Saluda Operation Workshop Fall - 2005

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SCE&G System Control

Contents

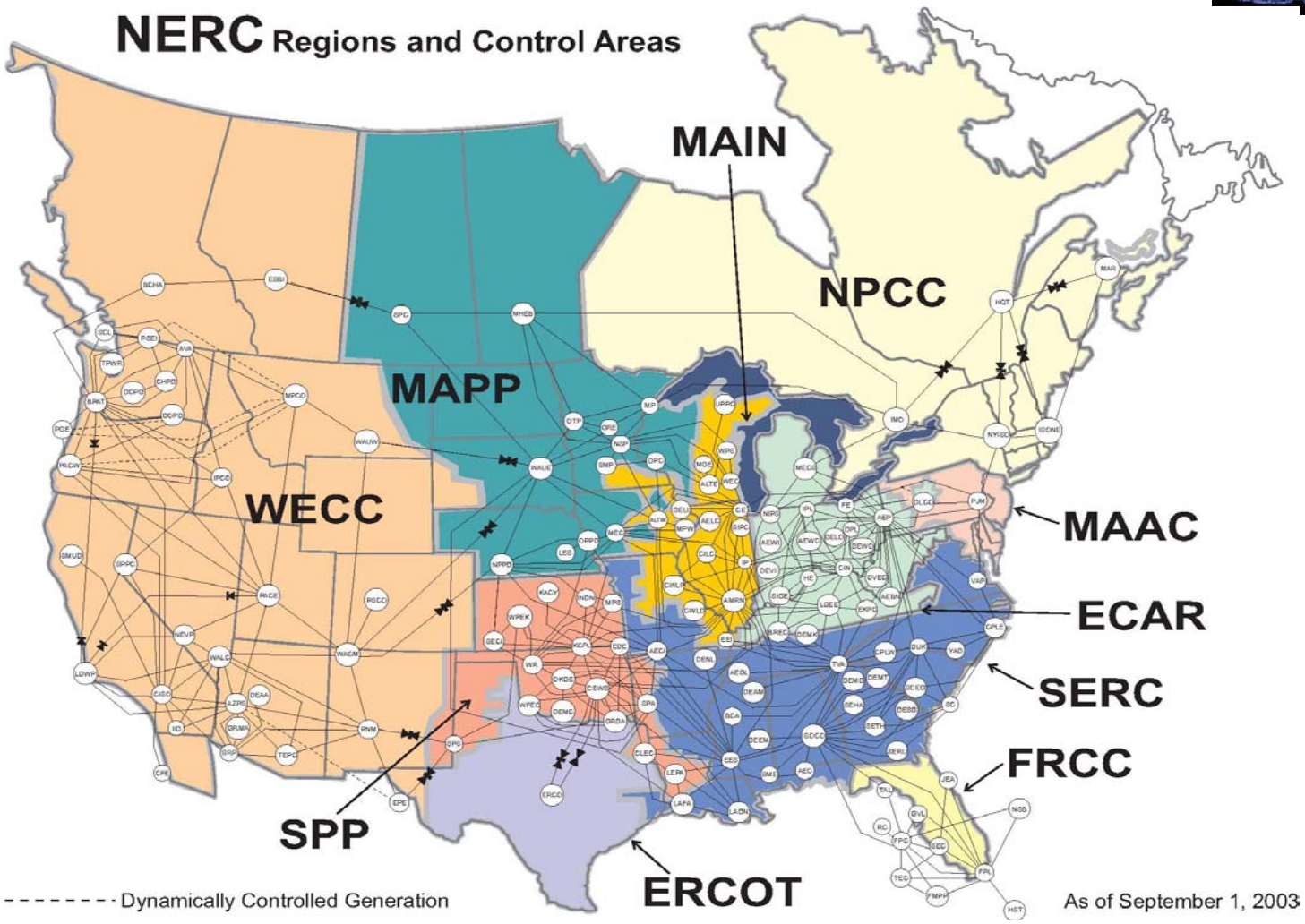
- We are going to talk about The Grid
- We'll talk about How The Grid Work
- We'll talk about Balancing the Grid
- We'll talk about The Grid Rules and who makes them
- We'll talk about Emergencies on the Grid
- We'll talk about why Saluda is used in Emergencies

The Grid

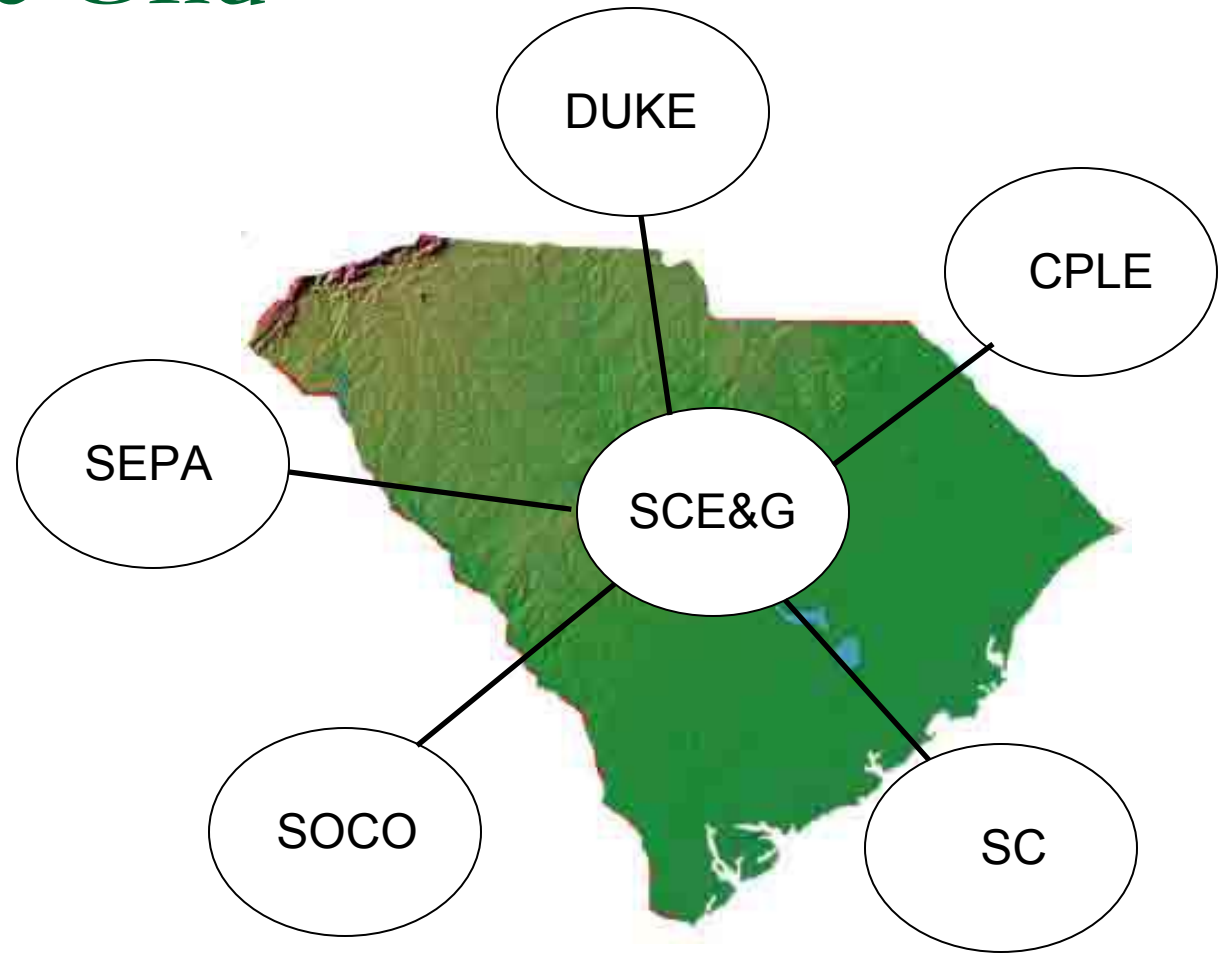
What is The Grid? (aka the Bulk Power System)

- The large towers you see crossing the highway make up the grid
- Hop on one of these to get across the country at the speed of light

The Grid


NERC Regions and Control Areas
MAIN
NPCC
MAPP
WECC
MAAC
ECAR
SERC
FRCC
SPP
ERCOT
Dynamically Controlled Generation
As of September 1, 2003

The Grid



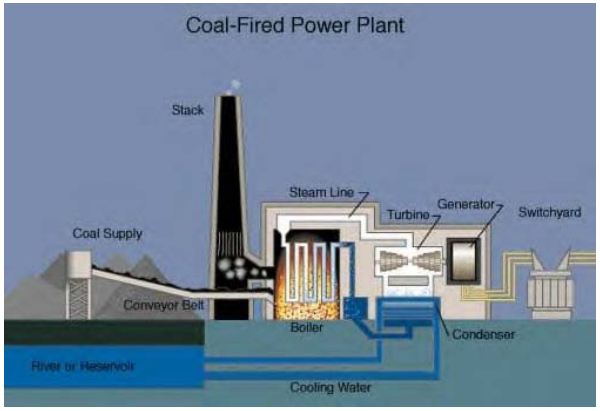
SCE&G is a Control Area that is connected to 5 other Control Areas

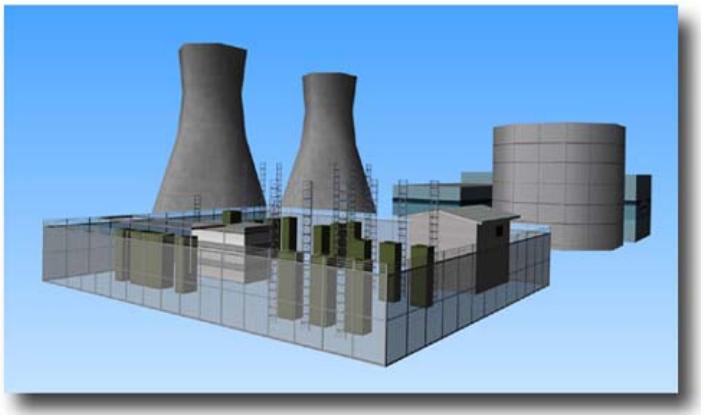
How the Grid Words

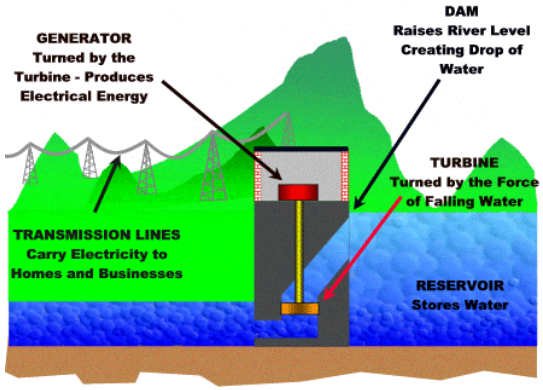
The Customers inside Control Areas demand power.

How the Grid Works

Power companies make enough power to meet that demand.







- Fossil
- Nuclear
- Hydro

Balancing the Grid

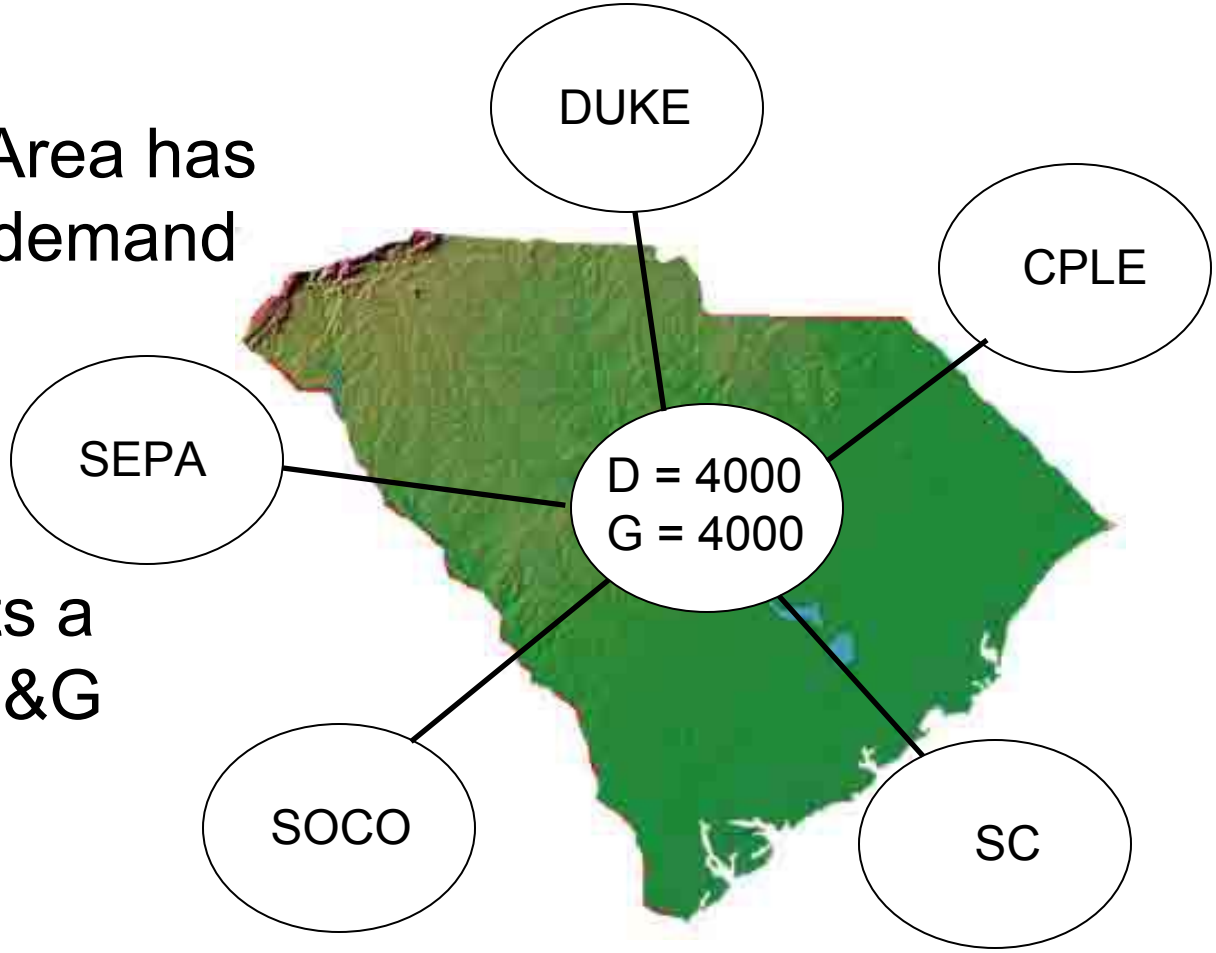
- Once the Demand and Generators are in place. They must be balanced.
- “Balanced” means that there is enough electricity flowing from the Generators to meet the Customer’s demand.
- This balance is measured in real time.
  - Remember the speed of light comment?

Balancing the Grid

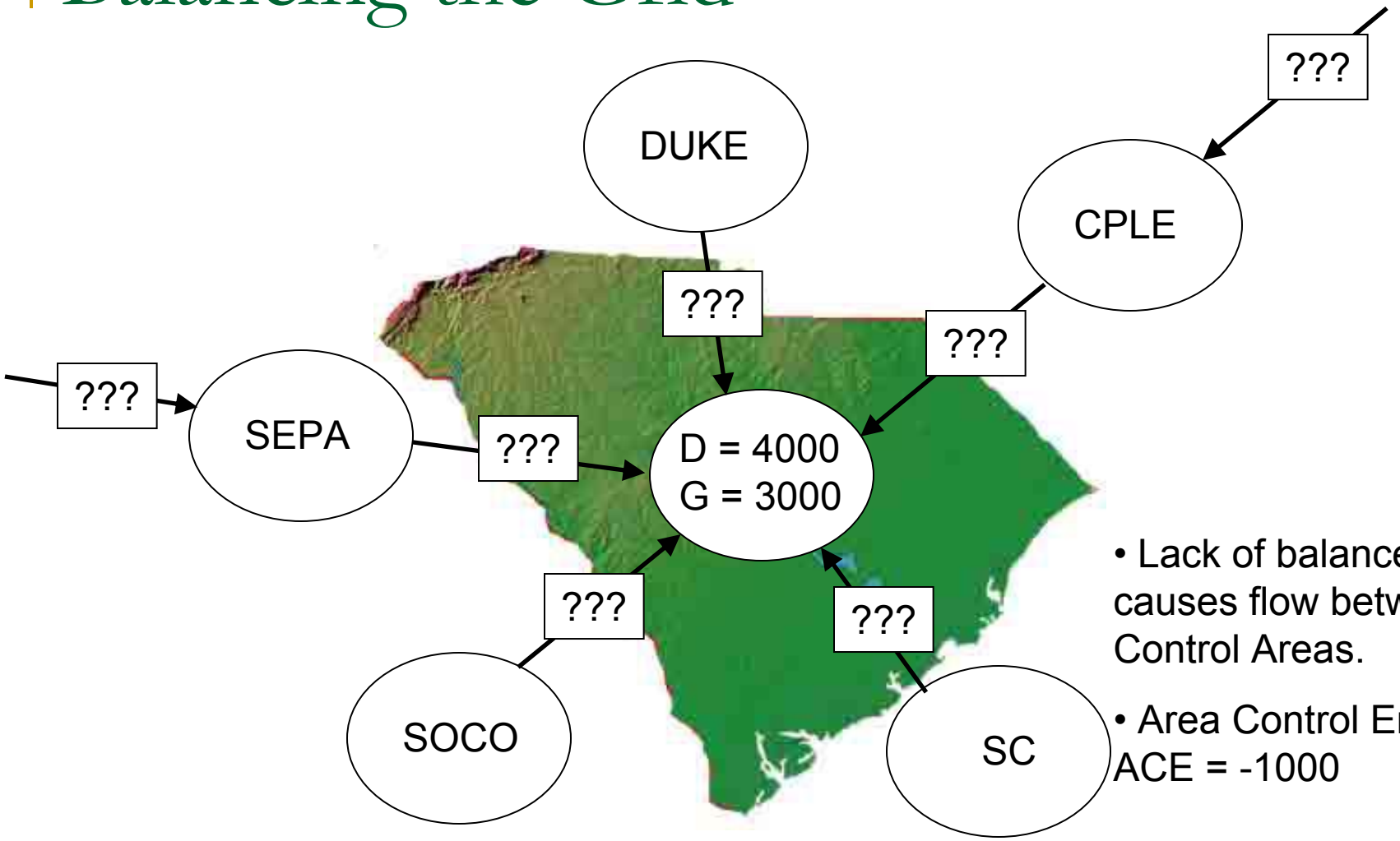
- System Controllers match changes in Demand by dispatching Generation
  - Load changes through out the day, but seasonal patterns are basically the same.
  - Winter patterns peak in the morning
  - Summer days peak in the afternoon

Balancing the Grid

- Each Control Area has to balance its demand
- This represents a balanced SCE&G Control Area

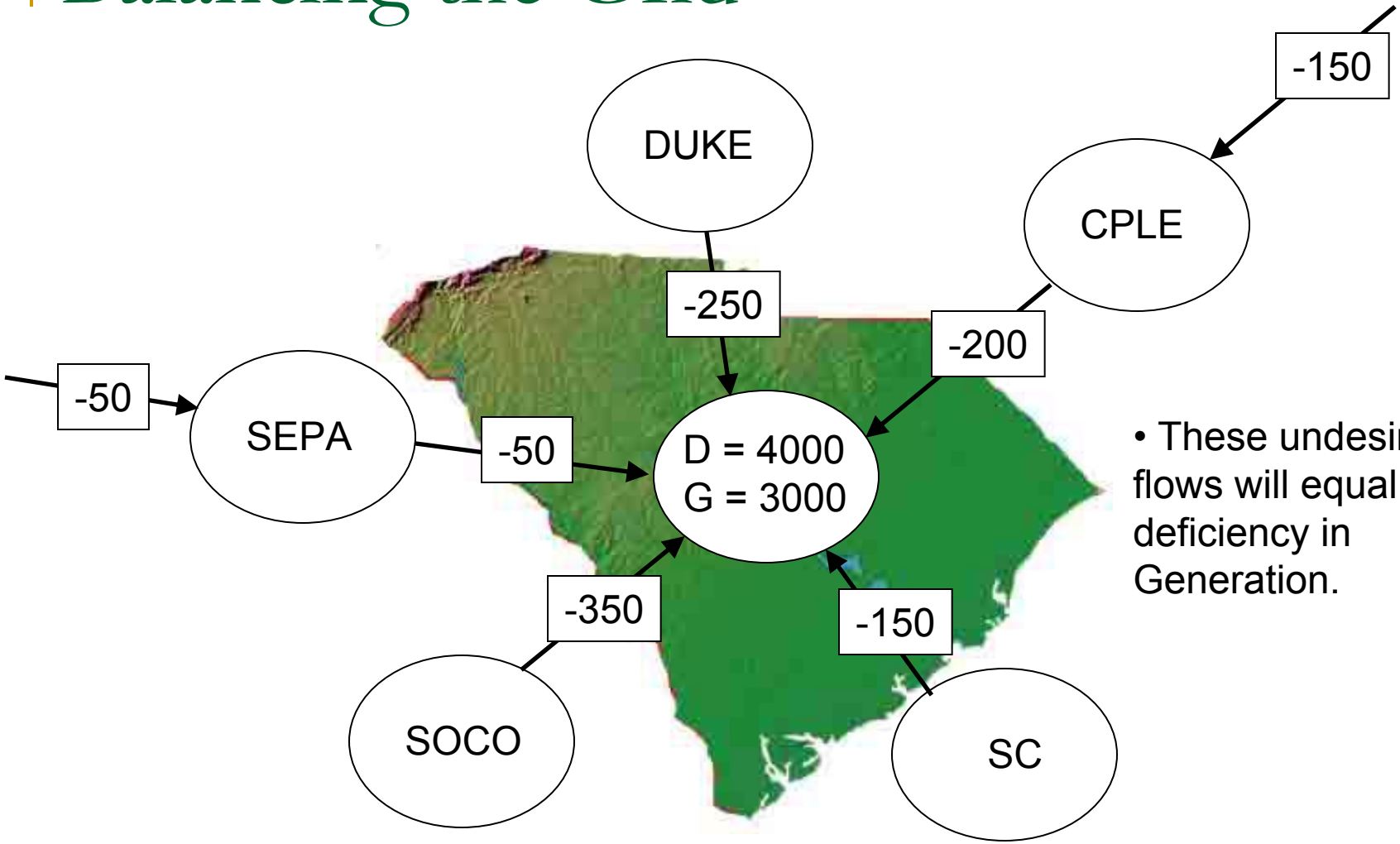


Balancing the Grid



- Lack of balance causes flow between Control Areas.
- Area Control Error ACE = -1000

Balancing the Grid



- These undesirable flows will equal the deficiency in Generation.

Balancing the Grid

- What causes imbalance? (4)
  - Power plants break down – After all, they are only machines.
  - Fuel problems.
  - Power lines don't allow power to flow.
  - Purchased power is curtailed.
  - Etc…

Balancing the Grid

- In such a case, what must SCE&G do to return balance? (2)
  - 1 – Increase generation
  - 2 – Reduce Demand
- What if SCE&G does not return balance?

The Grid Rules

- Who Makes the rules?
  - North American Electric Reliability Council (www.nerc.com)
  - Southeastern Electric Reliability Council (www.serc1.org)
  - VACAR – Virginia/Carolinas Subregion.
- What are the Rules?
  - The “NERC Reliability Standards” – over 800 requirements
  - The SERC Compliance Subcommittee monitors compliance.
  - VACAR Taskforces is how we coordinate with our neighbors.

The Grid Rules

- BAL–002– 0 is what requires us to run Saluda the way we do.
- It says that:
  - As a minimum, the Balancing Authority or Reserve Sharing Group shall carry at least enough Contingency Reserve to cover the most severe single contingency.
- What is SCE&G's most severe single contingency?

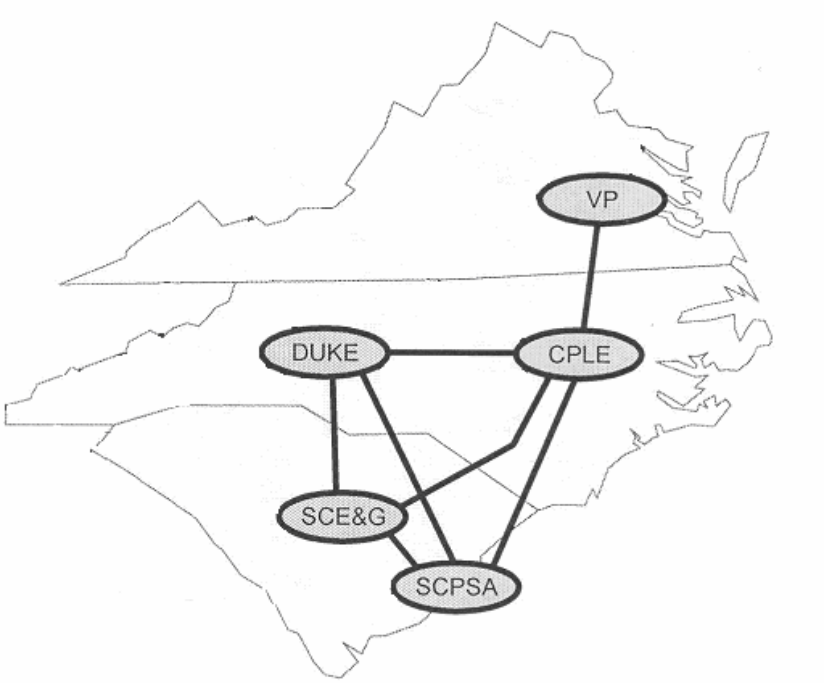
The Grid Rules

VC Summer Nuclear Station is in Jenkinsville, SC. This plant generates enough power in one hour to power over 1000 homes for 1 month!

Generation Capacity = 1000MWs >>>> We don't want to carry 1000MW in reserves

The Grid Rules

- To avoid carrying 1000MWs in reserves, SCE&G has joined the VACAR Reserve Sharing group.
- The VACAR RSG collectively carries 1500MW in reserves
- SCE&G must carry ~200 of the 1500.



Emergencies on the Grid

- If a Generator trips, the Balancing Authority must recover 100% of the loss in 15 minutes.
- Only a few units on SCE&G's system can generate up to 200MWs in 15 minutes.

Emergencies on the Grid

- Compliance reported per incident to VACAR
- Compliance reported Quarterly to SERC.

Emergencies on the Grid

- Example:
  - Williams Station trips
  - SCE&G ACE = -600MW
  - SCE&G has 15 minutes to get 600MW on its system.
  - Load up 150MW of available units at Fairfield
  - Load up 200MW at Saluda & call on 250MW of reserves from Duke
  - Buy 600MW from spot energy market next hour.

Emergencies on the Grid

- Example 2:
  - CPLE calls SCE&G and calls on 150MWs of contingency reserves.
  - SCE&G deliver in 1 minute on 0MW ramp
  - SCE&G ACE instantly become -150
  - SCE&G now has ??? minutes to recover balance
  - SCE&G loads up 1 last unit at Fairfield Pumped Storage and loads up 1 unit at Saluda.
  - Is that enough?
  - No – SCE&G loads up one more unit at Saluda.

Emergencies on the Grid

- This is not just a spreadsheet. This is how it really happens.
- And it happens without warning.

- After the fact, SCE&G and CPLE report compliance to each other.

Why use Saluda?

- Increasing generation by 200MW in 15 minutes is not easy.
- That's about 13.5MW/minute
- VC Summer Nuclear increases at 1MW/minute
- SCE&G coal averages 5MW/minute
- SCE&G can "Quick start" gas turbines for 75MWs – only 50% success rate; not reliable!

Review

- Generation trips can happen at any time.
  - There is always exposure
  - Summer afternoons and Winter mornings are more likely for sudden emergencies
- There are many factors that can cause an interruption of generation.
- There are few warnings.
- Saluda is the reliable option for assuring the lights stay on.

Questions?