Hydro Québec Distribution

Volt-VAR Control Implementation at Hydro Québec

Presented by
Hervé Delmas

Outline

1. Context
2. Volt-VAR control overview
3. Volt-VAR control optimization

1. Hydro-Québec's VVC Project

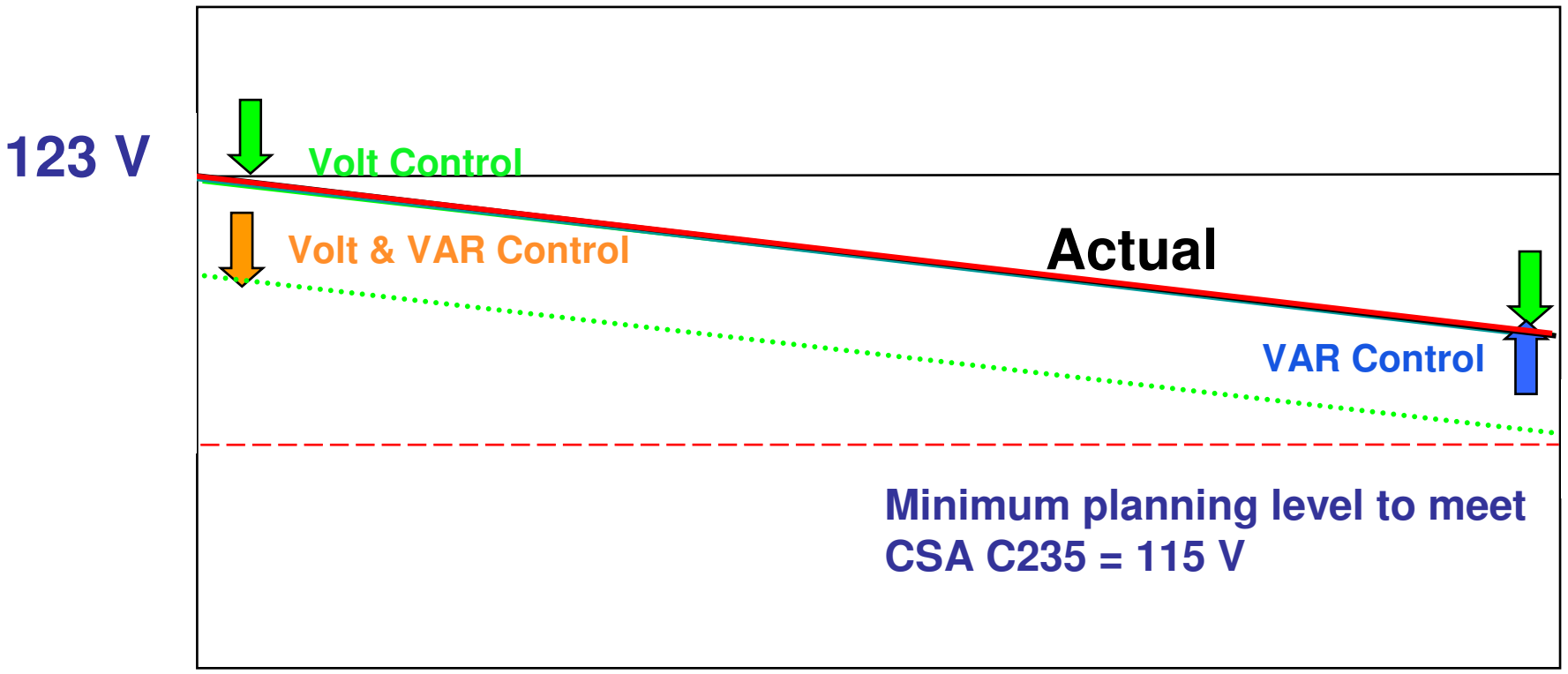
Context

- By 2015, HQ wants to reduce energy consumption by 11 TWh (reduction of 6.4%)
- Lack of at least 1000 MVAR for Transmission needs
- Solution for 2 TWh energy reduction: Volt and Var Control

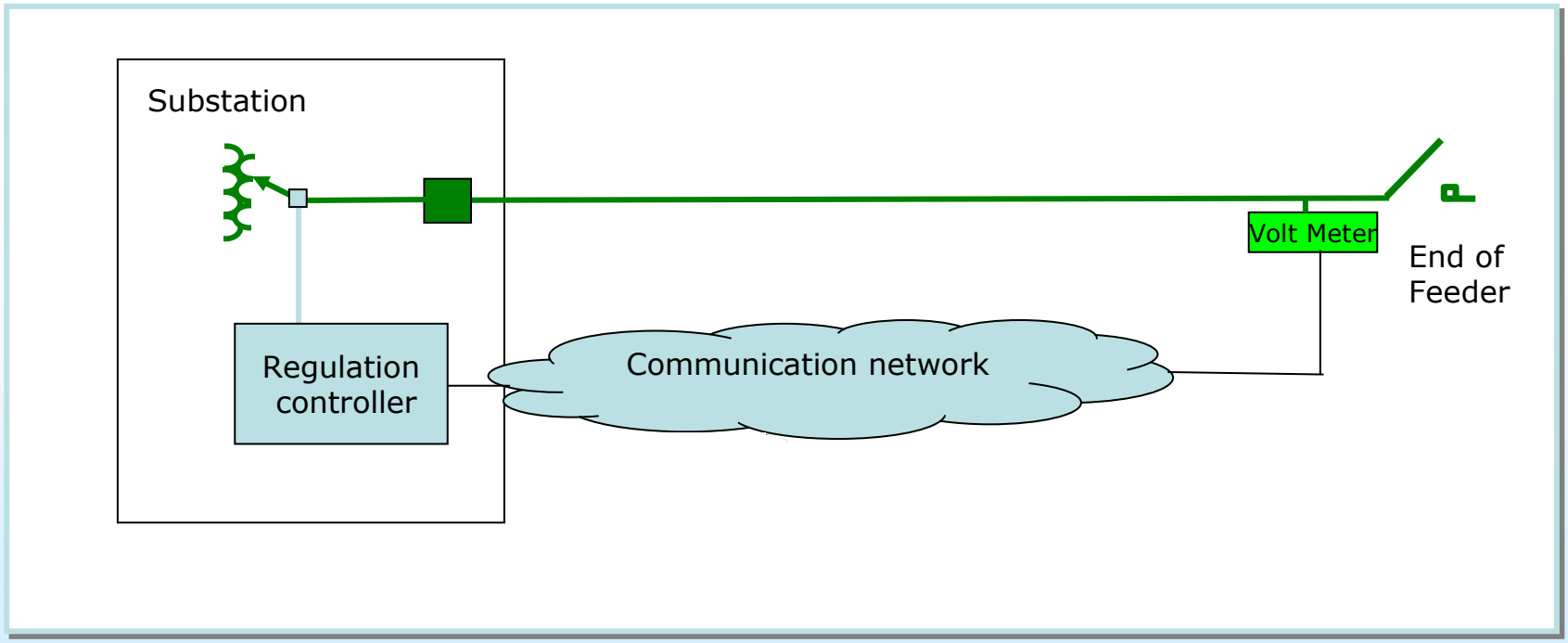
1. HQ VVC Project – Context

- Volt and Var Control
  - Addition of 2400 MVar on the distribution network. 2000 capacitor banks of 1.2 MVar. 3 installed for the demonstration project
  - Addition of 1000 measurement points (volt.), 6 installed for the demonstration project

2. VVC overview - Energy Saving



2. VVC overview – Simple Volt Control

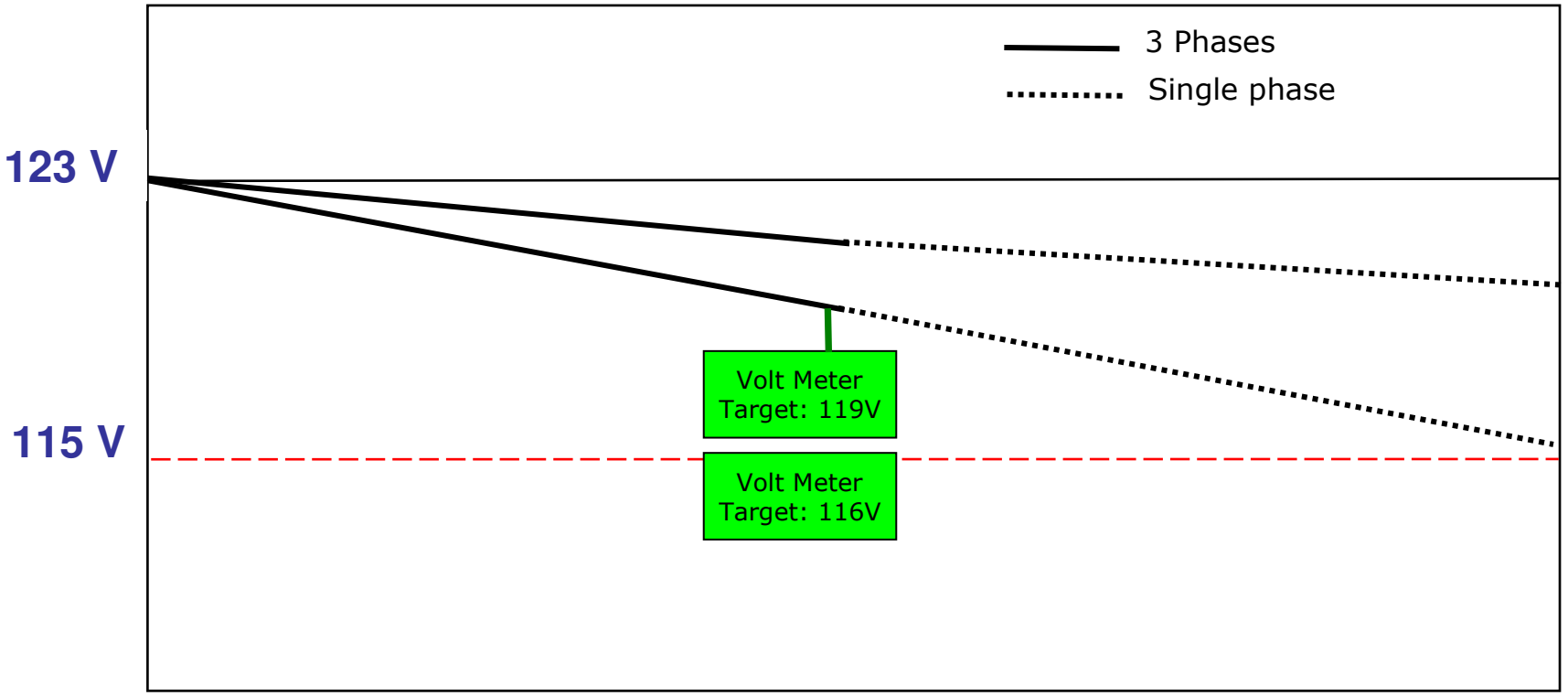


A local regulation controller monitors the end of feeder's voltage and sets the tap to maintain this voltage at 115V.

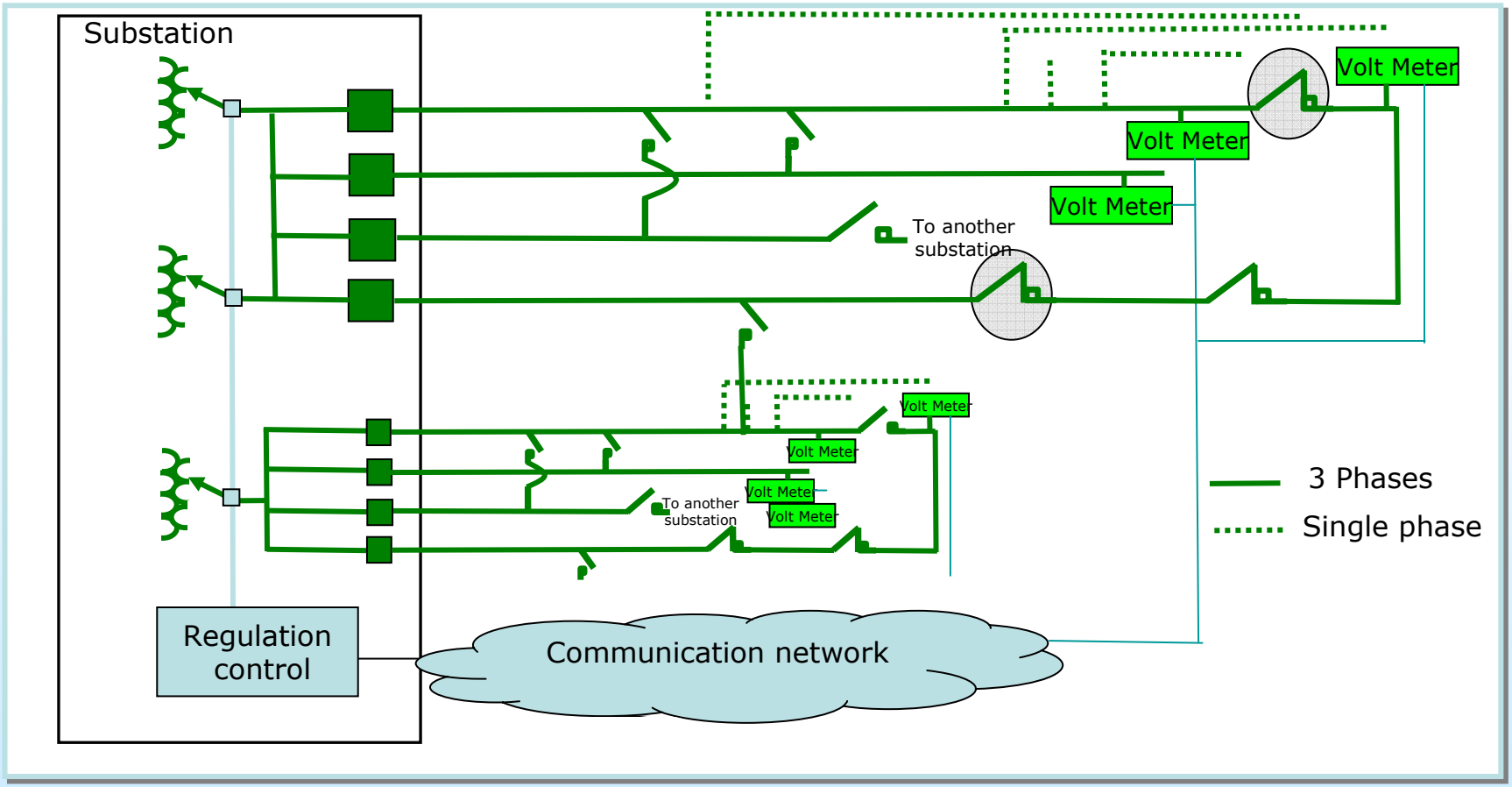
2. VVC overview – Simple Volt control

- Simple but not fully effective. Demonstration project gained only 30% of the estimated energy consumption.
  - Volt meters not really at the end of the feeders. Volt meters installed only on 3 phases circuits. Targets need to cover also the worst case voltage drop of the single phase networks.
  - Network topology during the demonstration project (1 year average) was not in its normal state 40% of the time.

3. VVC Optimisation - Volt Meter Position



3. VVC Optimisation – Volt Meter Position



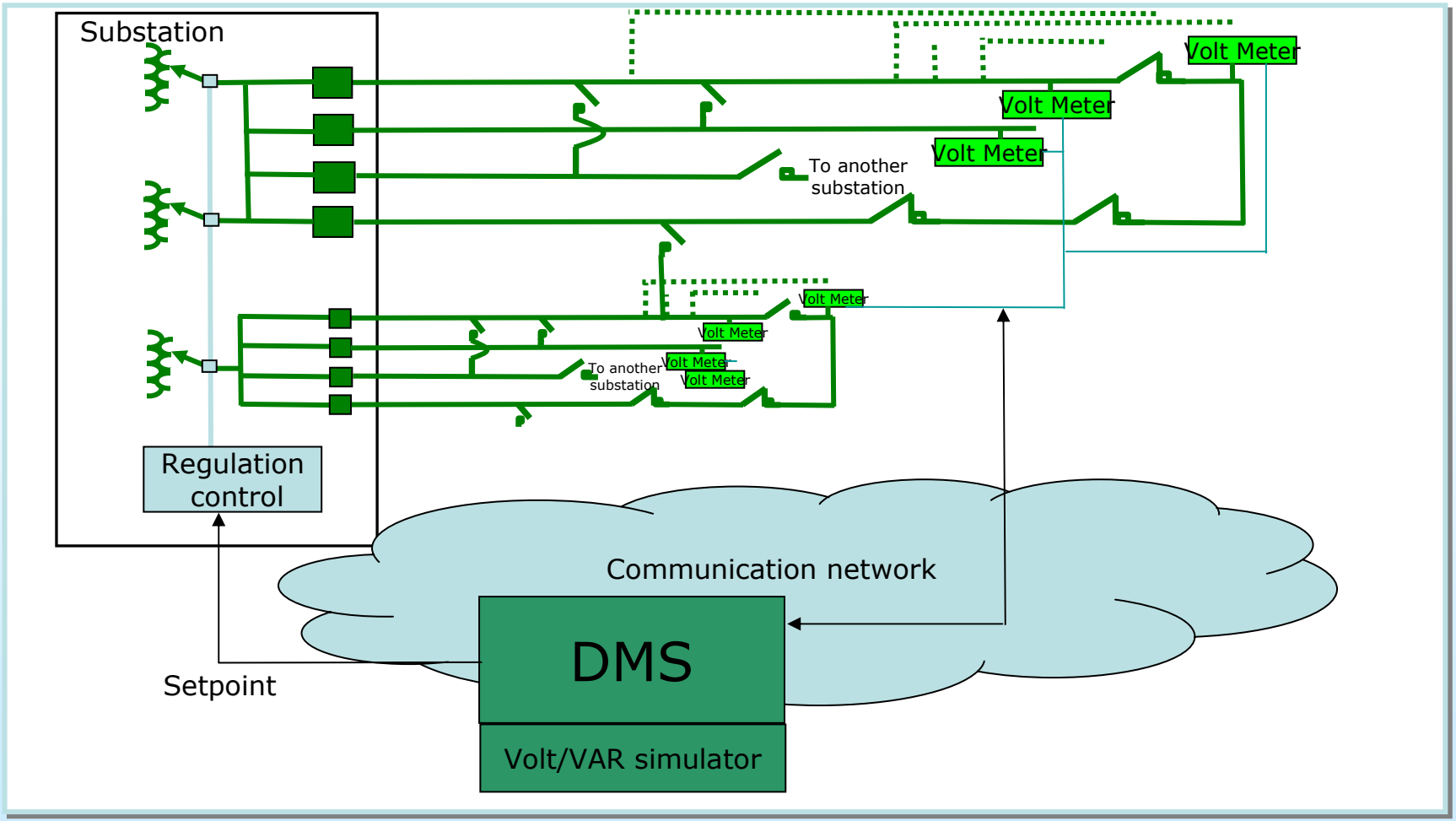
Volt meters can't be moved as network topology changes

Line is more complex

3. VVC Optimisation – Dynamic Target Calculation

- For each measurement point, the voltage target is calculated using a network simulator:
  - Target recalculation for any network topology change.
  - Target recalculation following a load change.

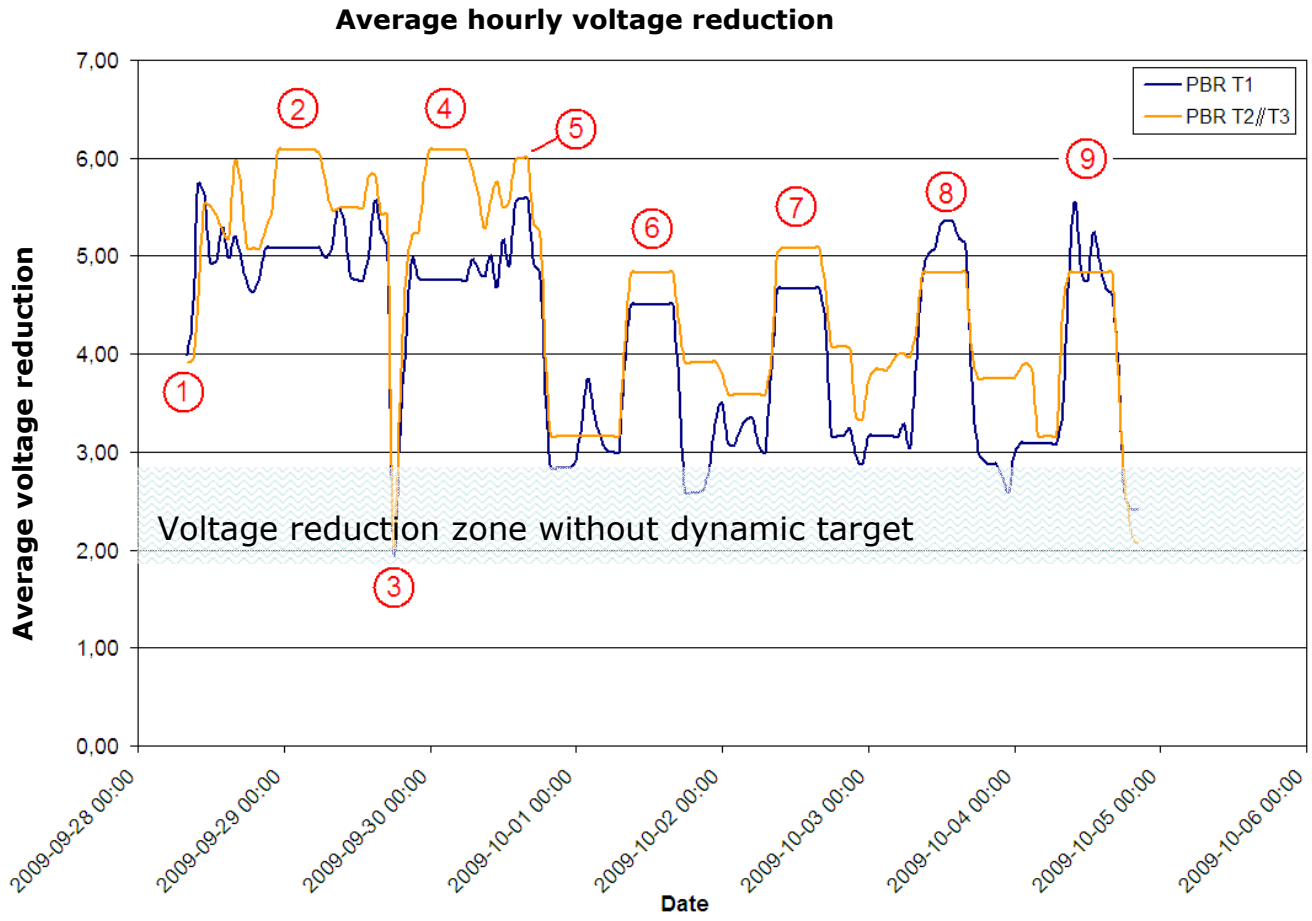
3. VVC Optimisation - Dynamic Calculation



3. VVC Optimisation – « Manual » proof of Concept

- Manual hourly simulation launched during one week using dynamic load and dynamic topology:
  - 24h/24h Monday to Wednesday
  - 8h/24h Thursday to Sunday

3. VVC Optimisation – manual calculation



3. Real Time Network Simulation

Challenges:

- Simulation robustness
  - Missing settings – e.g.: substation transformer impedance, tap changer settings, …
  - Missing measurements – e.g.: communication problem.
  - Database inconsistency.

- Simulation accuracy
  - Fixed load for commercial customer.
  - Hourly load profile.
  - Precision of measurements and dead band.
  - Database inconsistency.

Hydro Québec Distribution

Questions ?