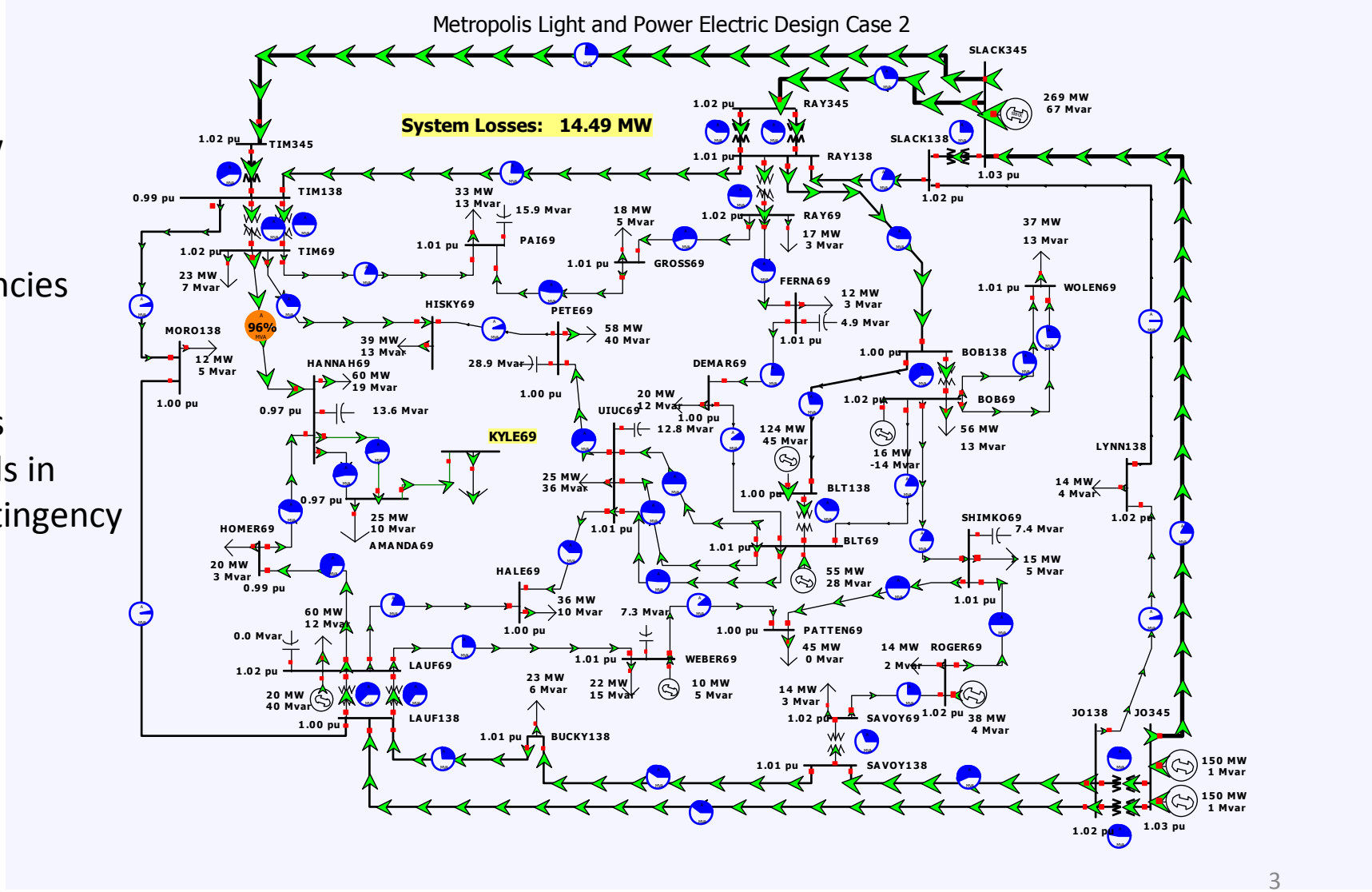
Lecture 3

Power Flow And Design

- One common usage of the power flow is to determine how the system should be modified to remove contingencies problems or serve new load
  - In an operational context this requires working with the existing electric grid, typically involving re-dispatch of generation.
  - In a planning context additions to the grid can be considered as well as re-dispatch.
- In the next example we look at how to remove the existing contingency violations while serving new load.

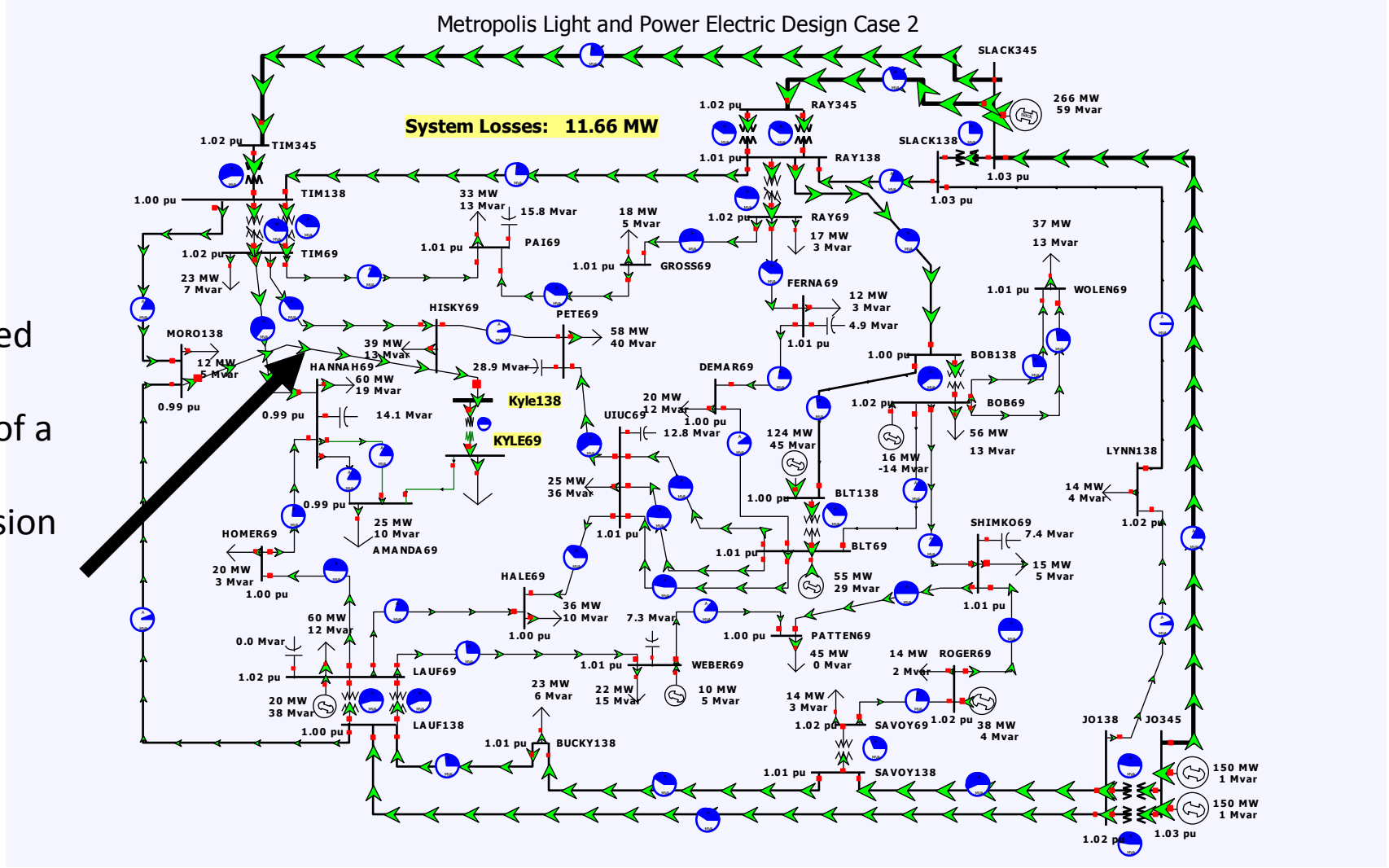
An Unreliable Solution: some line outages result in overloads

Case now has nine separate contingencies having reliability violations (overloads in post-contingency system).



A Reliable Solution: no line outages result in overloads

Previous case was augmented with the addition of a 138 kV Transmission Line

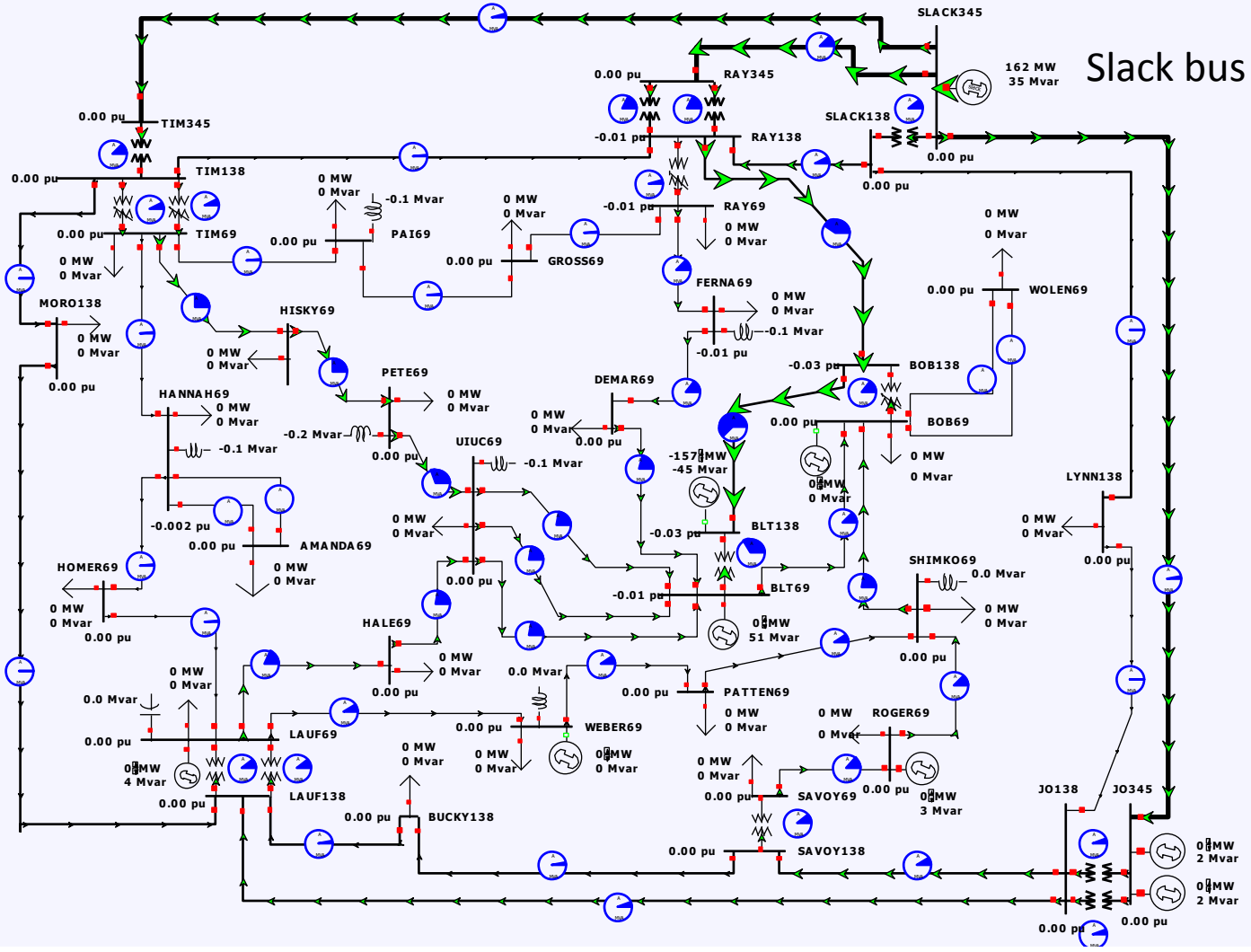


Generation Changes and The Slack Bus

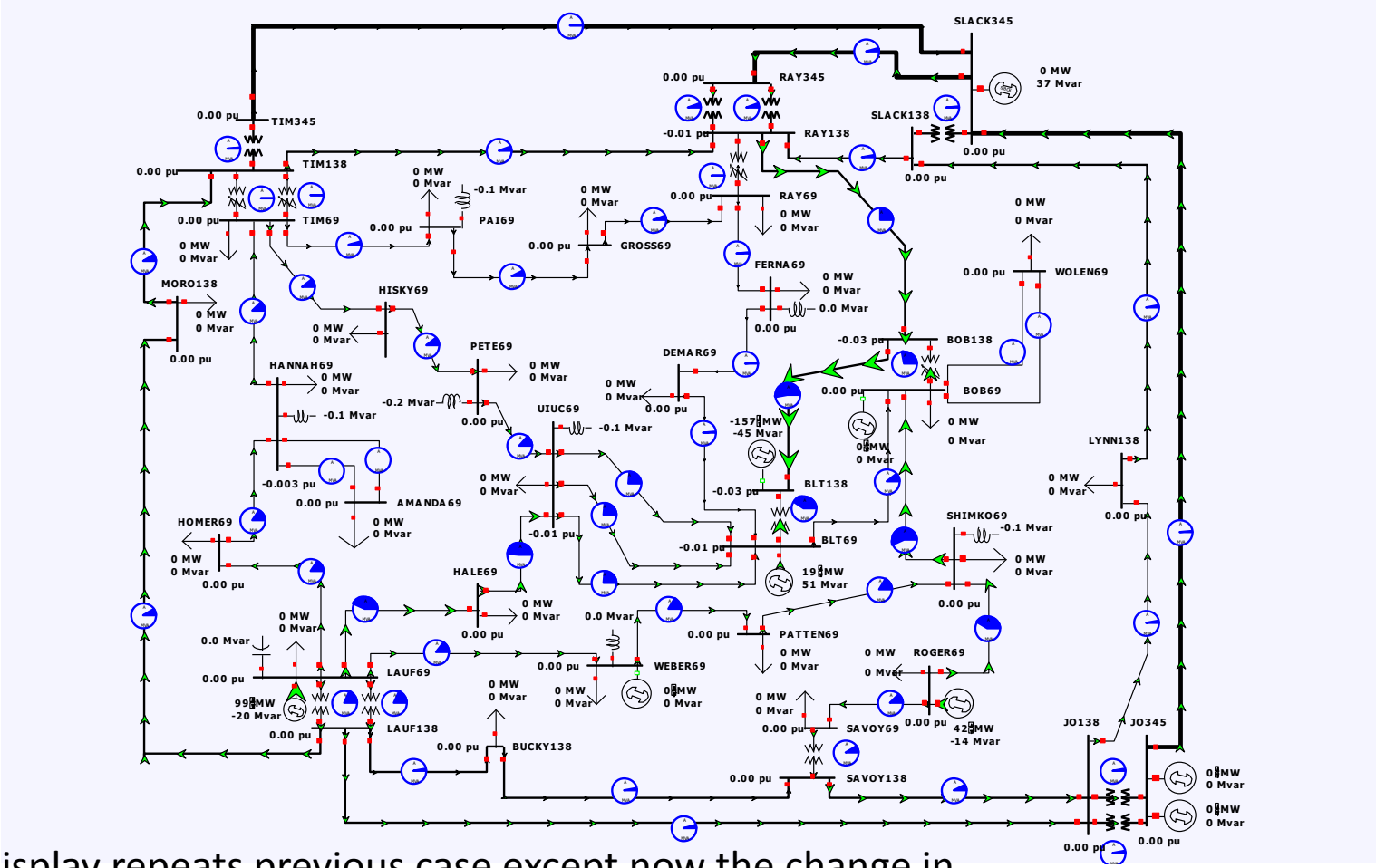
- The power flow is a steady-state analysis tool, so the assumption is total load plus losses is always equal to total generation
  - Generation mismatch is made up at the slack bus
- When doing generation change power flow studies one always needs to be cognizant of where the generation is being made up
  - Common options include “distributed slack,” where the mismatch is distributed across multiple generators by participation factors or by economics.

Generation Change Example 1

Display shows "Difference Flows" between original 37 bus case, and case with a BLT138 generation outage; note all the power change is picked up at the slack



Generation Change Example 2



Display repeats previous case except now the change in generation is picked up by other generators using a "participation factor" (change is shared amongst generators) approach.