Smart Street: A real UK Smart Grid project and its applicability to the Chilean context

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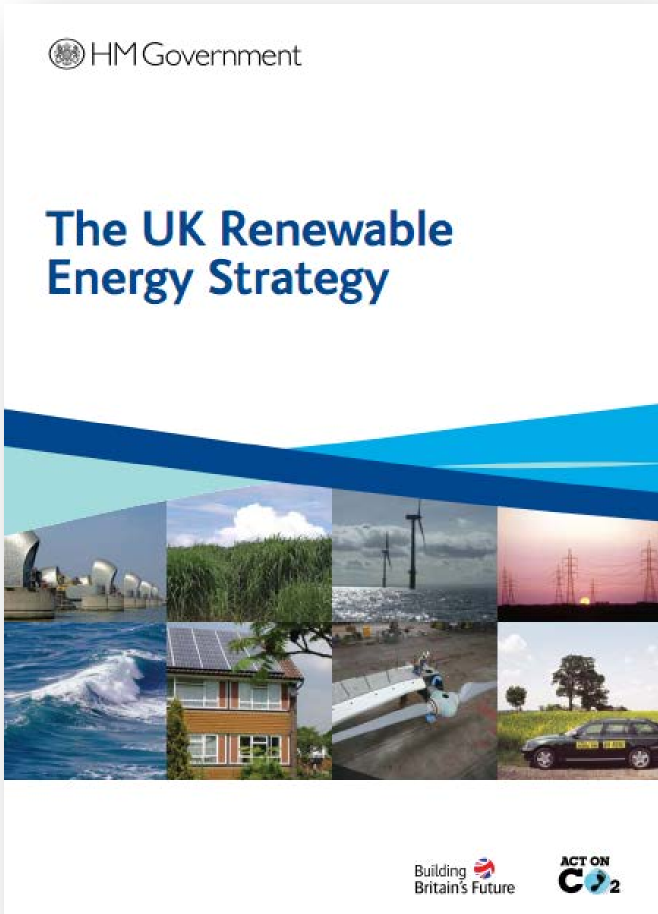
The University of Manchester – 1st December 2017

ChileGlobal Seminars UK – Energy in Chile: Trends, challenges and solutions

Outline

- The new energy context in the UK
- Motivation – Technical challenges
- Smart Street – A real UK Smart Grid project
- Discussion: Is this applicable in Chile?

The new energy context in the UK

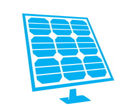


- UK Target of 80% reduction in CO_2 emissions by 2050 (Climate Change Act 2008)

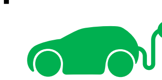
27% of CO_2 emissions come from electricity in UK

- Legally-binding target of 15% of energy demand to be sourced by renewables by 2020

- Government incentives for micro/small-scale generation



- Government incentives for people to buy electric vehicles



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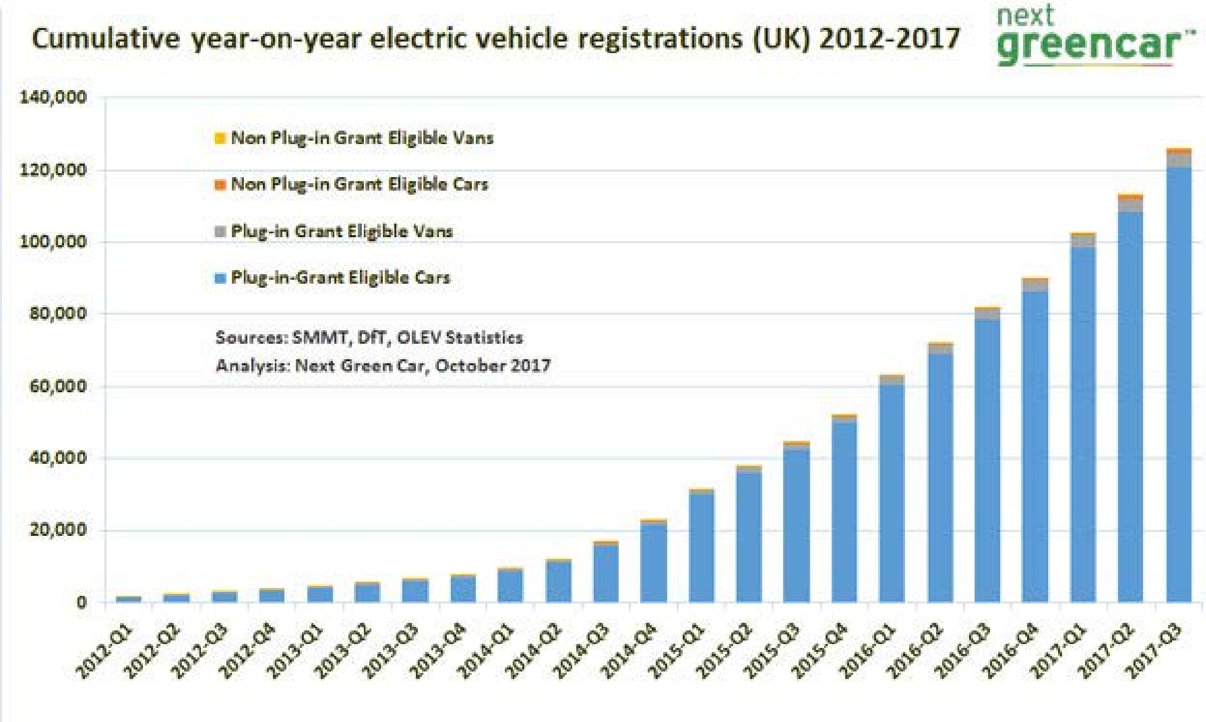
Electric Vehicles (EV) in UK

- **Plug-in car grant:**
  - Covers 35% of new car cost (EV, hybrid, fuel cells)
  - 20% in case of Vans
  - Up to £5000 or £8000 respectively

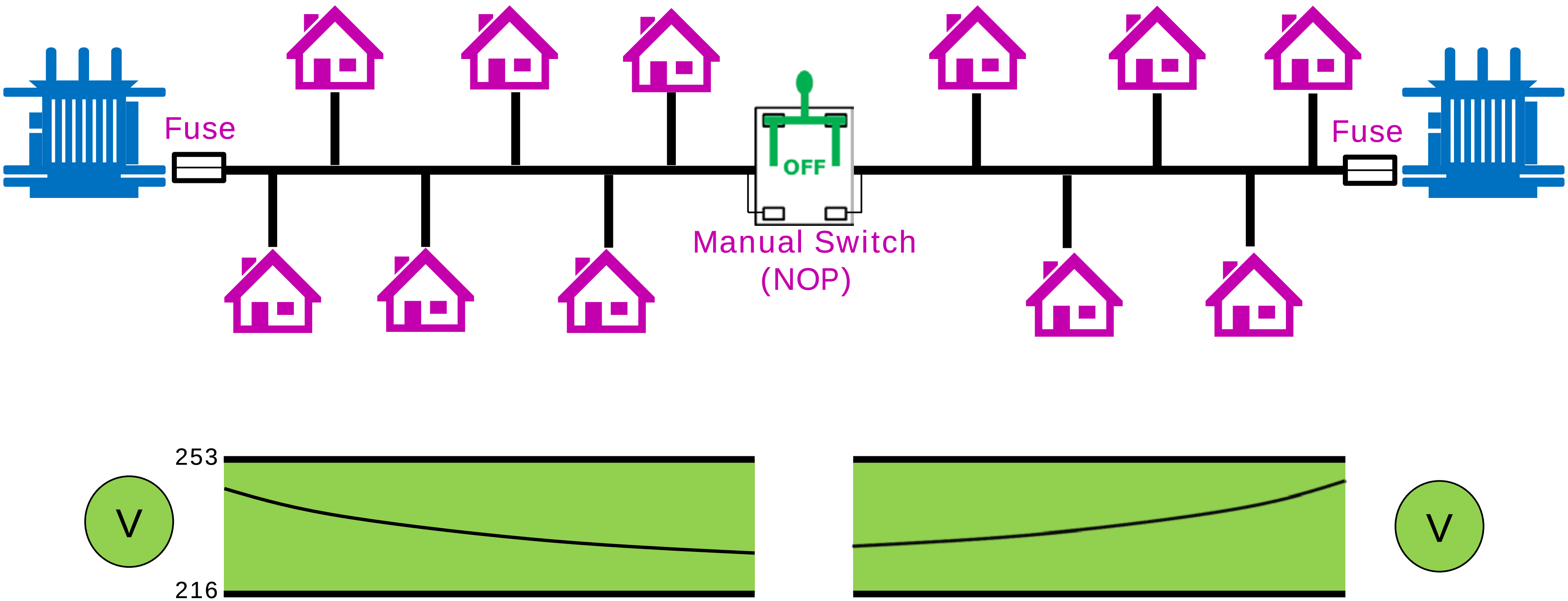


Refs:

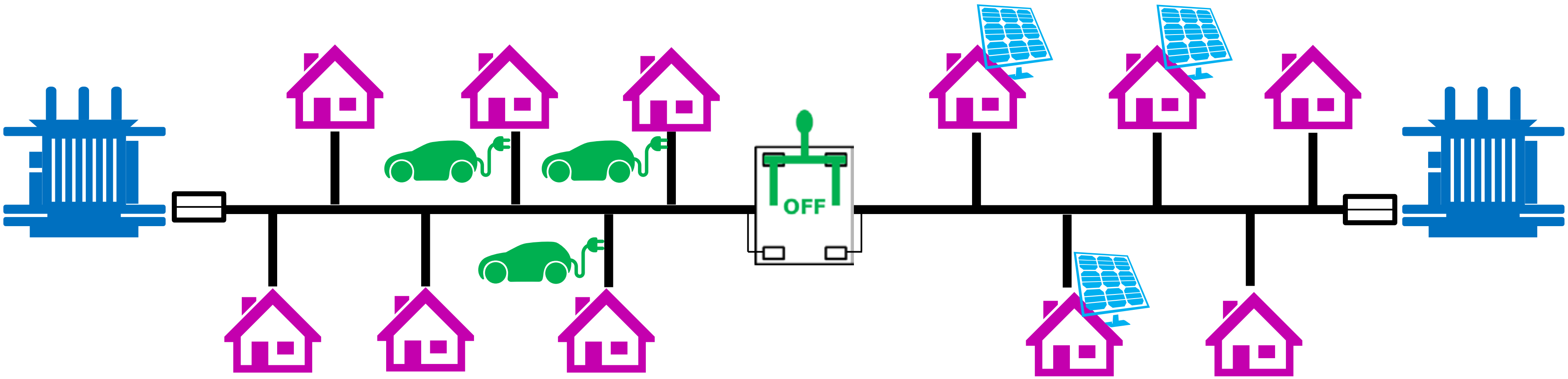
- UK Office for Low Emission Vehicles, Plug-in car and van grants, 2015
- Next Greencar, Electric car market statistics, 2017

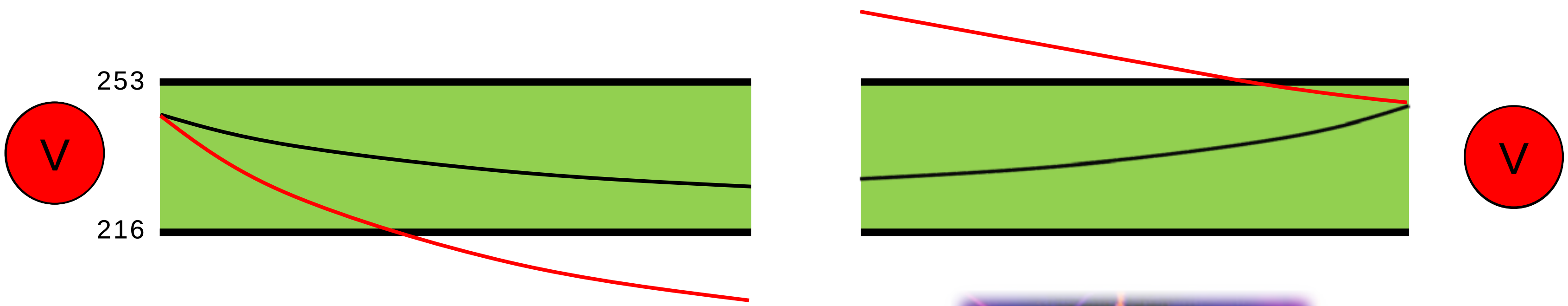
Motivation – Technical challenges

Normal operation of LV networks

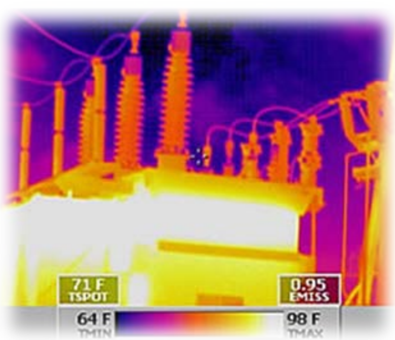


Effects of LCTs in LV networks





But also possible overloads!



Smart Street – A real UK Smart Grid project

Total Cost

£11.5m

SMART STREET

Project run by

Electricity North West Limited

electricity north west

http://www.enwl.co.uk/smartstreet

Project partners

KELVATEK

SIEMENS

TyndallManchester Climate Change Research

tnei enterprise with energy

MANCHESTER 1824 The University of Manchester

Queen's University Belfast

Impact Research

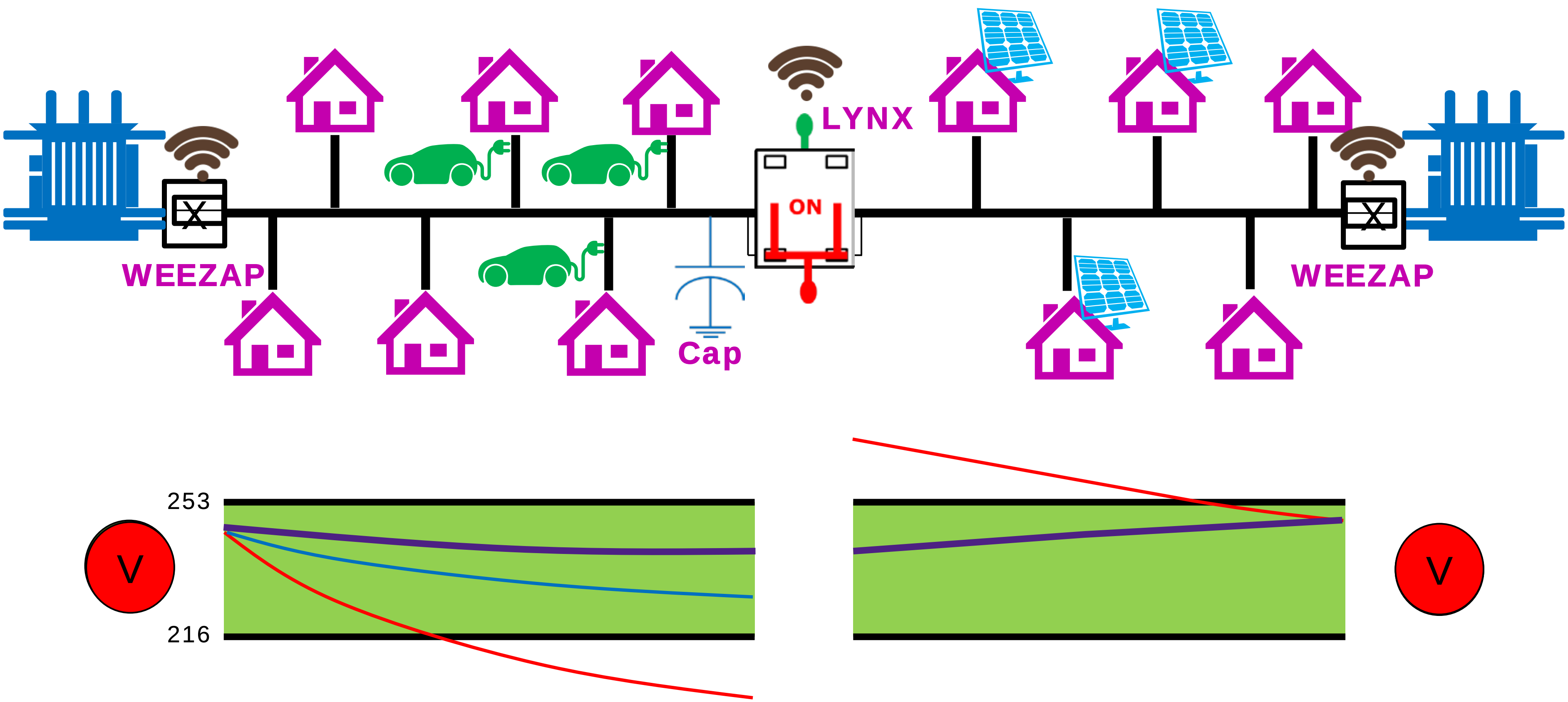
Smart Street in numbers

- 6 Primary Substations
  - 11 HV feeders
  - 6 HV capacitors
- 38 Secondary Substations
  - 163 LV feeders
  - 84 **LV capacitors**
  - 5 **LV OLTCs**
  - 80x3 **LYNXs**
  - 163x3 **WEEZAPs**
- **~67,500 customers**

http://www.kelvatek.com/

First fully centralised HV/LV network management and automation system in GB

LV Active Voltage Control

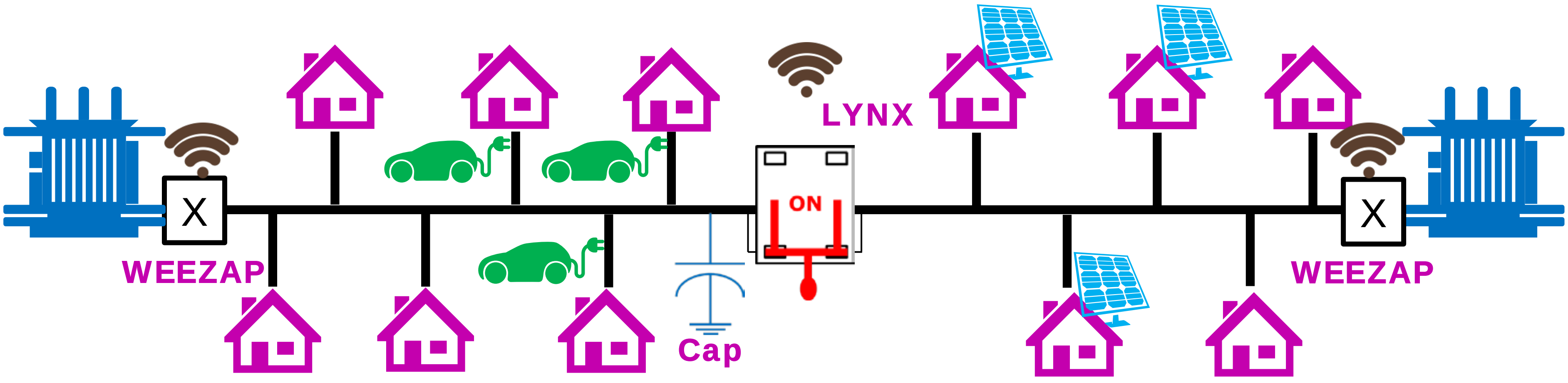


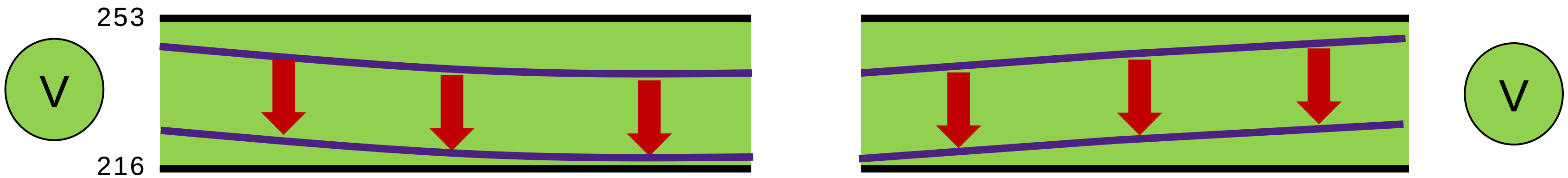
Capacitors help to bring back V in highly loaded feeders

Interconnection helps flattening voltages and balancing power flows

Helps accommodating more LCTs deferring expensive reinforcements

Energy Reduction (CVR)

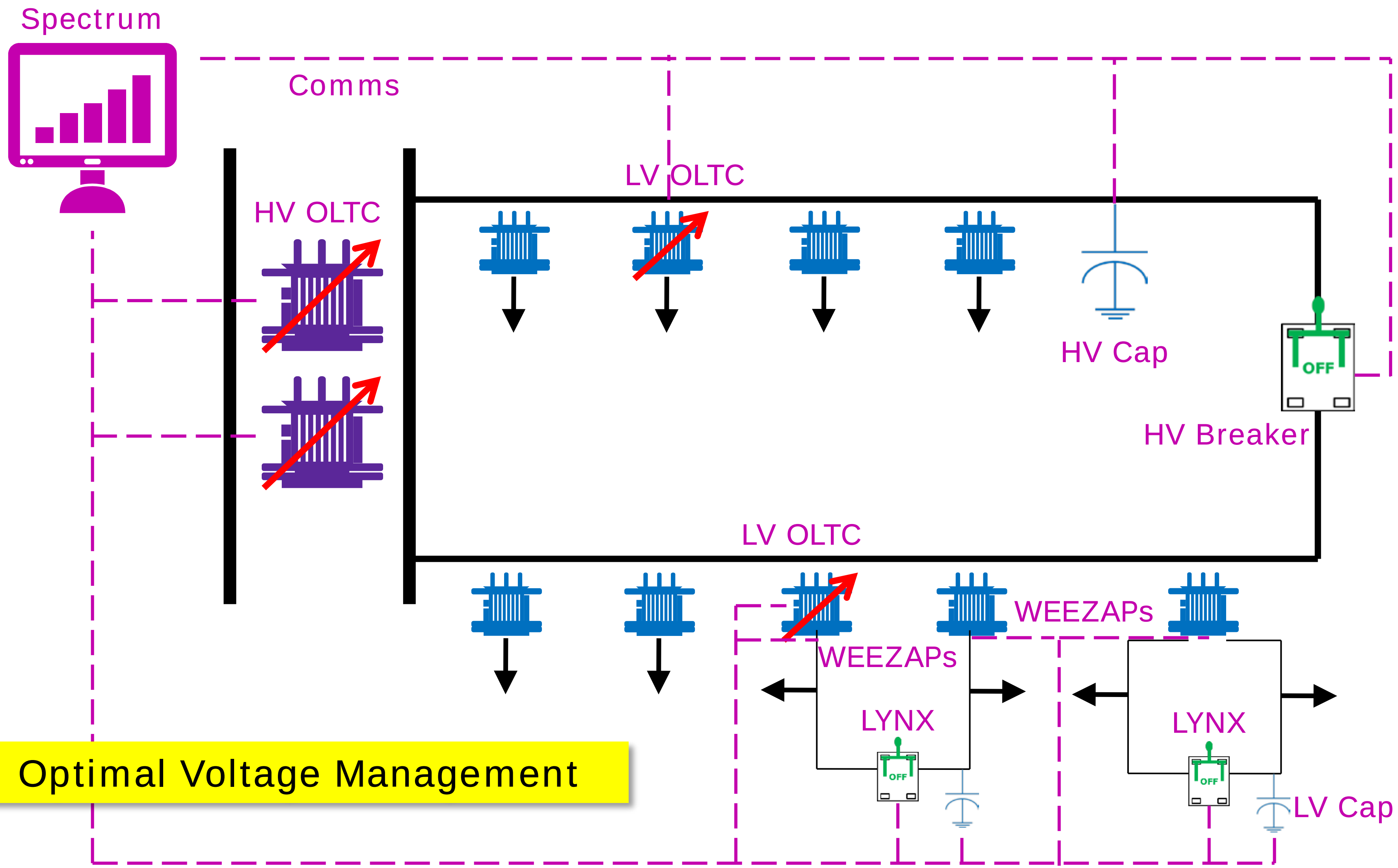




Lower voltages at customer sites

- Energy efficiency
- Lower energy bills

Voltage Control on HV and LV networks

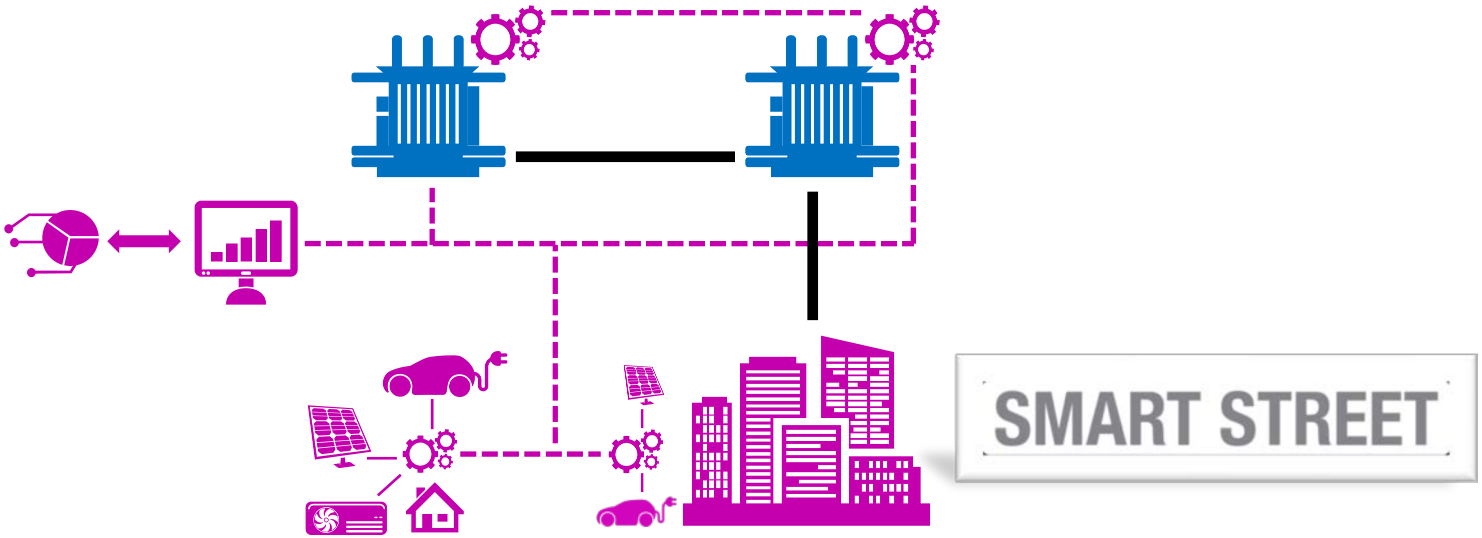


Optimal Voltage Management

Project contribution

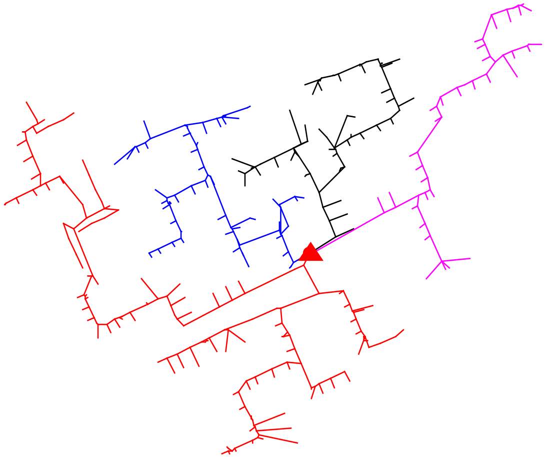
A complete optimal implementation (OLTCs, capacitors, interconnections) will shed lights on the advantages of each device to efficiently operate distribution networks with LCTs

Help DNOs with options to become DSOs



Is this applicable to Chile?

- Chilean distribution networks have an "European like" standard
  - LV networks with hundreds of customers
  - Similar cable distances and transformers
  - Similar MV networks with NOPs
  - Capacitors in long OH-MV networks (rural)
  - Remotely controlled switches in MV



- CVR has been applied since Summer 2008 in dry years

SEC

DNO must lower voltages:

-10% in urban areas

-12.5% in rural areas

Ok but CVR results?

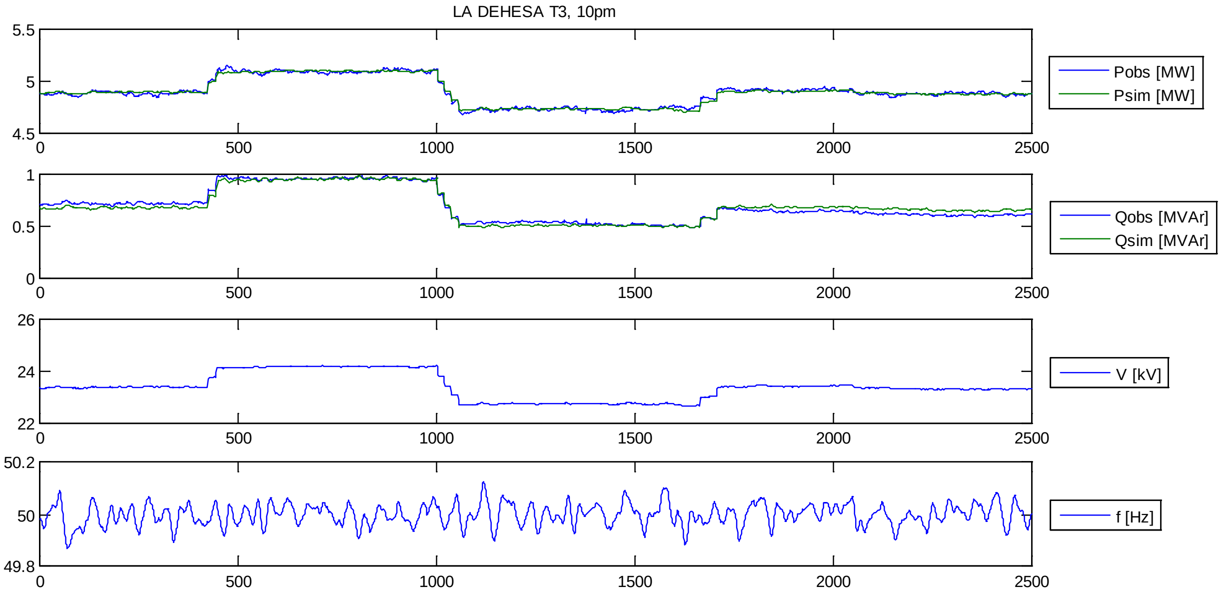
Go to field!

CVR in Chilectra (Bachelor Thesis)

$$P = P_0\left(\frac{V}{V_0}\right)^{n_p}$$

$$Q = Q_0\left(\frac{V}{V_0}\right)^{n_q}$$

Results



Residential $n_p \approx 1.2$

Commercial $n_p \approx 0.8$

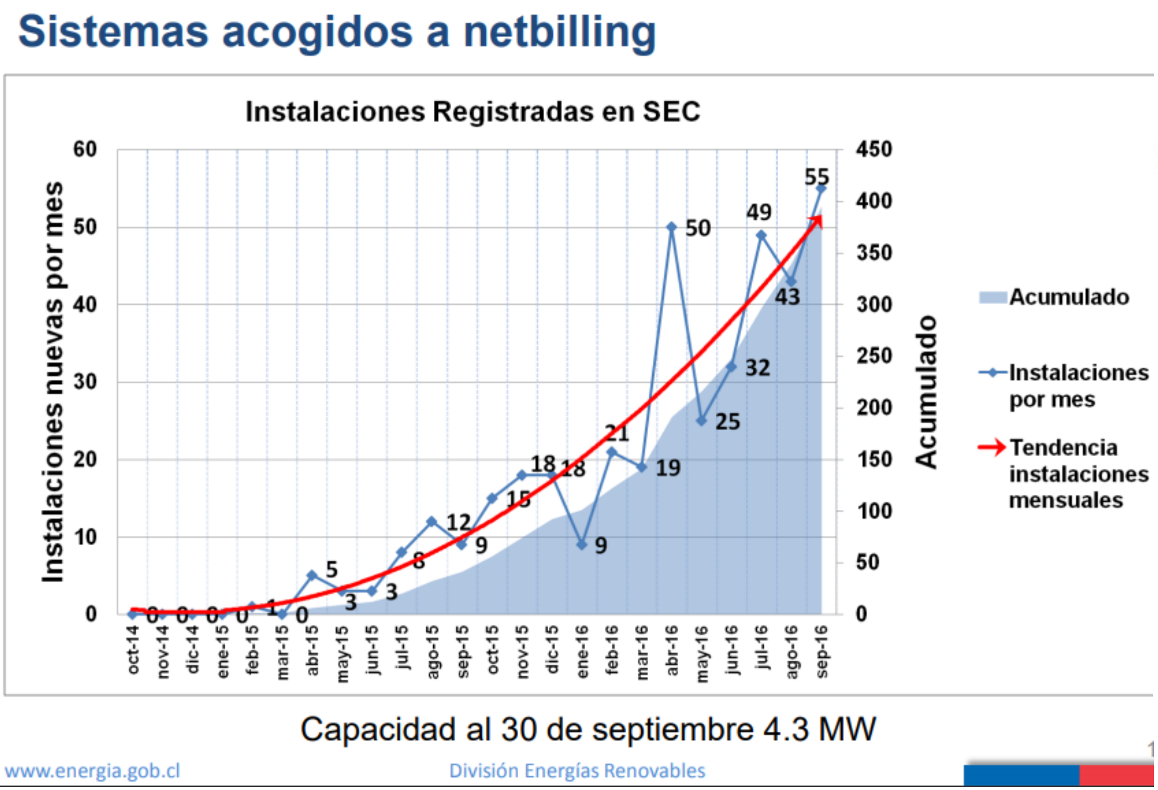
Industrial $n_p \approx 0.2$

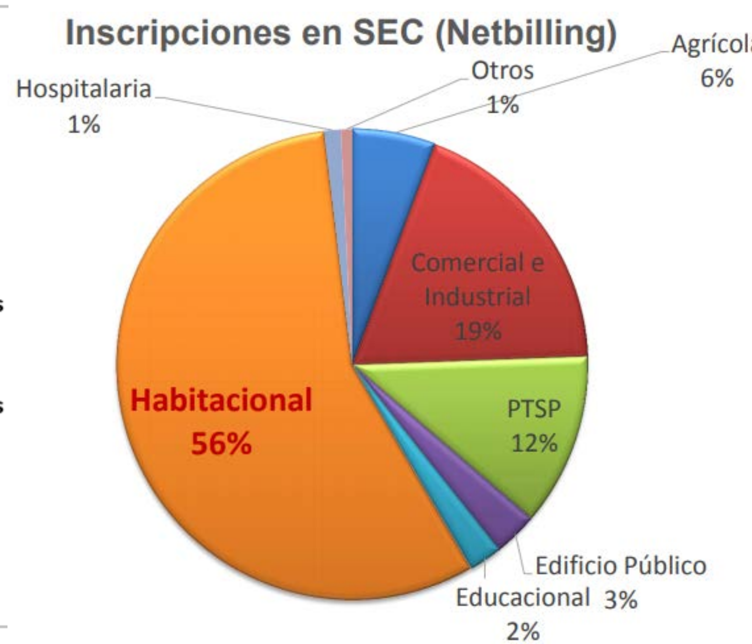
Reduction of about 3.6% in active power consumed by Chilectra.

L. D. Gutiérrez Lagos, "Efectividad de Baja de Tensión en Distribución como Medida de Disminución de Demanda de la Energía Eléctrica," Universidad de Chile, 2009.

Discussion

- High potential for PV generation in Chile → future Smart Grids?
  - Santiago has about twice of irradiation than south Germany
  - Net billing for DG below 100kW (you pay demand – generation) is slowly increasing the number of installations





THANK YOU!

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