



INTERNATIONAL ELECTRIC VEHICLE
SYMPOSIUM & EXHIBITION
MAY 19th - 22nd, 2019
EUREXPO - LYON, FRANCE

IDO-laad

EV Datamanagement - Five issues to solve

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In cooperation with:

The cities of Amsterdam, Rotterdam, the Hague, Utrecht, and the Metropolitan Region Amsterdam Electric

E2 - Market development strategies for charging infrastructure

www.researchgate.net/publication/332902240_EV_Charging_Data_Management_five_issues_to_solve

EV charging data 01-2014 till 03-2019

- Data owners: the G4 cities, and MRA-E
- Charging session CDRs and metre values of kWh uptake
- public charging points
- 9,484,156 valid sessions
- 82,417,880 kWh charged
- 161,580 unique charging cards
- 5,882 charging stations used in 1 month
- Data managed by AUAS
- Research data: no real-time data

And now... What?



Selection tools i

Filter based on KPI i

Vulnerability i

Charge point classification i

Car sharing analysis i

Generate report

Clear selection & filters

Decision support

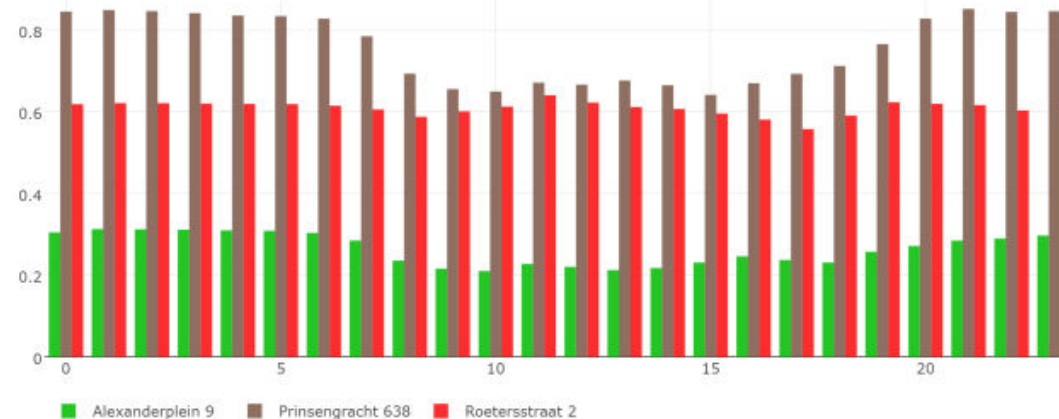
Selection tools i

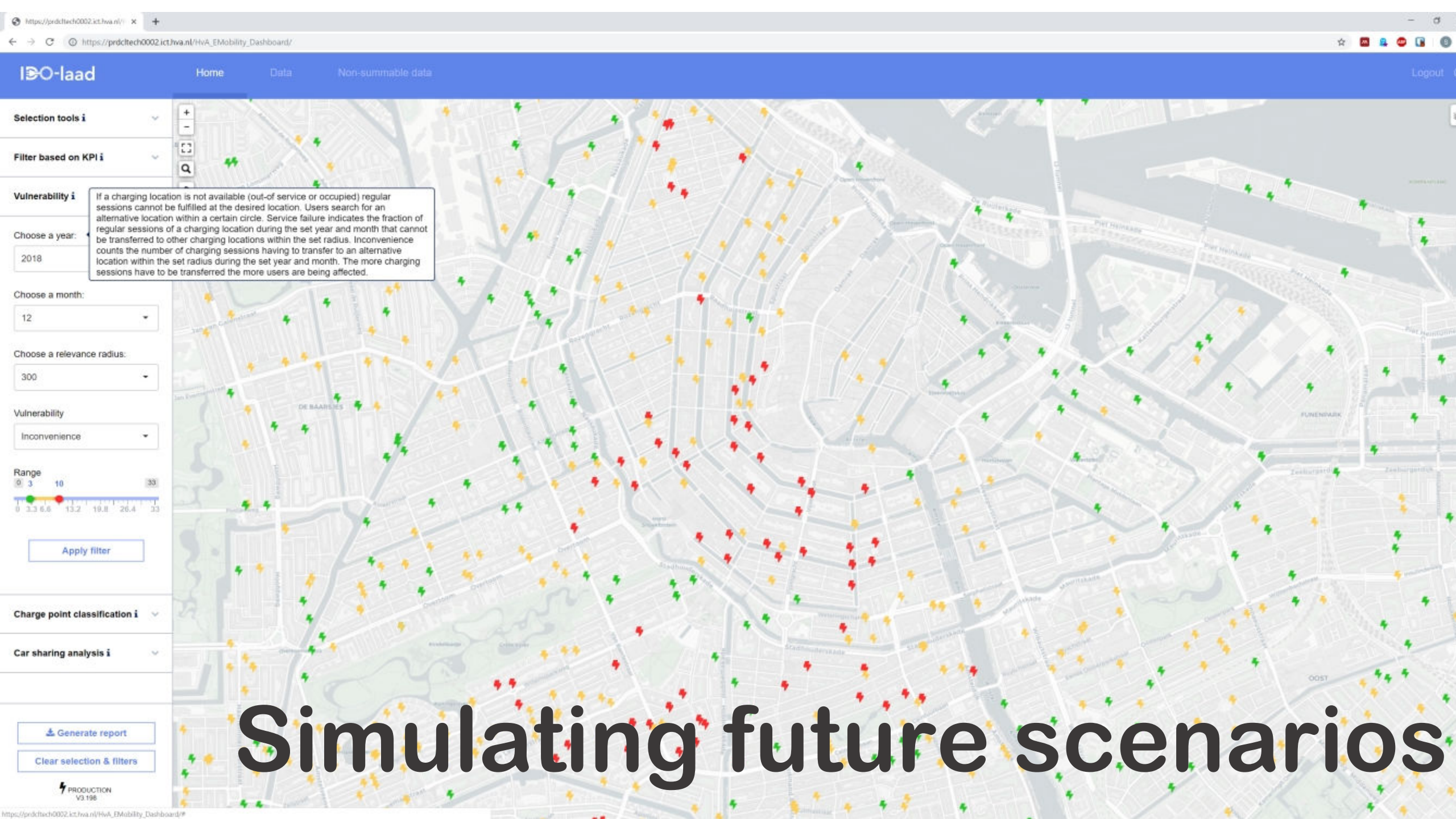
Show graph selection (3)

24 H Occupancy i

Month Year
Starting date 5 2017

Month Year
Ending date 5 2019





Simulating future scenarios



Background
information

Monthly charging
infrastructure
utilisation

Number of used
charging stations

Number of charging
sessions

Number of unique
active users

Total kWh Charged

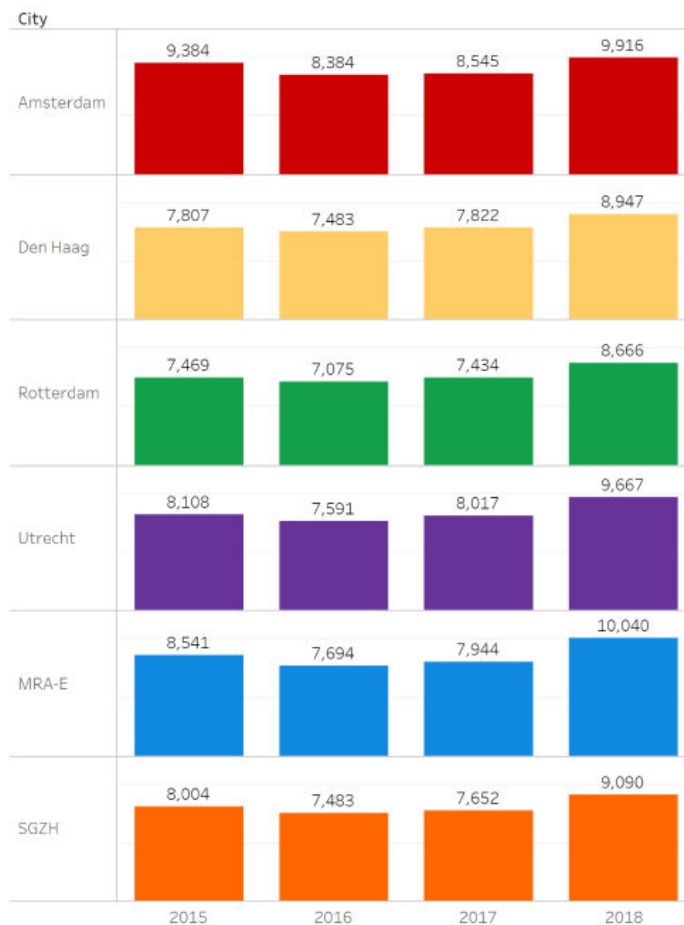
Charged kWh per
charging session

Charging
infrastructure



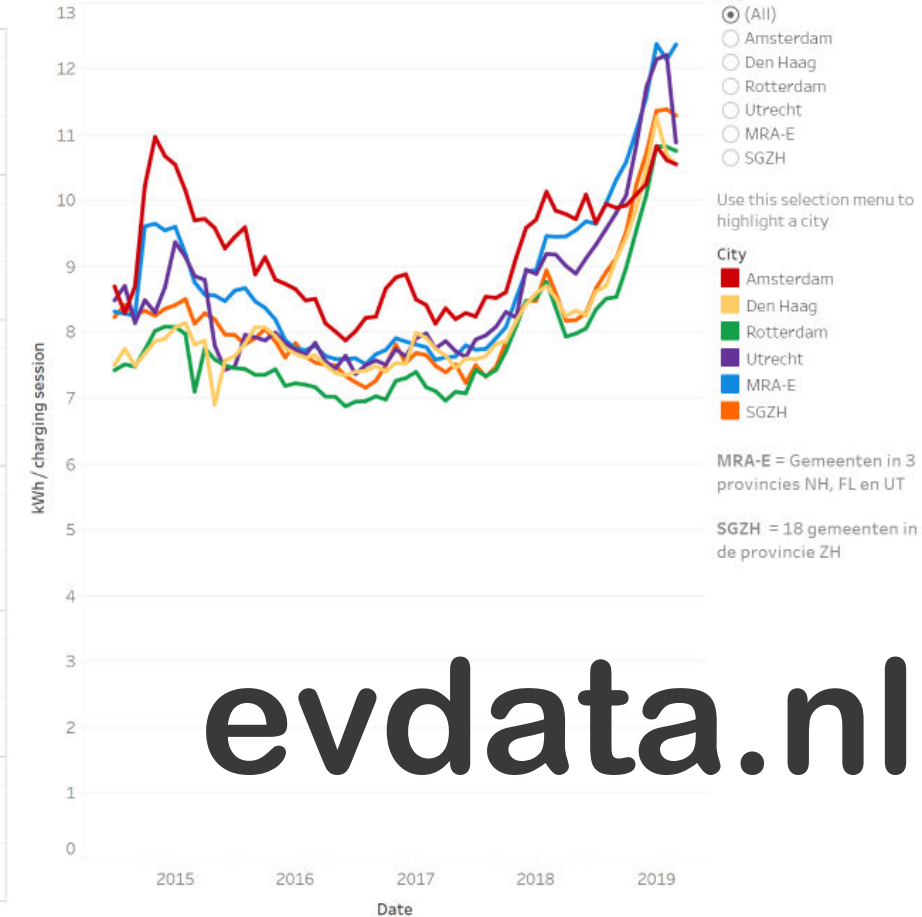
Charged kWh per session, yearly

Source: www.evdata.nl



Charged kWh per session

Source: www.evdata.nl

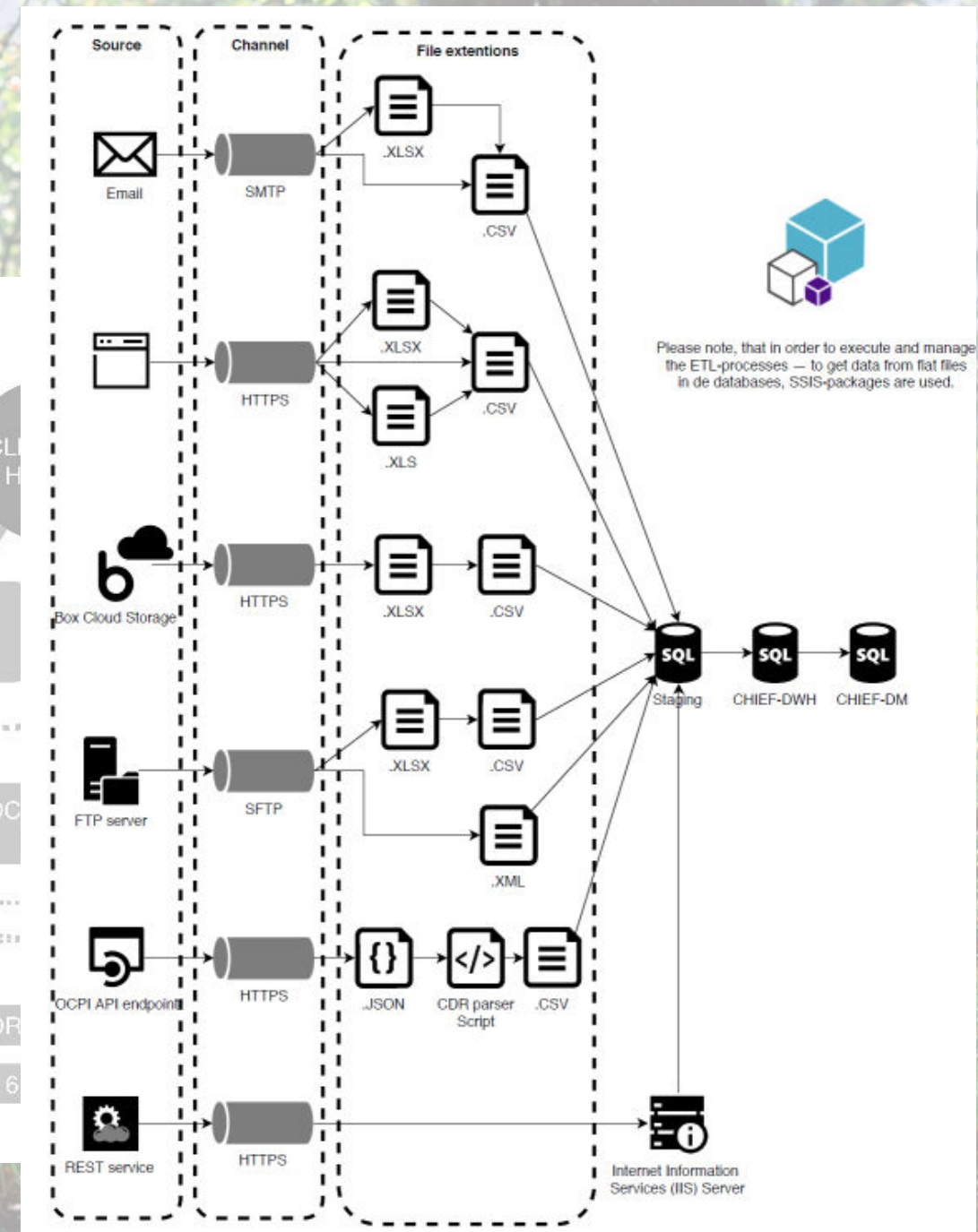
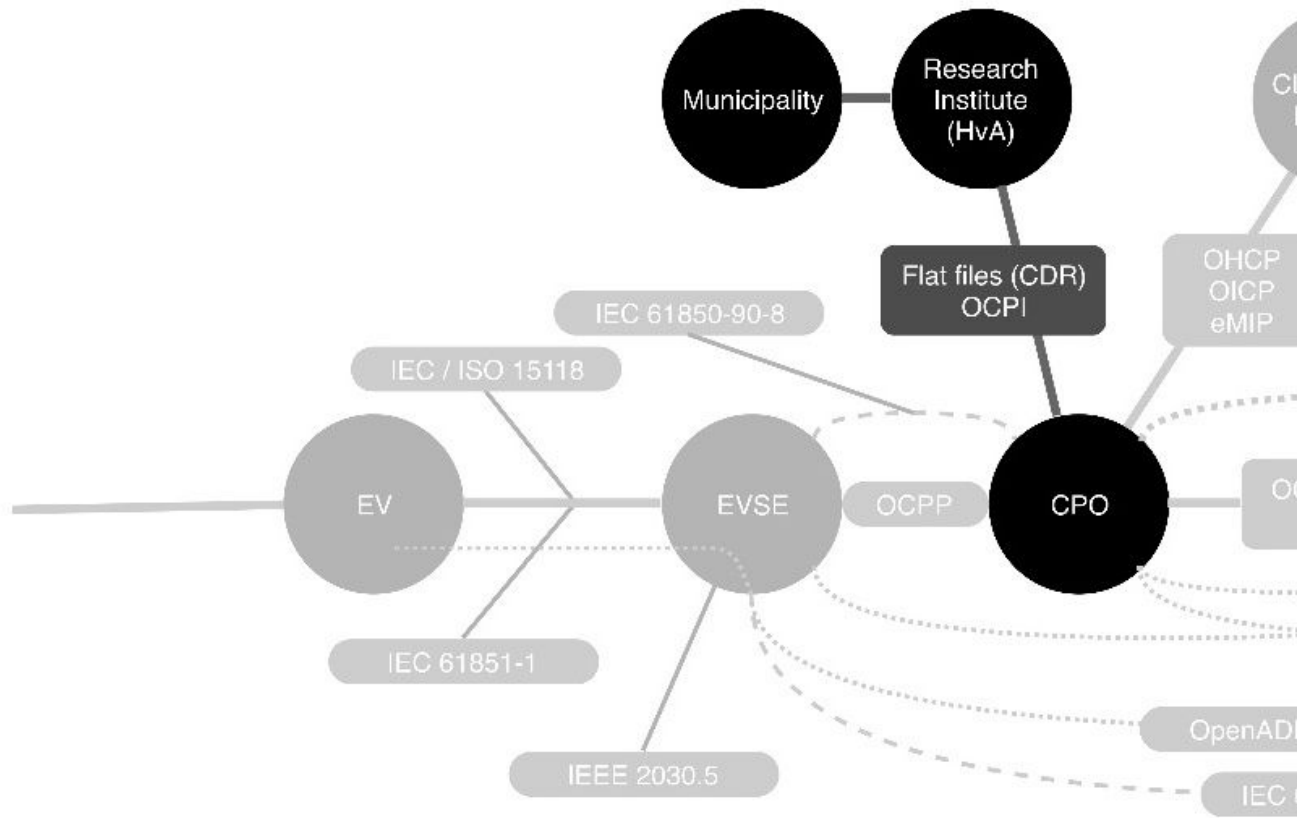


evdata.nl

Five issues and their solutions

	Issue	Solution
1. Data collection	Different sources and file formats	SSIS packages for ETL
2. Data quality	Errors and inconsistencies	SSIS packages for ETL, manual corrections
3. Structuring data	Research flexibility	MS SQL server
4. Enriching data	Shifting research contexts	Contextual data stored and available for datascience
5. Data access	Data security, privacy and conflicting interests	Data sharing protocol including three levels of data access.

1. Data Collection



2. Data Quality

	Examples	Cleansing results
1	Missing data	Any cell can be empty No action
2	Data errors	kWh > 100 kWh kWh < 0 kWh Mark session invalid
		Invalid date or date in the future Mark session invalid
		StartConnectionTime > EndConnectionTime Switch of StartConnectionDateTime and EndConnectionDateTime after check with given Connection Time
3	Data inconsistencies	Double rows within batch Mark session invalid
		Broken session (same RFID repetitively connected within portion of an hour) Mark session invalid, if fastcharger=Y: session = valid. Under construction: chaining broken sessions at non-fastchargers.

3. Structure

DIM_PROJECT	
PK	Project_skey
ProjectName	
ProjectDescription	
ProjectOwner	
StartDate	
EndDate	
ProjectWindowStartDate	
ProjectWindowEndDate	

FACT_PROJECT	
PK	Fact_skey
FK	Project_skey
FK	ChargePoint_skey
FK	RFID_skey
FK	Car_skey
LoadDateTime	

DIM_RFID	
PK	RFID_skey
RFID	
Company	
ClientNr	
OwnerType	
UseType	
CardStatus	
MaxCharges	
MaxCapacity	
Contract_ID	
ServiceProvider	
DerivedServiceProvider	
AlterDateTime	
LoadDateTime	
RFIDHashSHA2_256	
TaxiCompany	
UseTypeCompany	
UseTypeNew	

DIM_CHARGEPOINT	
PK	ChargePoint_skey
ChargePoint_ID	
Provider	
ChargePointType	
NumberOfSockets	
NumberOfSocketsIsEstimate	
MaxKw	
IsFastCharger	
IsChargeHub	
InternationalName	
Model	
NetworkProvider	
Uid	
Vendor	
ExecutionInstanceGUID	
FirstActiveDateTime	
LastActiveDateTime	
Status	
LoadDateTime	
StartIsChargeHubDateTime	
IsCarSharingOnly	

DIM_CAR	
PK	Car_skey
CarMake	
CarModel	
LoadDateTime	

FACT_CHARGESSESSION	
PK	ChargeSession_skey
Transaction_ID	
Provider	
FK	Location_skey
FK	ChargePoint_skey
FK	Socket_skey
FK	RFID_skey
ChargePoint_ID	
ChargePoint_Imported	
IsFuzzyLocation	
IsLastKnownLocation	
IsValid	
FK	StartDate_skey
FK	EndDate_skey
StartConnectionDateTime	
EndConnectionDateTime	
ConnectionTimeHours	
ChargeTimeHours	
kWh	
NrOfRowsInvolved	
ExtractedFileName	
ExecutionInstanceGUID	
LoadDateTime	
LocationImported	
FK	Car_skey
RFID	
IsToBeReportedOn	
FK	Remark_skey
IsProcessedForSnapshot	
IsCurrentFrom	
IsCurrentTo	
IsCurrent	

DIM_SOCKET	
PK	Socket_skey
Socket_ID	
SocketType	
SocketTypeDescription	

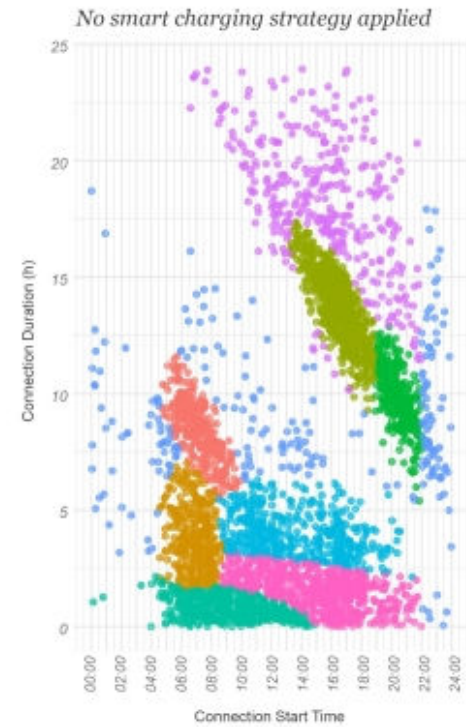
DIM_DATE	
PK	Date_skey
DateExp	
DateText	
DateTextShort	
Year	
YearText	
QuarterNr	
QuarterText	
MonthNr	
MonthText	
MonthNumberOfDays	
DayNrOfMonth	
DayNrOfWeek	
DayText	
IsWeekend	
IsHoliday	
HolidayText	
YearMonthNr	
YearQuarterNr	

DIM_LOCATION	
PK	Location_skey
County	
StateLong	
State	
RegionLong	
Region	
City	
CityChargeSession	
Address	
PostalCode	
District	
SubDistrict	
SubSubDistrict	
CBSDistrictCode	
CBSSubDistrictCode	
DistrictCode	
SubDistrictCode	
SubSubDistrictCode	
Latitude	
Longitude	
GeoPoint	
LatitudeGoogle	
LongitudeGoogle	
GeoPointGoogle	
IsGarage	
NameGarage	
LoadDateTime	
AlterDateTime	

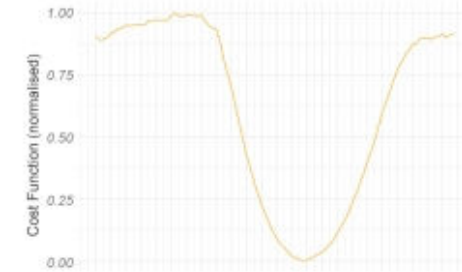
LOOKUP_REMARK	
PK	Remark_skey
RemarkText	
Description	
IsRepairActionAvailable	
RepairAction	
FaultTolerance	
SQL	

4. Enrichment

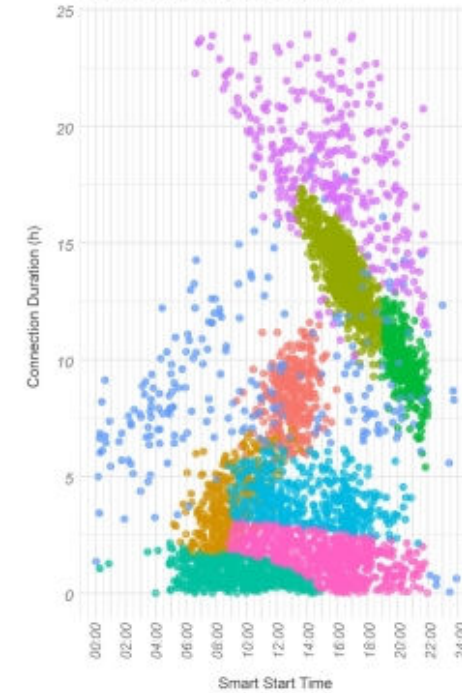
Start time and connection duration
Nine user clusters (Gaussian Mixture Models)



Solar power cost function
Sustainable energy (averaged over 2015-2018)



Morning sessions postponed



5. Data Access

The screenshot displays the RStudio IDE interface with several annotations:

- Managed resource sharing (PRO version)**: An arrow points to the code editor, stating "Users make use of same server. The admin sets rights per user/group for # resources)".
- User specific environment**: An arrow points to the Environment pane, stating "Each user has a individual home drive".
- Shared libraries and code snippets**: An arrow points to the File Explorer pane, stating "Shared resources such as packages".
- Download are disabled (PRO version)**: An arrow points to the File Explorer pane, stating "To assure no data leaves the server".
- Linux (Ubuntu) rights management**: An arrow points to the Console pane, stating "Extented rights mngmnt keeps environments save."

The code in the editor includes R scripts for exploring charging points over time, creating a map of the Netherlands, and generating a sample dataset. The Environment pane shows a global environment with no objects. The File Explorer pane shows a list of files and folders, including 'Vulnerability', 'Untitled1.ipynb', 'Typology EV users', 'try-catch-nbclust.R', 'SEVA example', 'ResultNBclust.csv', 'R', 'powerlaw', 'NBclusttest.R', and 'Isdissimilarities.RData'.

We Make The City

Thank You!

Metropolitan Mobility Conference

Getting Around Smart

E-Mobility: getting smart with data!

June 18th 2019 | 09.30 – 16.30 h. CET | ABN AMRO HQ & CIRCL | Amsterdam

In cooperation with:

Amsterdam University of Applied Sciences, Pakhuis de Zwijger, City of Amsterdam, ABN AMRO Bank, Shell, Schiphol Airport, Port of Amsterdam, Uber, AMS Institute, Amsterdam Economic Board, Amsterdam Smart City, SADC and many more