The e-Radio™ Ecoport experience

Special IREC MCI info session

Oct 9th 2021

Part I Agenda

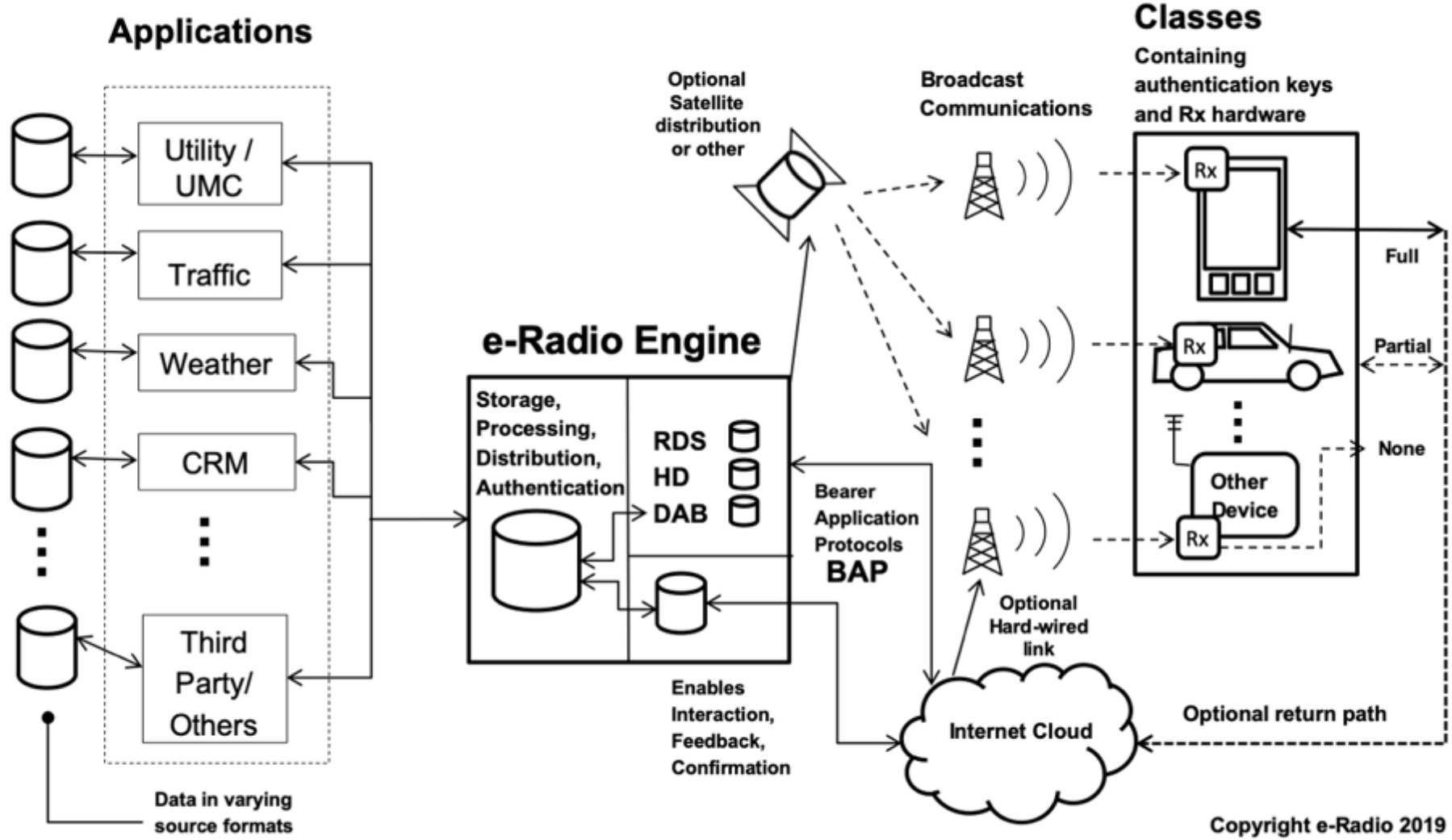
- e-Radio background
  - History of e-Radio
  - Preamble to CTA 2045
  - ANSI – CEA/CTA 2045 (Ecoport) events and timeline

e-Radio background : ITS

- e-Radio founded in 1999
- ITS :Intelligent Transportation System & Automotive telematics
- SAE driver/traveller informatics
- RDS TMC
- DAB TPEG
- ISO TC/204 WG10 meta language/official translation

e-Radio

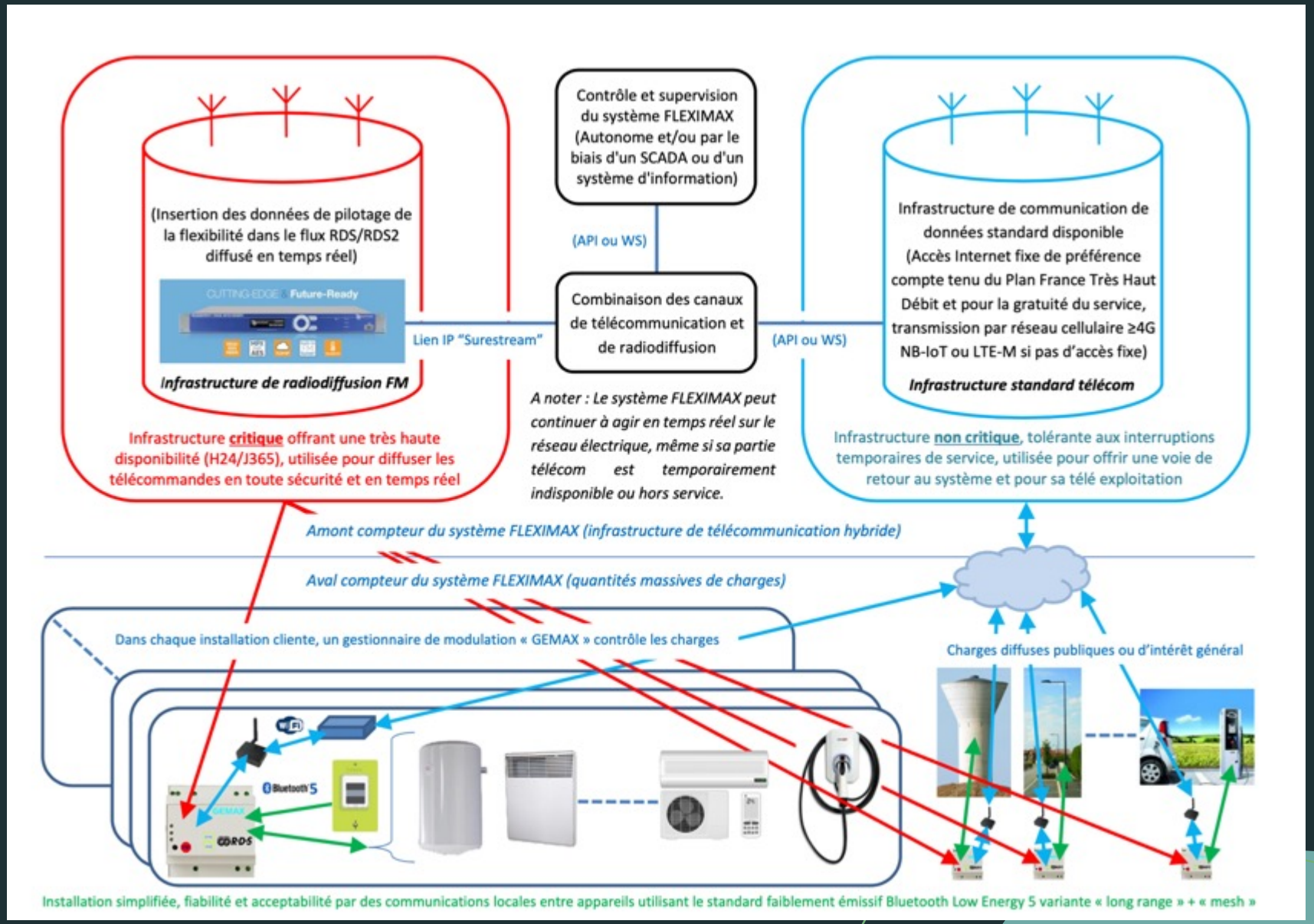
A Smart Grid Broadcasting Architecture



Why FM?

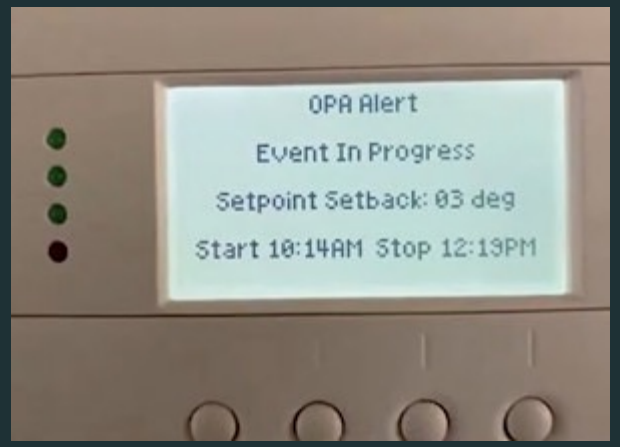
1. FM devices are easy to install – just plug and play
2. 99.9% of population covered by existing broadcast system
3. Adding FM to the existing IOT paradigm improves
   - Efficiency: one station to infinite devices over the airwaves
   - Cybersecurity: multi-factor authentication
   - Cost effectiveness: ~$1/year cost vs. ~$1/day value (per home)
4. Global scale & standards: GHG have no borders
5. FY 22+ Fleximax EU € 6.5M project to test FM-RDS

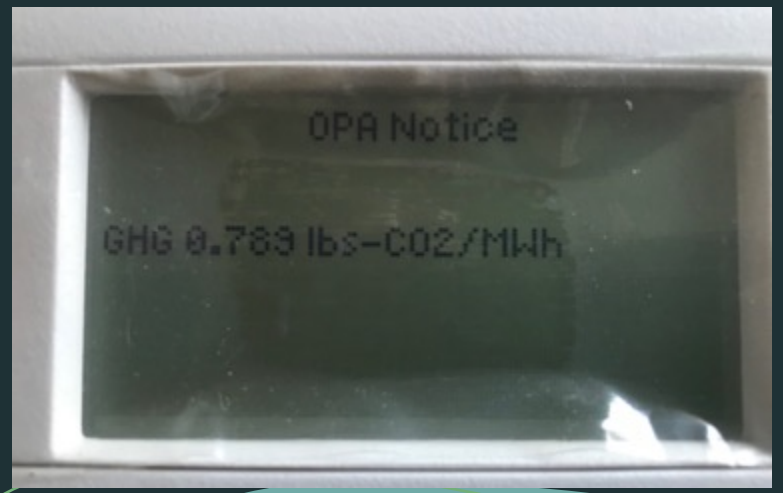
EU Fleximax project architecture



e-Radio background : PCT

- e-Radio CEC PIER T24 PCT 2006-8
- 2008 PCT demo in 2021 in Sacramento





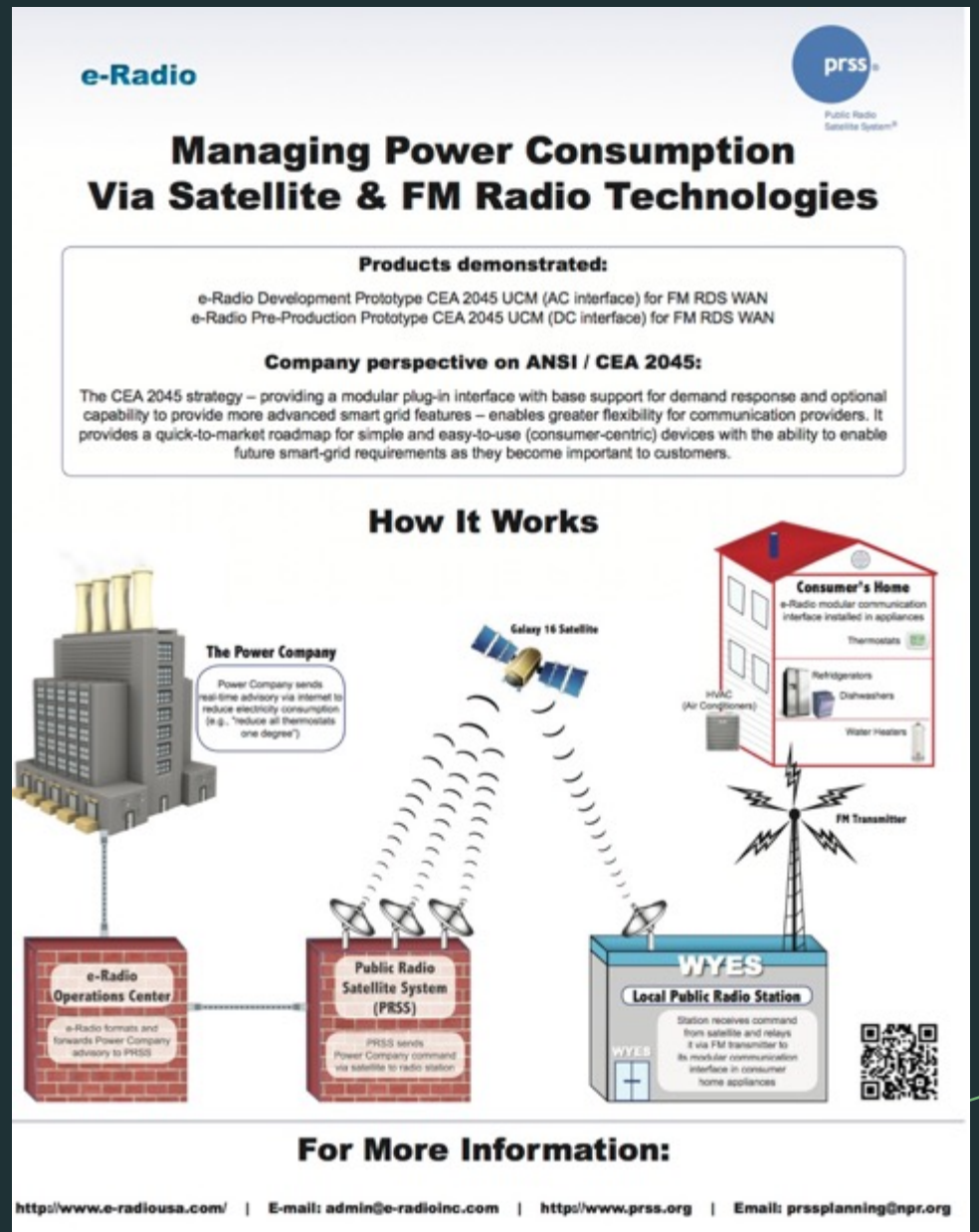
e-Radio background : Appliances

- e-Radio equipped white appliances 2008 w major OEM

e-Radio background and history : 2045

- ~2010 EPRI early days of 2045, why MCI?
- level playing field : metrics
- future proof
- Utilities can simply ship UCMs to customers, NO TRUCK ROLLs

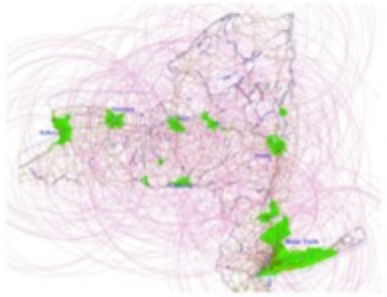
e-Radio history :EPRI/NPR/e-Radio 2011 demo



e-Radio history : 2012 IEEE ITEC paper

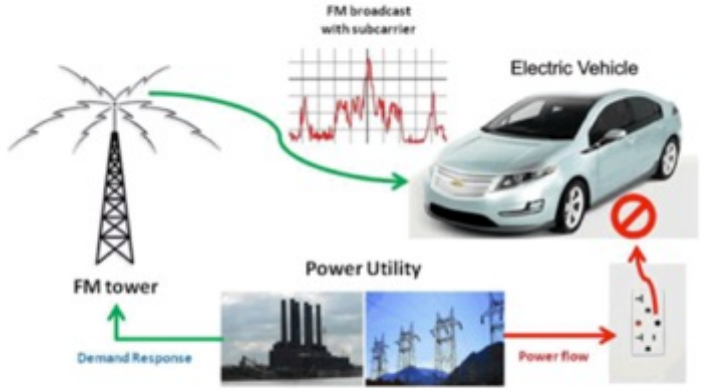
FM RDS for Smart Charging of PEVs

1. Motivation



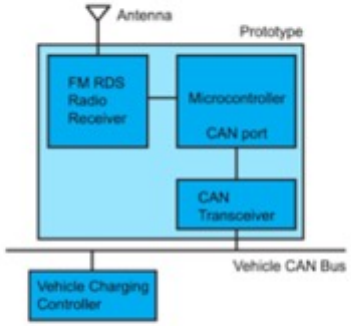
- Road vehicles already have an optimized and pre-established communication channel in place: FM radio broadcast receivers
- Many new FM radio head units have the Radio Data System (RDS) hardware and software built in
- Coverage and infrastructure installation cost issues facing other technological standards are addressed by large public FM Radio networks, such as the Public Radio Satellite System (PRSS) in the U.S., the CBC in Canada, and the BBC in the UK as well as privately-owned FM networks that offer additional and redundant coverage of most geographic markets
- The coverage of New York State shown here is an example of extensive coverage already in existance

2. Architecture



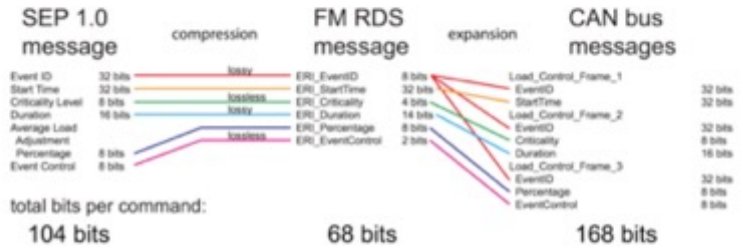
- Electricity pricing and load control information originates at the power utility or an independent system operator (ISO) and is sent, for example, by OpenADR XML to the e-Radio aggregator server
- e-Radio translates the utility/ISO Smart Energy Profile (SEP 1.0 was implemented on the prototype due to availability) messages using a mapping and compression algorithm into a format suitable to one-way low bandwidth broadcasting (e-Radio FM RDS Utility Message Channel or UMC) and directs those messages to the e-Radio data-casting network
- Messages are distributed to the FM broadcasters via terrestrial and/or satellite networks to where the FM RDS data is embedded within 57kHz subcarrier of the existing FM transmission
- FM RDS capable receivers capture the signal and data within the large coverage area of the station transmitter; however, only the e-Radio prototype is capable of decoding the EV-specific commands for the vehicle

3. Design of the Prototype



- The prototype is executed as an on-board stand-alone FM RDS gateway that plugs into the existing vehicle Controller Area Network (CAN) bus via a diagnostic port connector
- The dedicated e-Radio FM RDS receiver allows other broadcast data applications to reach the vehicle bus in addition to EV charging control protocol (like emergency notifications)
- The gateway prototype expands the compressed messages from e-Radio FM RDS format to CAN bus frames after reception
- The gateway CAN interface also manages the necessary flow-control parameters for multipart messages and the responses to messages on the bus
- Existing standards for EV charging including SEP 1.0, SAE J2847/1 and SAE J2836/1 provided the basis for the prototype CAN bus messages

4. Message Mapping / Compression



total bits per command:

104 bits | 68 bits | 168 bits

5. Summary

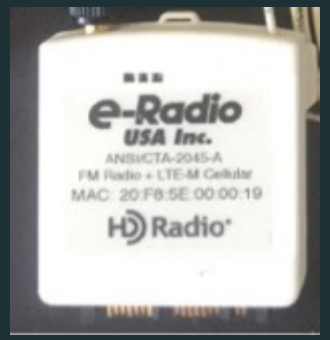
- FM RDS was successfully demonstrated as a viable solution for control of EV charging
- Load control (an immediate reduction in charging power usage) and update of time-of-use pricing tables (affecting both current and future charging schedules) were both successfully demonstrated using a basic set of EV charging control messages in accordance with SEP 1.0, SAE J2847/1 and SAE J2836/1 via a live FM RDS channel (CBC in Toronto) to an EV in the field
- e-Radio plans to undertake real-world validation of the smart-grid impact (economically and technically) of FM RDS in cooperation with utilities, standards bodies and broadcasters

e - Radio

SAE J1962,
SAE J1772

e-Radio history : CTA 2045 projects

- 2016-2018 BPA PNW WH study
- 2015+ Major Utility FL lab & Tampa/St. Pete field tests
  - WH
  - EVSE
  - PCT
  - Pool Pumps

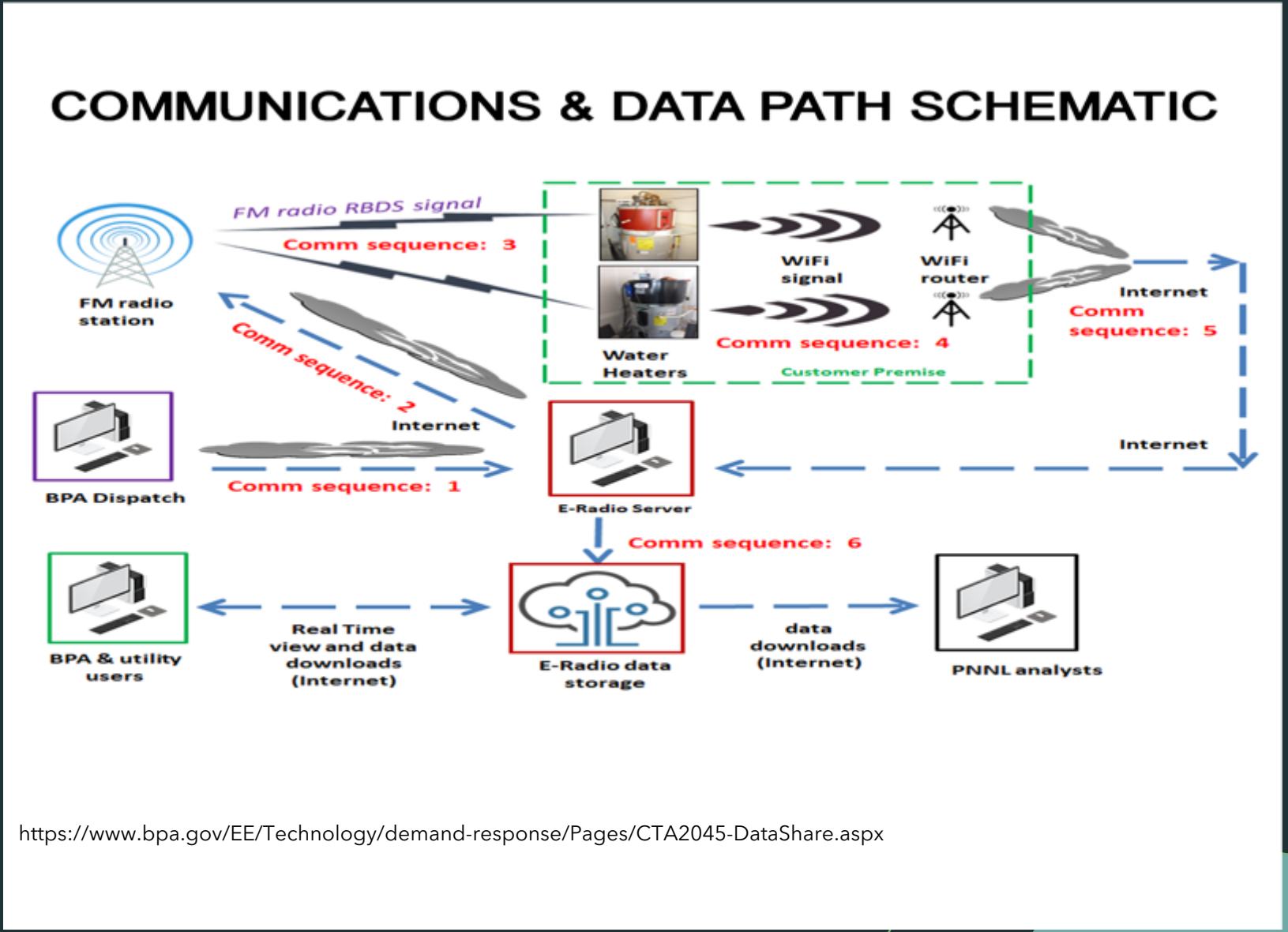


- 2022 BPA/PNNL HVAC: Mini splits

Part II

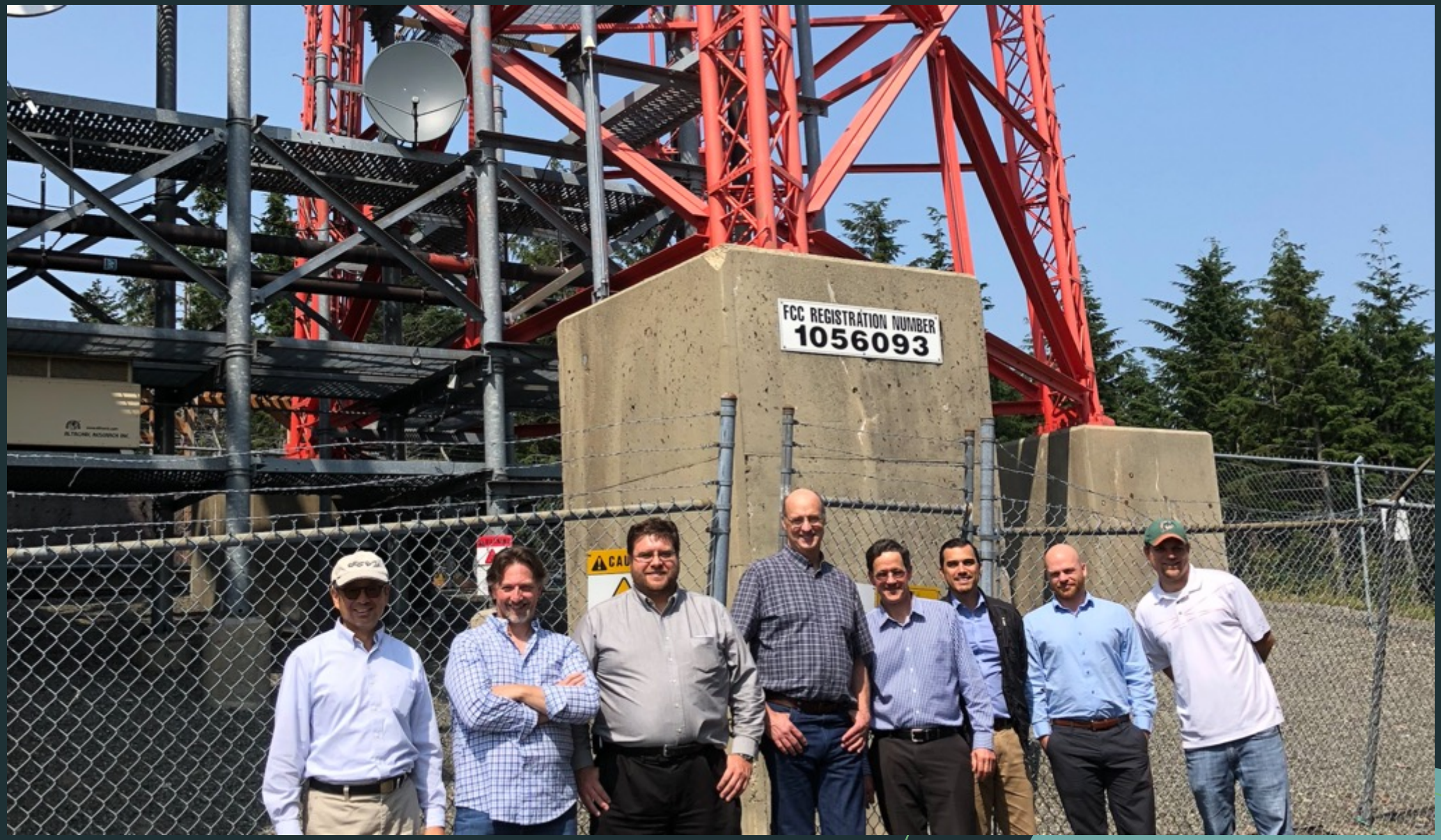
- BPA tour of Broadcast facilities in OR, WA
- California LMS & FDAS
- Euro projects
- Consumer metrics in relations to Ecoport
- Conclusions & Next Steps (IREC)

BPA WH project architecture



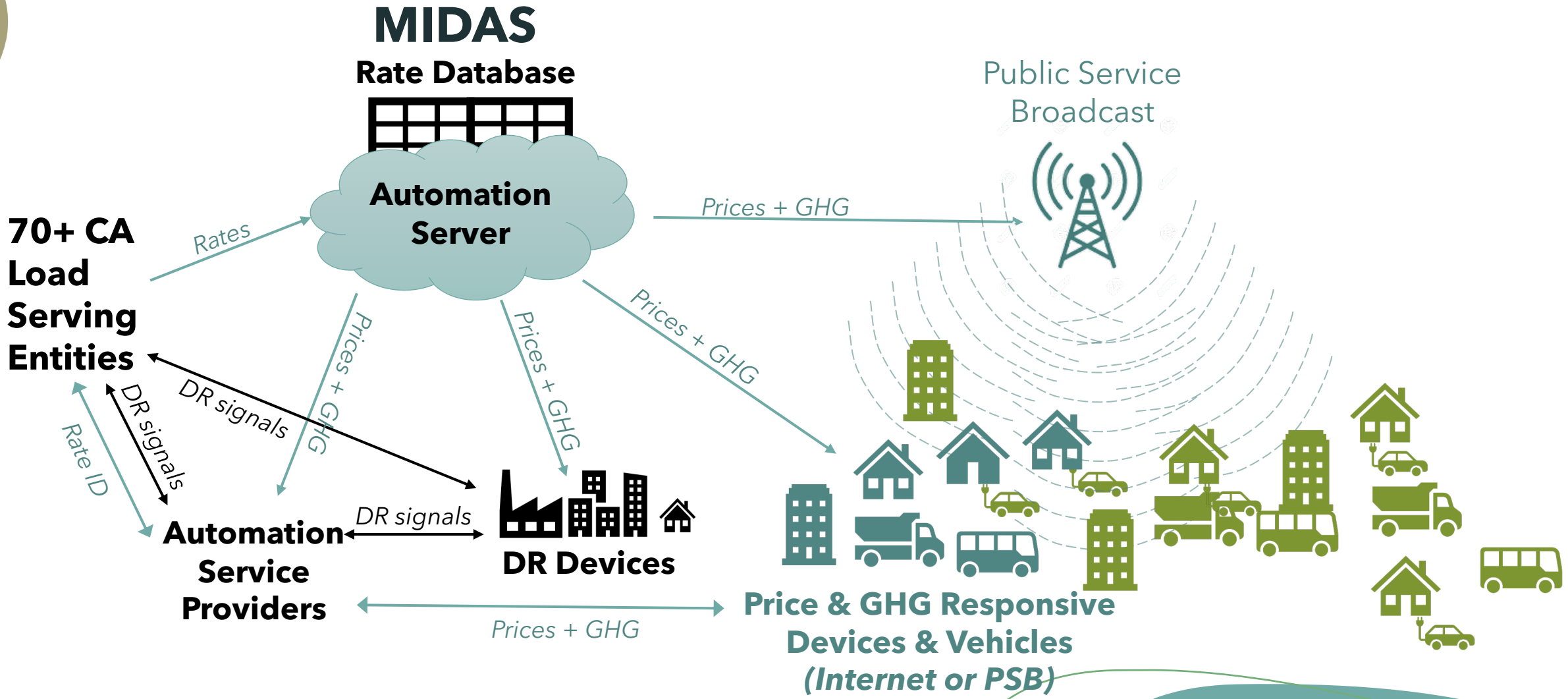
https://www.bpa.gov/EE/Technology/demand-response/Pages/CTA2045-DataShare.aspx

2018 BPA tour of Broadcast infrastructure



2018 BPA tour of Broadcast infrastructure

CEC Vision for Load Flexibility

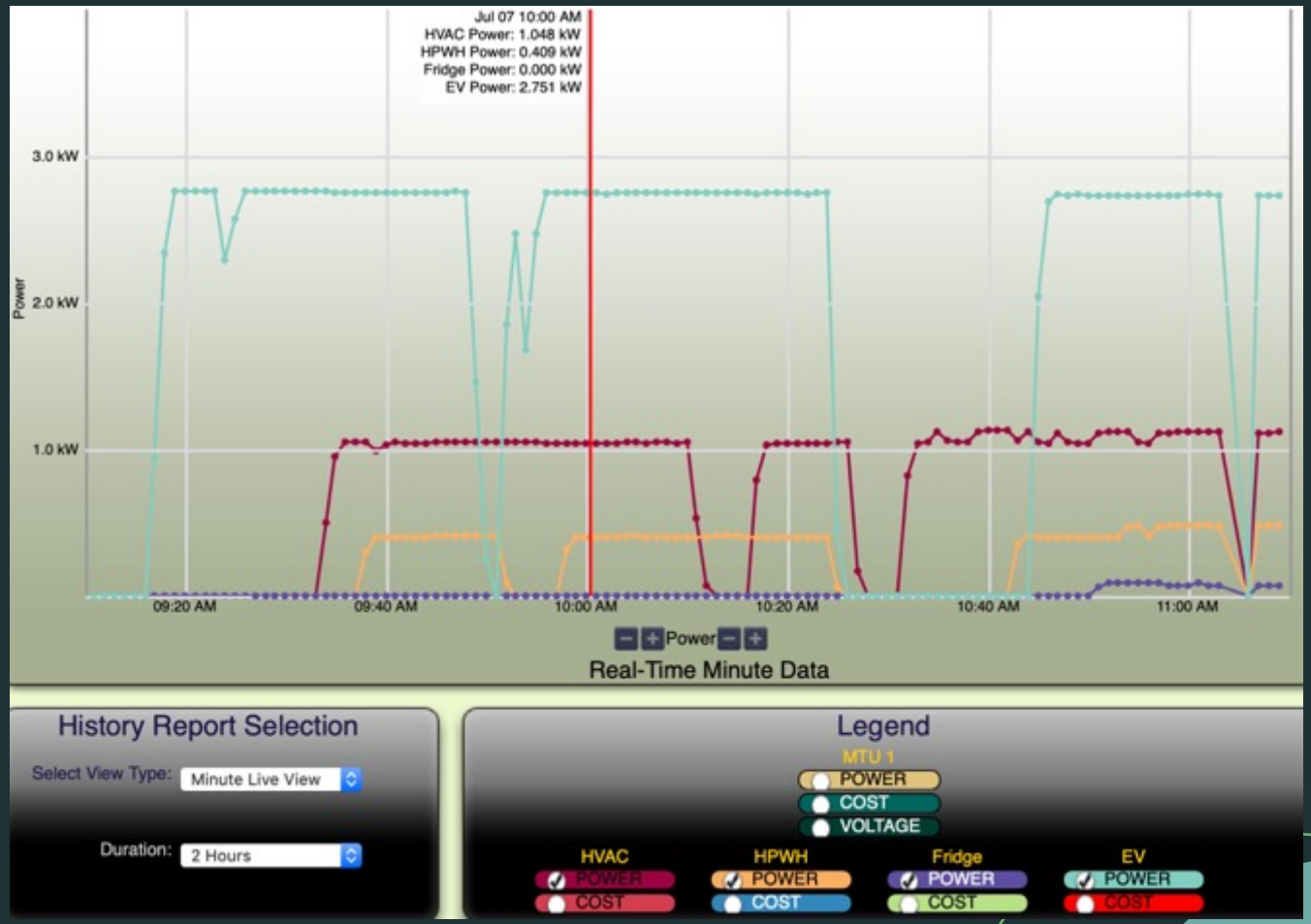


e-Radio

Live demo to CEC Load Management & Appliances Standards team July 7th 2021 : EVSE, EV

Live demo to CEC Load Management & Appliances Standards team July 7th 2021 : HPWH

Live demo to CEC Load Management & Appliances Standards team July 7th 2021



Consumer metrics

- How much value is created
- How many kWh saved, used (server farms = ~%2 of all elec generated)
- How much does consumer save
- How much GHG impact: lb/kWh
- Safety, Security & privacy
  - RF & biomed effects (higher data = higher freq, higher absorption including skin)
  - listen but not talk
  - talk optional
  - Hybrid FM arch as 2FA

Conclusions and next steps (IREC)

- Framework for model , EPA mileage loop like
- Estimate & error bars
- Look at possible funded effort
- IREC to publish model for others to use and record data for refinement