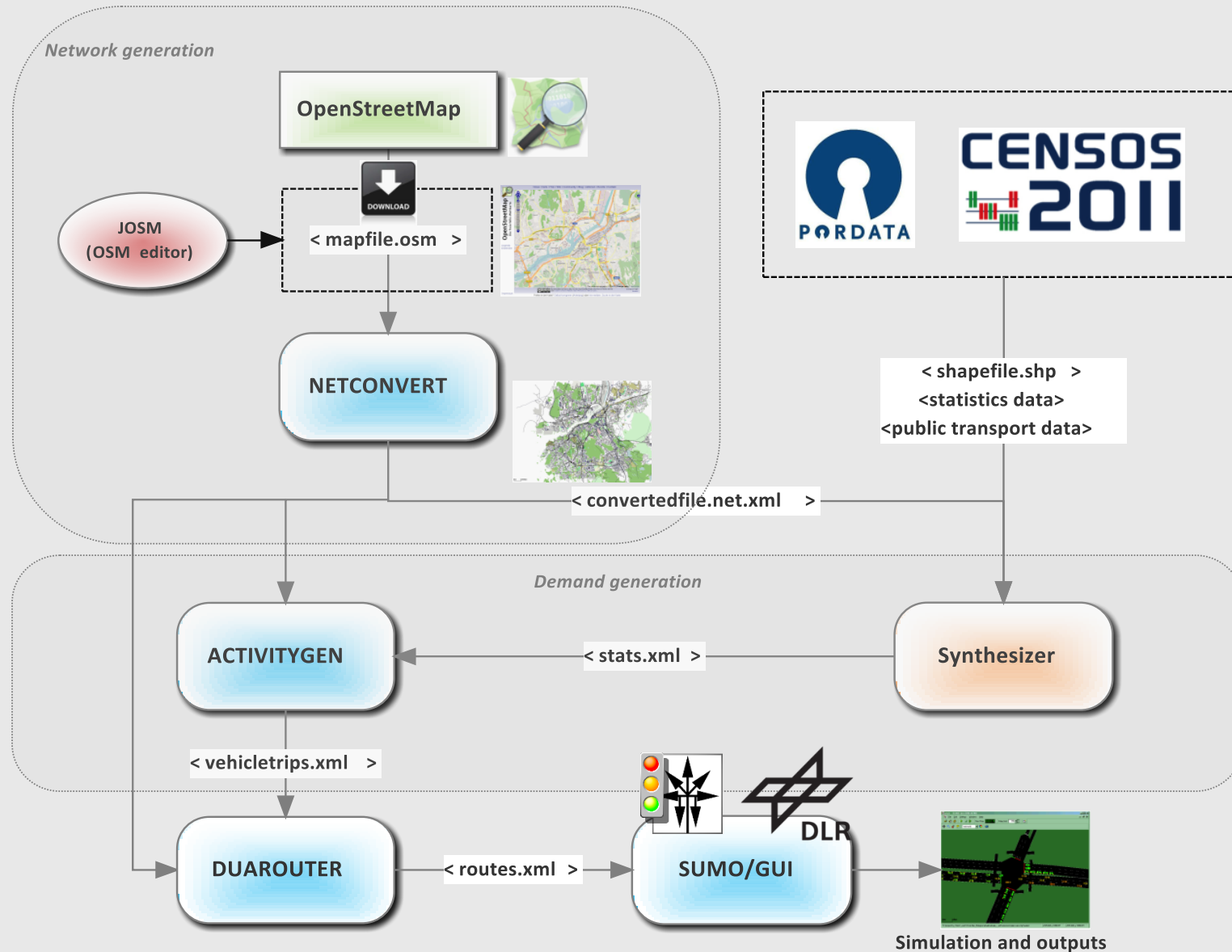
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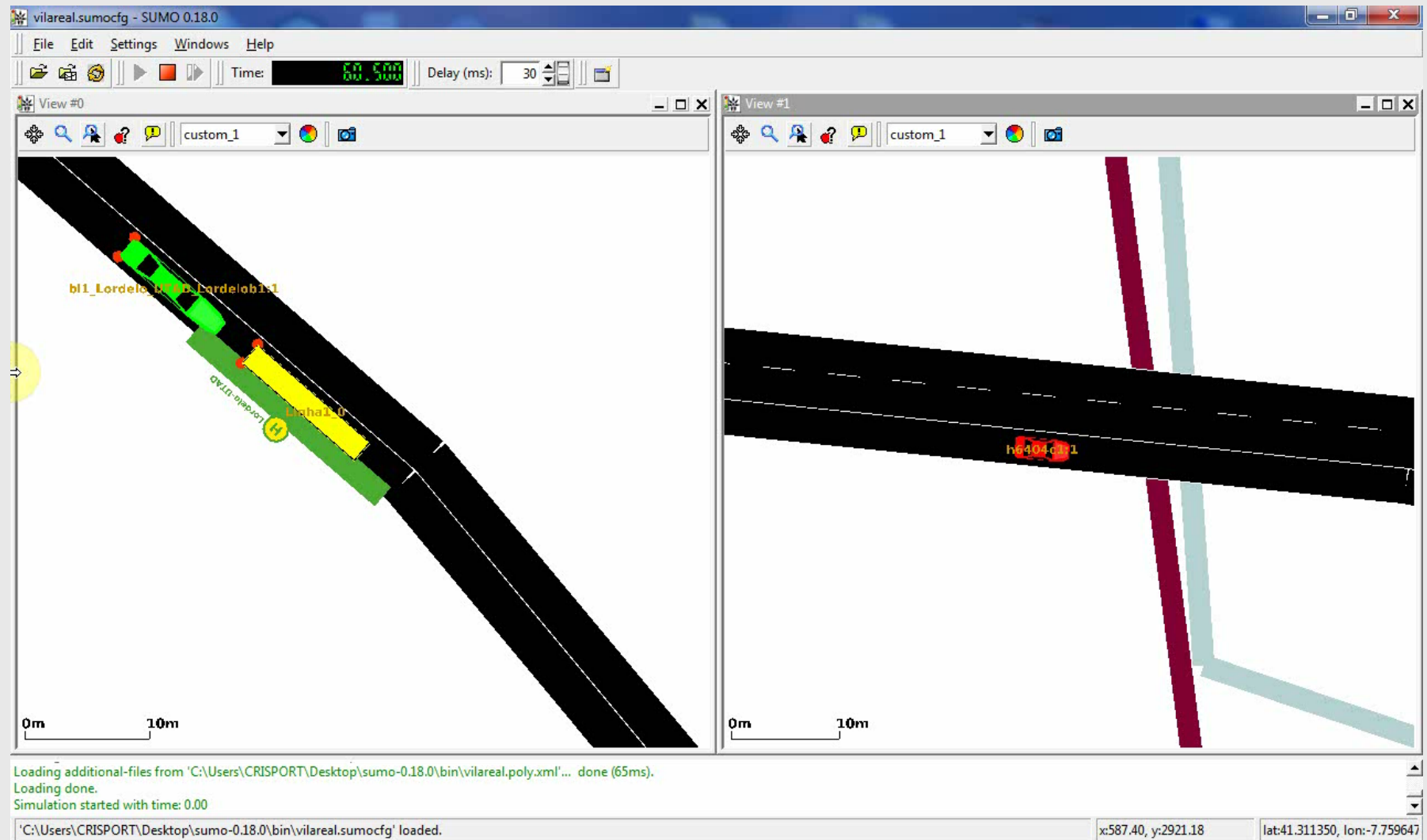
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Article

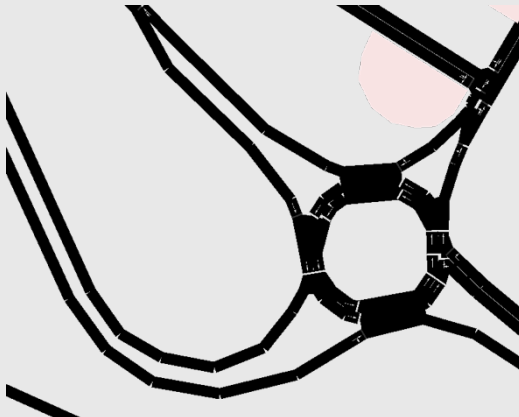
Electric Vehicle Scenario Simulator Tool for Smart Grid Operators





- **Integration with EVeSSi – next step**

- **Outputs of traffic simulator -> inputs of new EVeSSi**
- **EVeSSi will correspond distribution network with geographic points**
- **EVs scenarios**





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Any question?

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