Distributed Generation's Role in the Distribution Circuit of the Future

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Introduction

"Engineering, technical and business excellence to achieve perfect safety and reliability at less than today's delivery cost."

-E&TS Vision

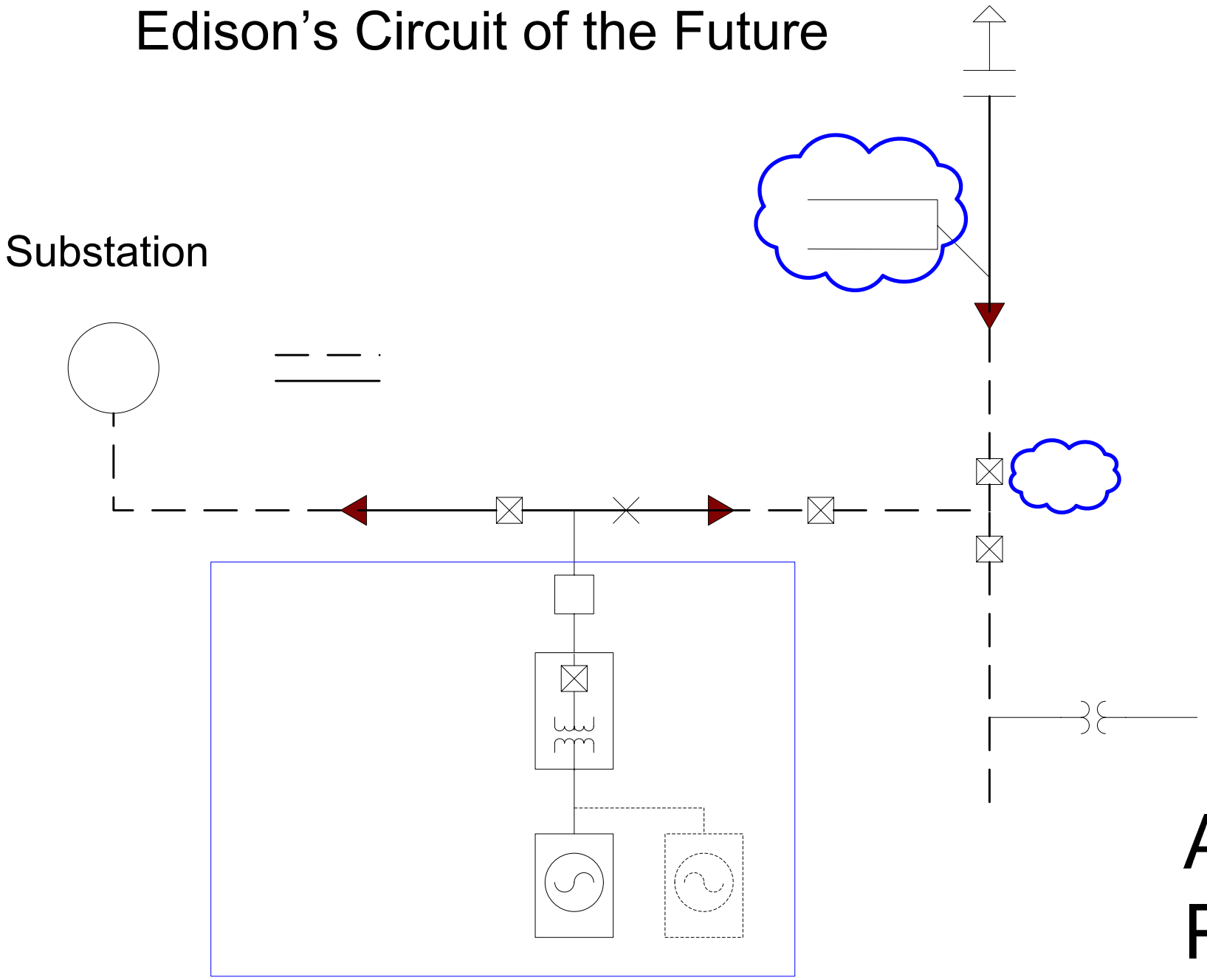
Overview

- Overview Distribution Circuit of the Future
- Technology
- Uses of technology
- Perception of technology
- Items to Overcome
- Steps taken to overcome obstacles
- Summary

Overview of Distribution Circuit of The Future

- Why are we building the Circuit?
- What's New?
  - Topology
  - Technology
- When will it be constructed?

Edison's Circuit of the Future



AR-PS-FI -

Technology

- Two technologies
  - Fuel Cell
  - Inverter
- Inverter based on power electronics
  - Responds at sub cycle speeds
- A fuel cell coupled with an inverter can provide:
  - Watts
  - VARs
  - Combination of both

Technology (Continued)

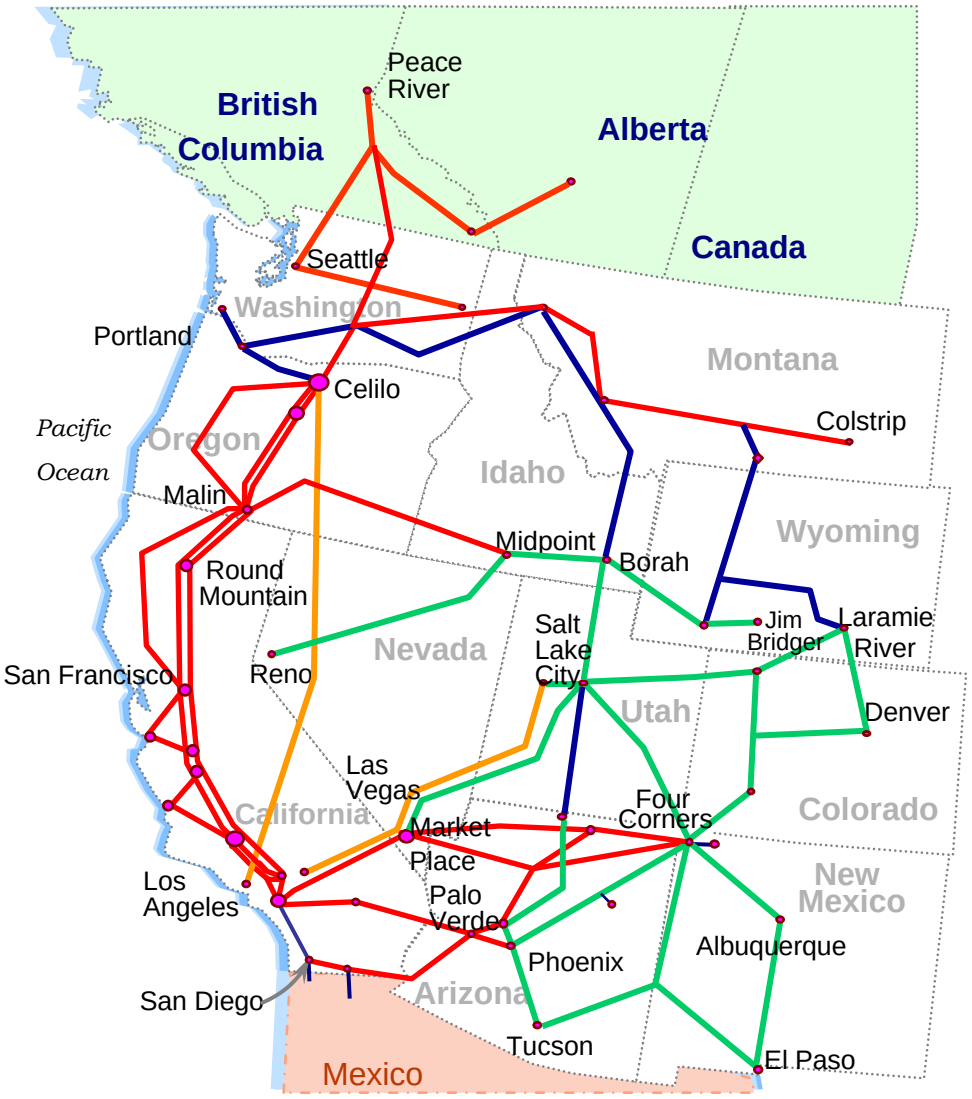
- Fuel cells are based on a chemical process other than combustion
  - The chemical process can be reversed to allow fuel cells to act as energy storage devices

Uses of Technology

- Power Producer (Watts)
  - Thermal limits
    - Medium term maximum output to prevent circuits from overheating (ramping up to above 100% of nominal output for several hours at a time)
    - Prevent overloading of the line during peak demand
    - Increase line ratings due to power being supplied by DG.
    - Flatten load curves through the use of reversible fuel cells

Uses of Technology (cont.)

- System Stability
  - Quick ramping up or ramping down of power to keep areas in the same phase for successful reclosing of breaker
- HVDC Operation

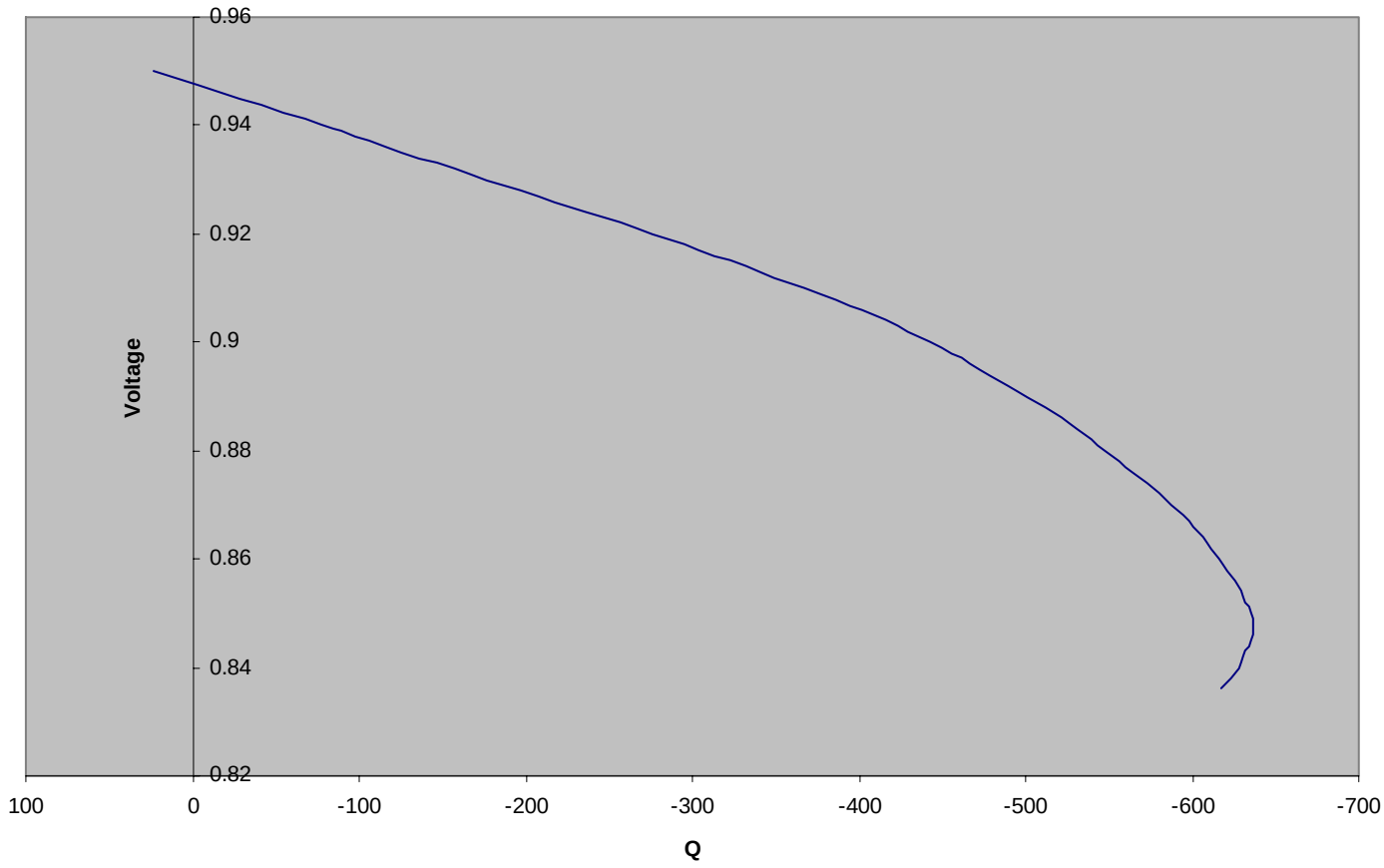

British Columbia
Peace River
Alberta
Canada
Seattle
Washington
Portland
Montana
Celilo
Colstrip
Pacific Ocean
Oregon
Idaho
Malin
Wyoming
Midpoint
Borah
Round Mountain
Jim Bridger
Laramie River
Salt Lake City
Nevada
San Francisco
Reno
Utah
Denver
Las Vegas
Four Corners
California
Market Place
Colorado
New Mexico
Los Angeles
Palo Verde
Albuquerque
Phoenix
San Diego
Arizona
Tucson
El Paso
Mexico

WECC Map

Uses of Technology (cont.)

- Reactive Power Support (VAR)
  - Voltage Regulation
  - VAR Support
  - Voltage Stability

Q-V Stability Curve



Perception of Technology

- Viewed as a technology that must be accommodated, not viewed as an asset
  - Circuits were not built to incorporate DG
  - IEEE 1547 – states that any disturbance on the circuit requires DG to disconnect
    - Protect power system if fault occurs
- From Nuisance to Asset

Items to Overcome

- Technological Barriers
  - Control
  - Communication
- Business Barriers
  - Complexities of Investor Own Utility Business Model
  - Win / win model for both utility and DG integrator
  - New business model for DG integration into utility

What is being done to overcome obstacles

- Circuit of the future as test bed for DG with connection point
- Need standardization to minimize cost of interconnecting new generation

Summary

- Using the full capabilities of fuel cells and inverters presents some attractive qualities for utility use
- Programs such as Circuit of the Future offer opportunity to advance this potential. SCE is interested in appropriate partnering.
- A number of technological and business issues need to be resolved

Questions?