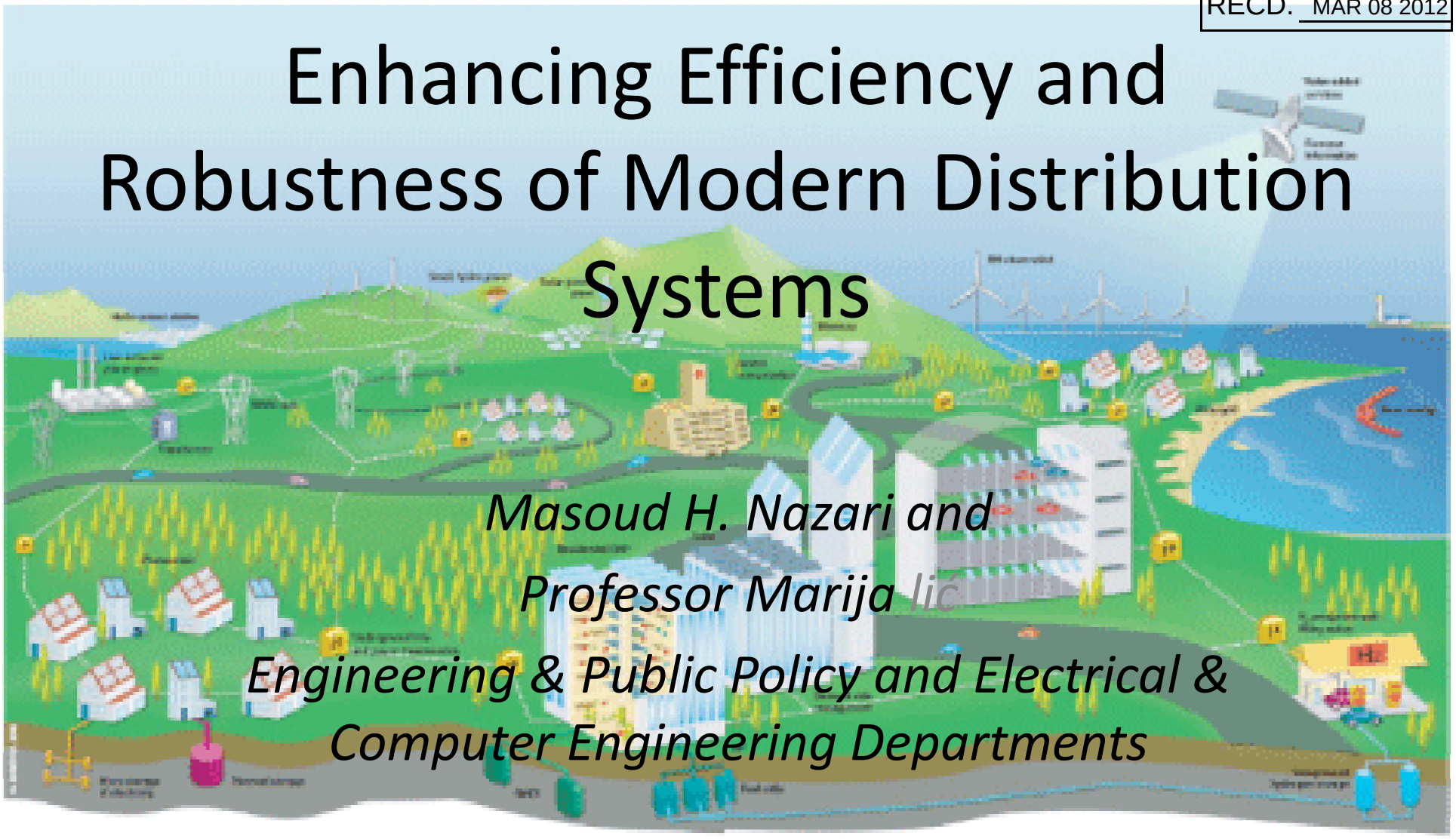
Enhancing Efficiency and Robustness of Modern Distribution Systems



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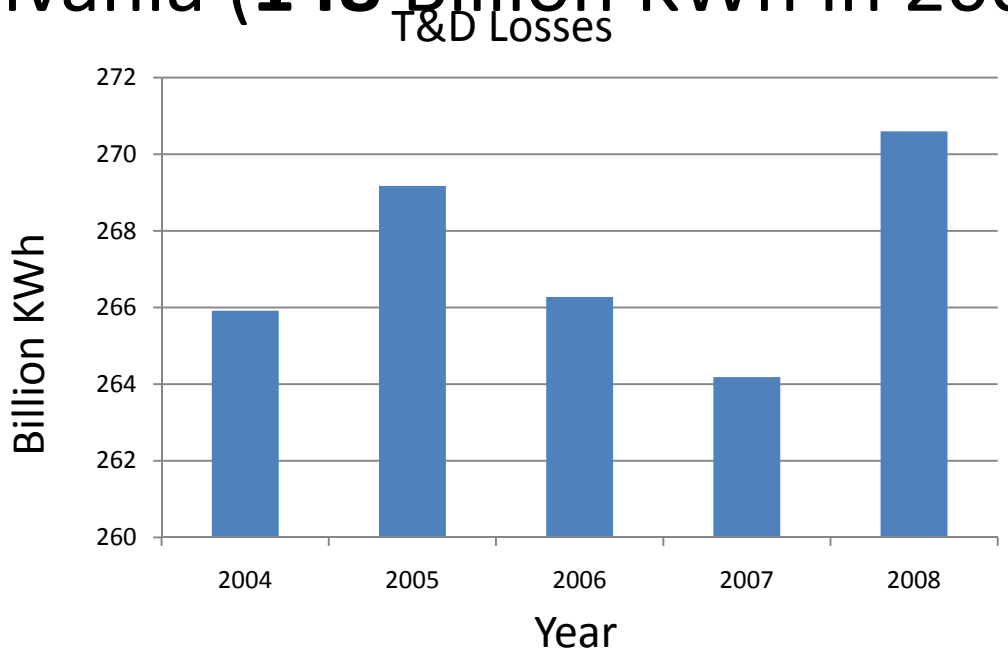
Transmission & Distribution Losses

- T&D losses in U.S.: **6.5%** in 2007 (**270** Billion KWh per year)
- Greater than total electricity consumption of Pennsylvania (**148** Billion KWh in 2005)

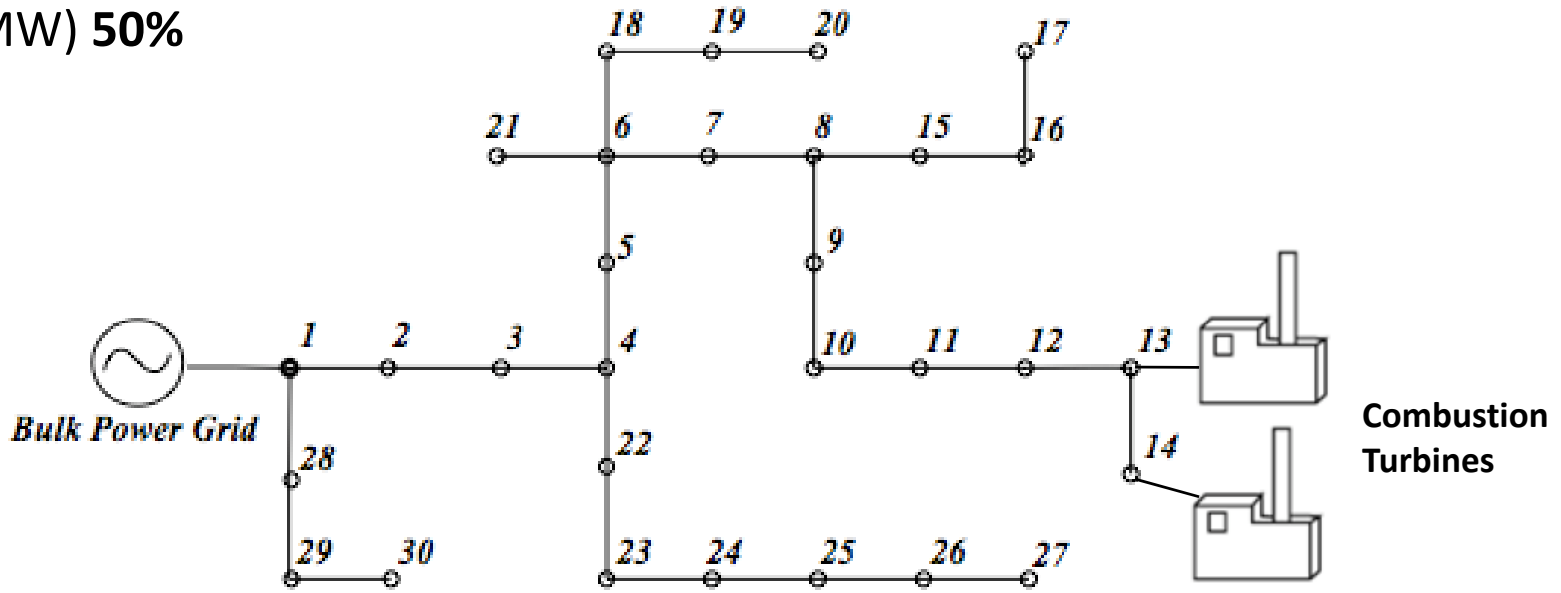


Masoud Nazari presenation, Carnegie Mellon, October 2010

Case study

- IEEE 30-bus distribution system:
  - 15 MW demand
  - DGs: 2 combustion turbines (C-T), **10%** of demand
- Distribution power losses before placing DGs: 1.4 MW
- Power loss reduction by optimum placement and optimum voltage set:

(0.7 MW) **50%**



Policy Implications

- Operation and planning of today's distribution systems should use optimization algorithms
- Optimal location of DGs might violate the *laissez-faire* policy, so it is critical to develop incentive mechanisms
- IEEE1547 standard needs to be revised for robust control purposes

Thoughts from RED on Study Import of DG to Line Losses

- One MW of correctly located DG, with grid control of power factor, can displace, on average 1.5 MW of grid generation and associated costs and pollution.
- The same 1 MW could displace 2 to 2.25 MW of central generation on peak, and avoid a similar investment in peaking generation and wires
- One MW of DG in less ideal grid locations could still displace 1.2 to 1.4 MWs of central generation and even more on peak generation
- Most avoided cost calculations do not even give credit for the 6.5% line losses, much less 20% to 50% savings of central power.
- Recognition, new pricing signals, and FERC focus could significantly reduce U.S. line losses, in addition to other benefits of CHP