Identifying the Right Places for Cost-Effective DG/DSM Alternatives to Distribution Capacity Expansion

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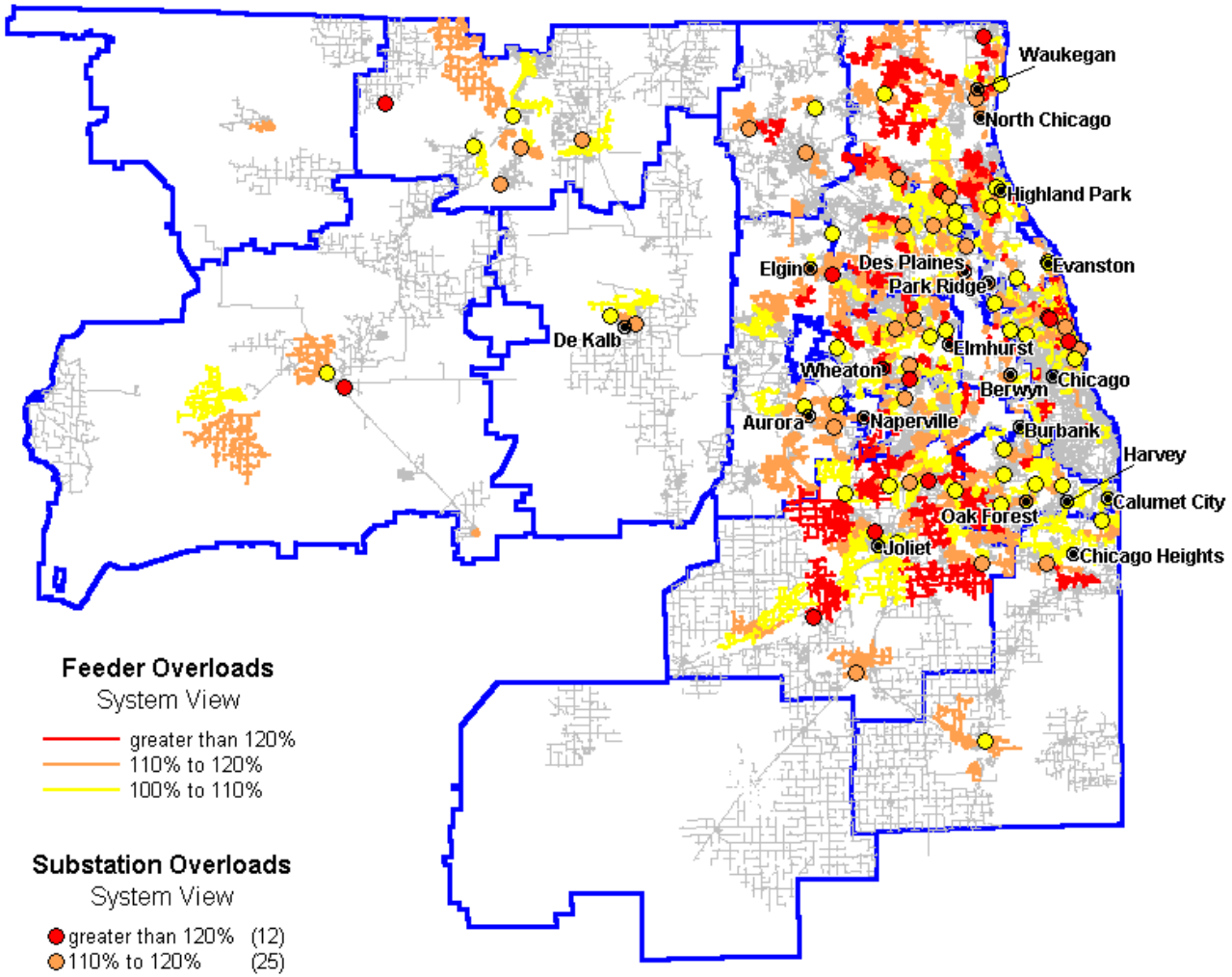
ComEd

- Part of Exelon Corporation - merger of Unicom and PECO
- One of Midwest's largest electric utilities
- Serves Northern Illinois including Chicago
- 3.4 million customers
- $7 billion revenues

Headlines in Chicago

- USA Today - “Power Failure kills lights in Chicago”
- Rockford Register Times - “Blackout halts Chicago workday”
- Chicago Sun Times -
  “South Loop workers left in dark by power failure”
  “Power failure puts ComEd on hot seat”
  “Enraged Daley ‘sick and tired’ of ComEd”

Com Edison System:
Overloaded Feeders and Substations Focus



ComEd

- Distribution system issues
- Distribution system data
- Funding

Center for Neighborhood Technology

- Community mapping
- Community development expertise
- Community partnerships

COMMUNITY ENERGY COOPERATIVE

- Distributed Resources
- Community Development
- Customer Benefits

Summary Of Three-Year Experiment

- Covers three years ending 1/10/2003
- ComEd will provide funding to the Center For Neighborhood Technology (CNT) for startup
- Scope of startup includes:
  - targeting place-based distributed resources
  - developing, testing and managing coop models
  - implementing programs in targeted communities

Goals

- Establish the Community Energy Cooperative in several communities
- Test several business models
  - curtailment
  - long-term load reduction
  - market-based pricing
- Understand how load reduction resources impact distribution system economics
- Determine how DSM and distributed generation can fit in a deregulated framework

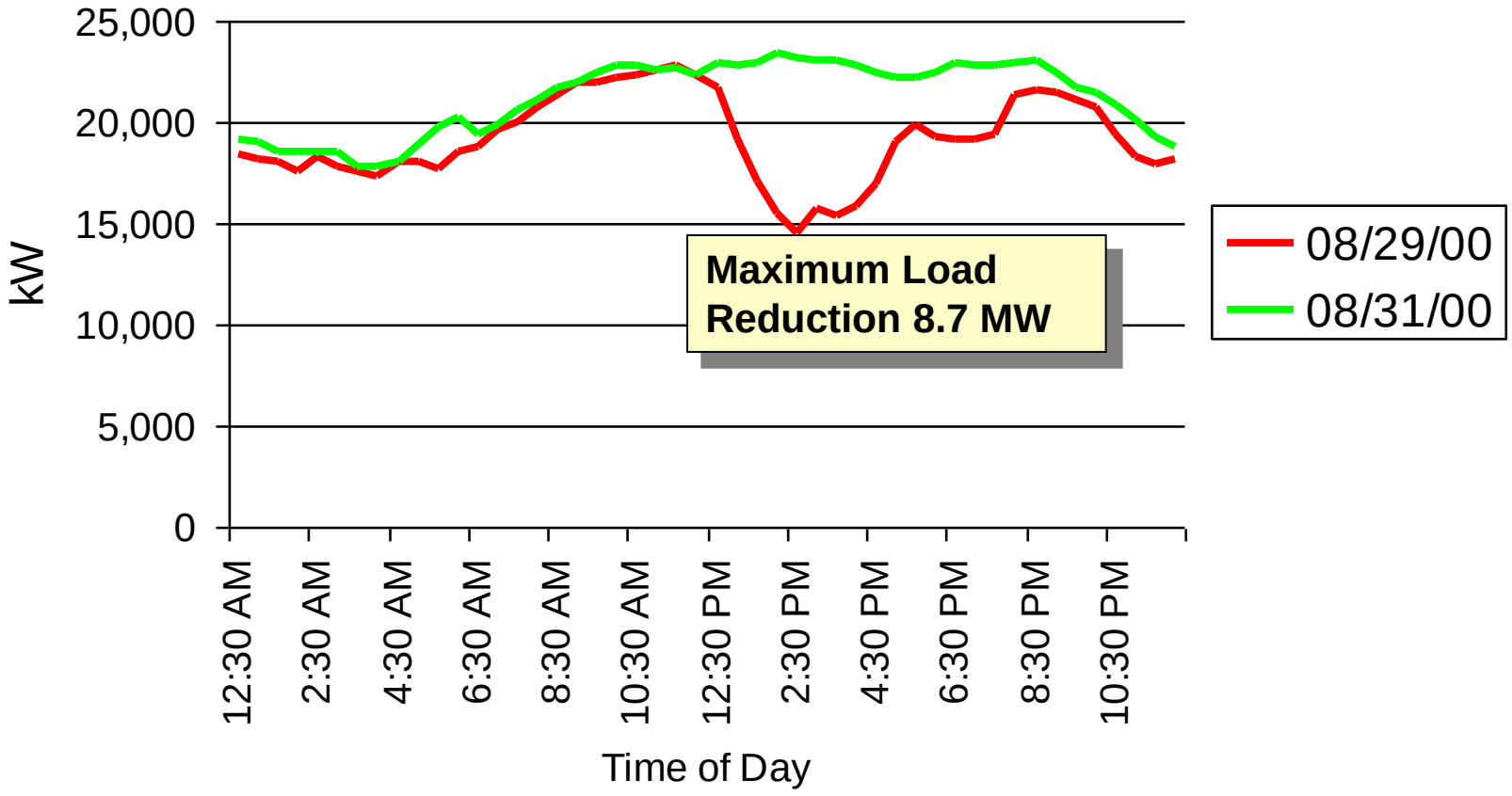
Initial Results

- Curtailment Results
  - 2000 - 8.7 MW curtailed on 8/29/2000
  - 2001 - 16.7 MW curtailed on 8/8/2001
- Long Term Reductions
  - 2000 - Focus on testing pilot programs
  - 2001 - 7.1 MW reduced
- Coop Membership
  - 2000 - 1,500 members
  - 2001 - 6,800 members

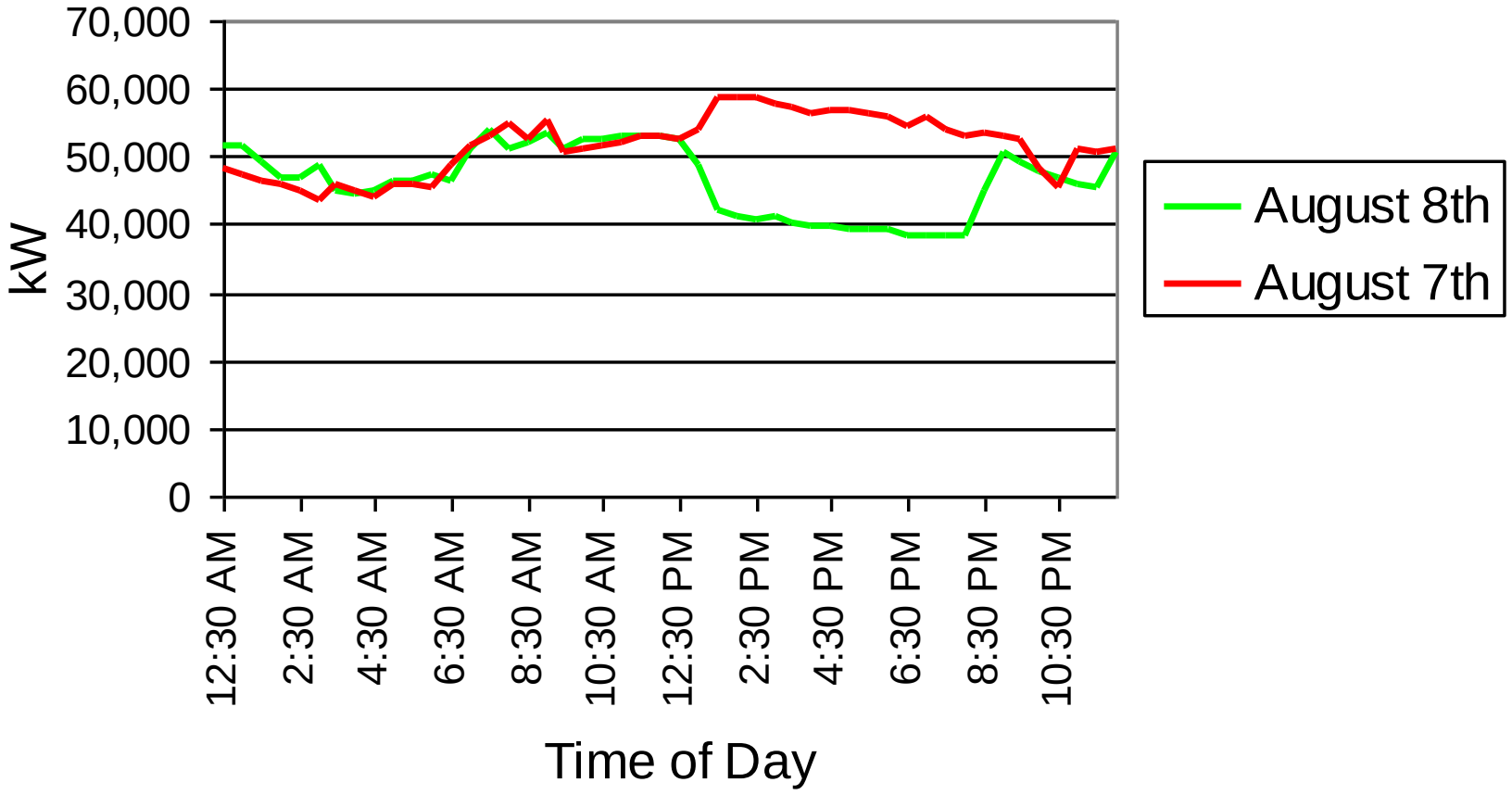
Portfolio of Distributed Resources

- Air Conditioners
- Lighting
- Onsite Generation
- Fuel Cell
- Microturbines
- Photovoltaic Systems
- Thermal Energy Storage

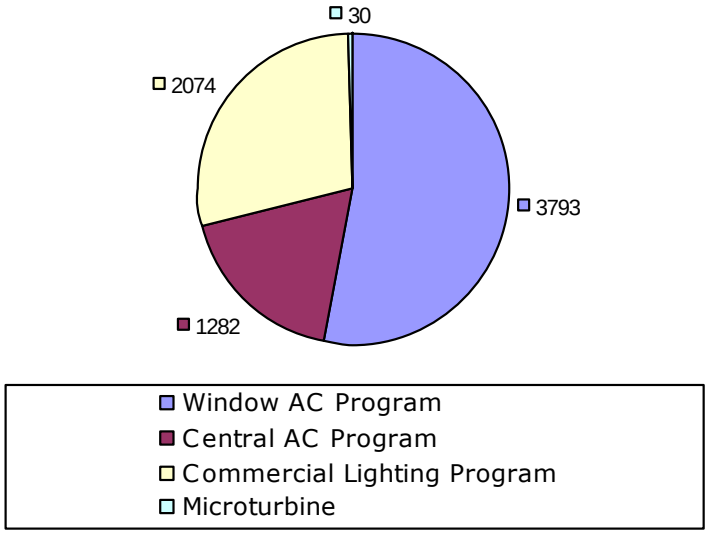
Community Energy Cooperative



Curtailment - 2001



Long-Term Reductions - 2001



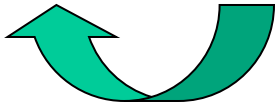
What have we learned so far?

- CNT and ComEd can target communities and establish two types of cooperatives
- Community organizations can be mobilized and leveraged focusing on energy issues
- Community based cooperatives can produce significant curtailment resources with a short lead time
- Additional outside partners will share costs
- Broad public recognition for the project
- Bottom line: **Coops can reduce load in communities**

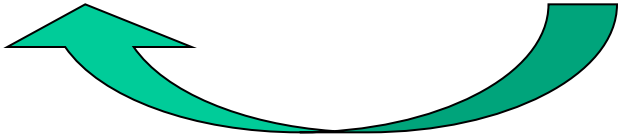
On To Economics...

How do load reduction resources impact distribution system economics?

Two approaches to capacity planning

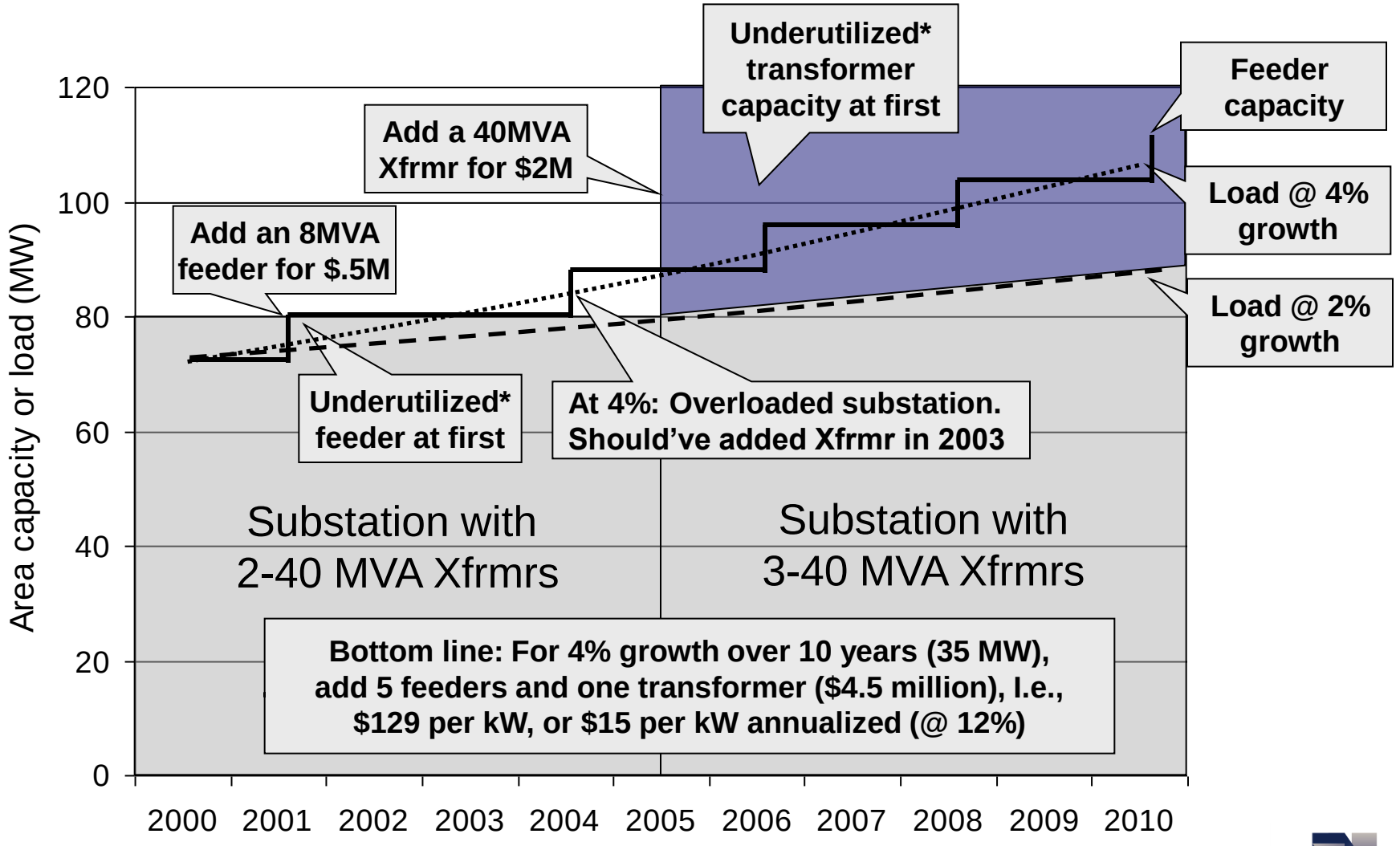


Capacity additions add to ‘supply’



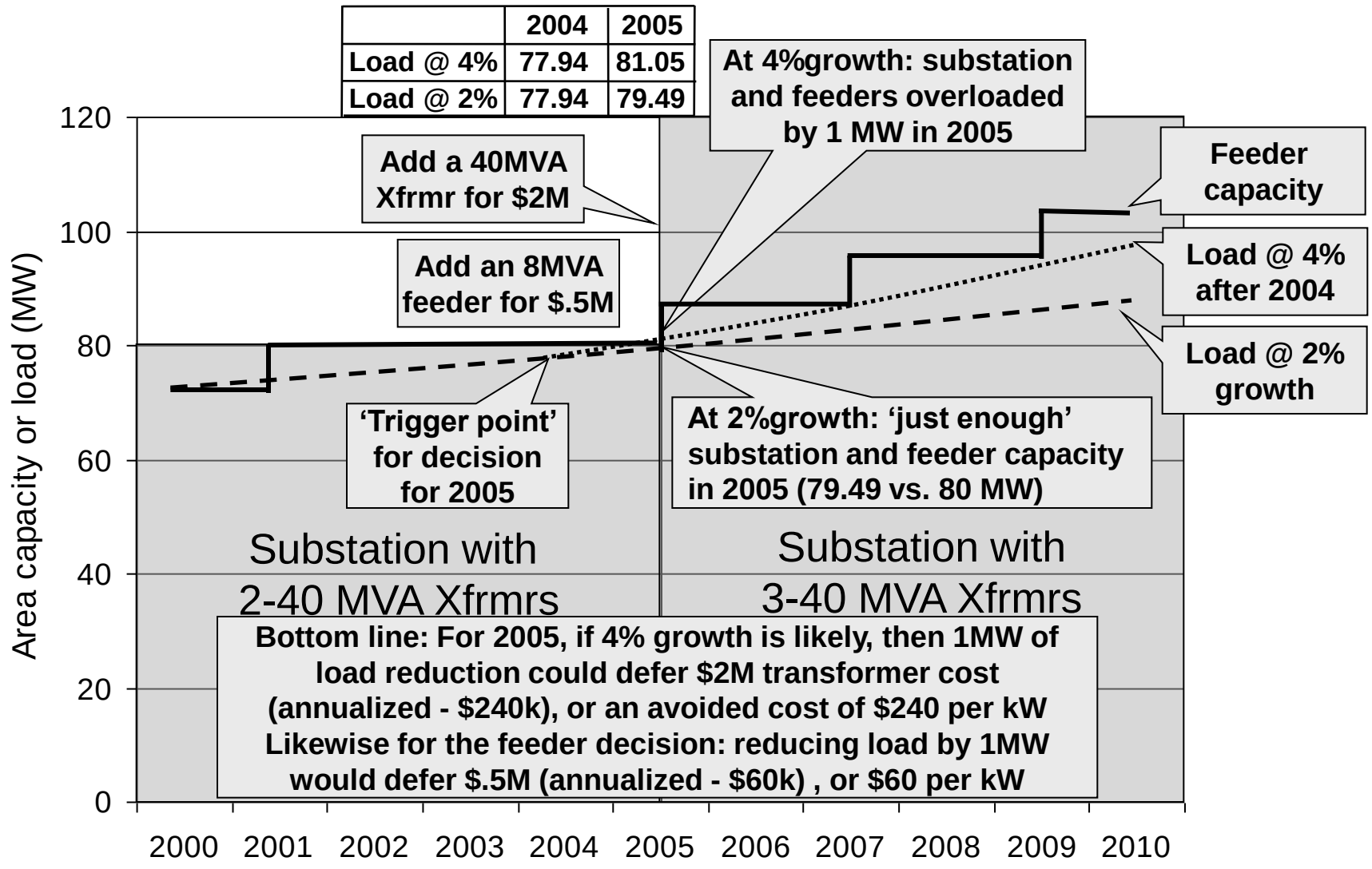
Load management reduces ‘demand’

If the only overloaded area resources are substation transformers and feeder mains, they can be relieved very cost-effectively in the long run



* Often, underutilized capacity may be partially used to relieve overload of nearby areas

In the short run, deferring 'lumpy' costs saves $300 per kW that year



If the long run never comes, short run economics rule

- In the previous examples, if it were **known** that load was going to continue to grow at 4%, the value of the load reduction would approach the long-run value of the capacity addition:

Year	Cumulative Cost of Capacity Addition	Annual Cost @ 12%	Load Reduction Required (kW)	Avoided Cost Per kW
1	$2,500,000	$300,000	1,050	$286
2	$2,500,000	$300,000	4,292	$ 70
3	$3,000,000	$360,000	7,664	$ 47
4	$3,000,000	$360,000	11,170	$ 32
5	$3,500,000	$420,000	14,817	$ 28
6	$3,500,000	$420,000	18,610	$ 23
7	$4,000,000	$480,000	22,554	$ 21
8	$4,000,000	$480,000	26,656	$ 18
9	$4,500,000	$540,000	30,923	$ 17
10	$4,500,000	$540,000	35,359	$ 15

- But if the 4% growth **does not occur**, or occurs only in the first year, with subsequent years at the same level due to a slowing economy, or changing demographics, then the value of the deferral remains at the initial high level, year after year, because the avoided cost is still $300,000, and the load reduction required is still only 1,050 kW

The slower the growth, the 'lumpier' the investment

If growth is slow, the lumpy investment stays underutilized longer

- If the growth were 2% instead of 4%, the avoided cost would stay at higher levels over time.

Year	Capacity Addition	Cost @ 12%	Required (kW)	Per kW
1	$2,500,000	$300,000	1,050	$286
2	$2,500,000	$300,000	2,671	$112
3	$2,500,000	$300,000	4,324	$69
4	$2,500,000	$300,000	6,011	$50
5	$2,500,000	$300,000	7,731	$39
6	$3,000,000	$360,000	9,486	$38
7	$3,000,000	$360,000	11,275	$32
8	$3,000,000	$360,000	13,101	$27
9	$3,000,000	$360,000	14,963	$24
10	$3,500,000	$420,000	16,862	$25

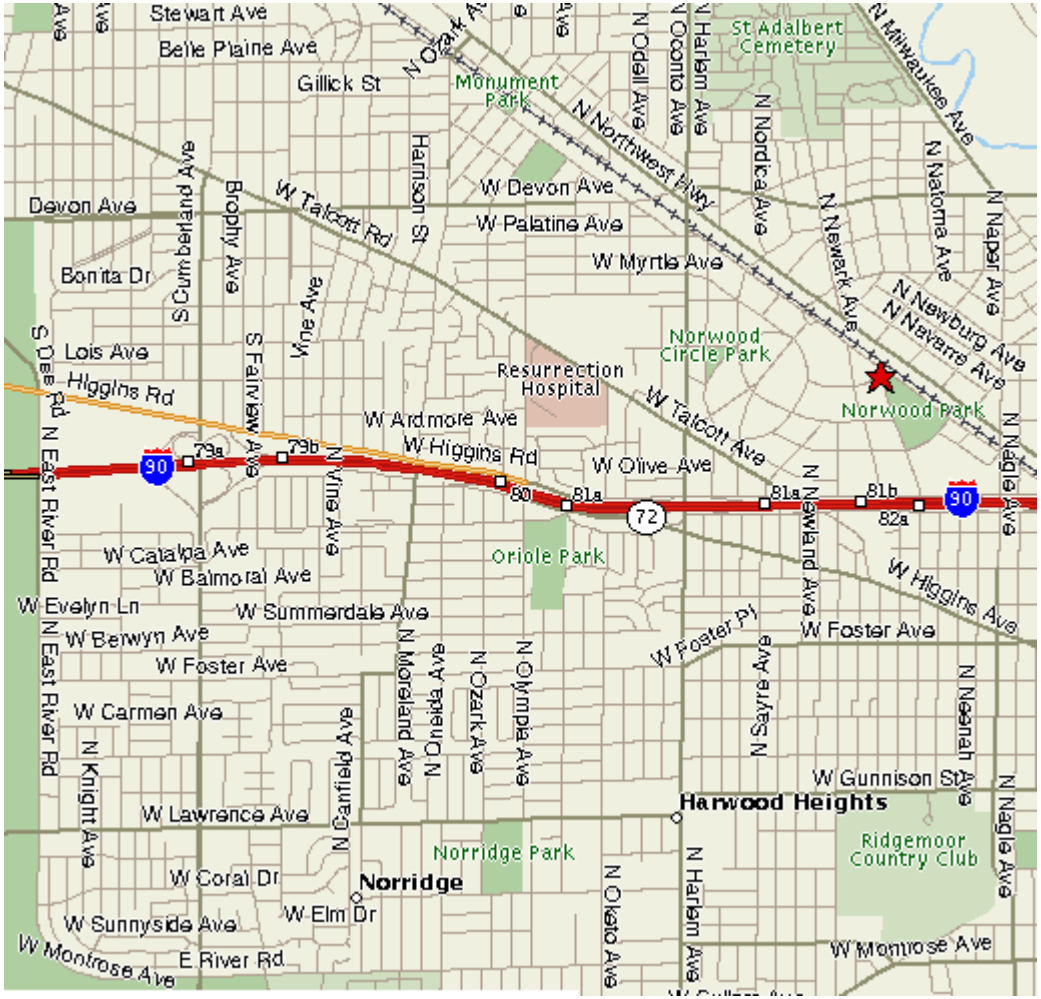
Other situations can result in high avoided costs

- High customer density areas have higher costs for land and construction
- Feeders spanning longer distances, especially underground can significantly add costs
- In low density areas, costs to connect the customer to the grid can be high because of:
  - long feeder mains
  - long laterals
  - underused transformers
  - long secondaries

One target is the X-Y-Z area

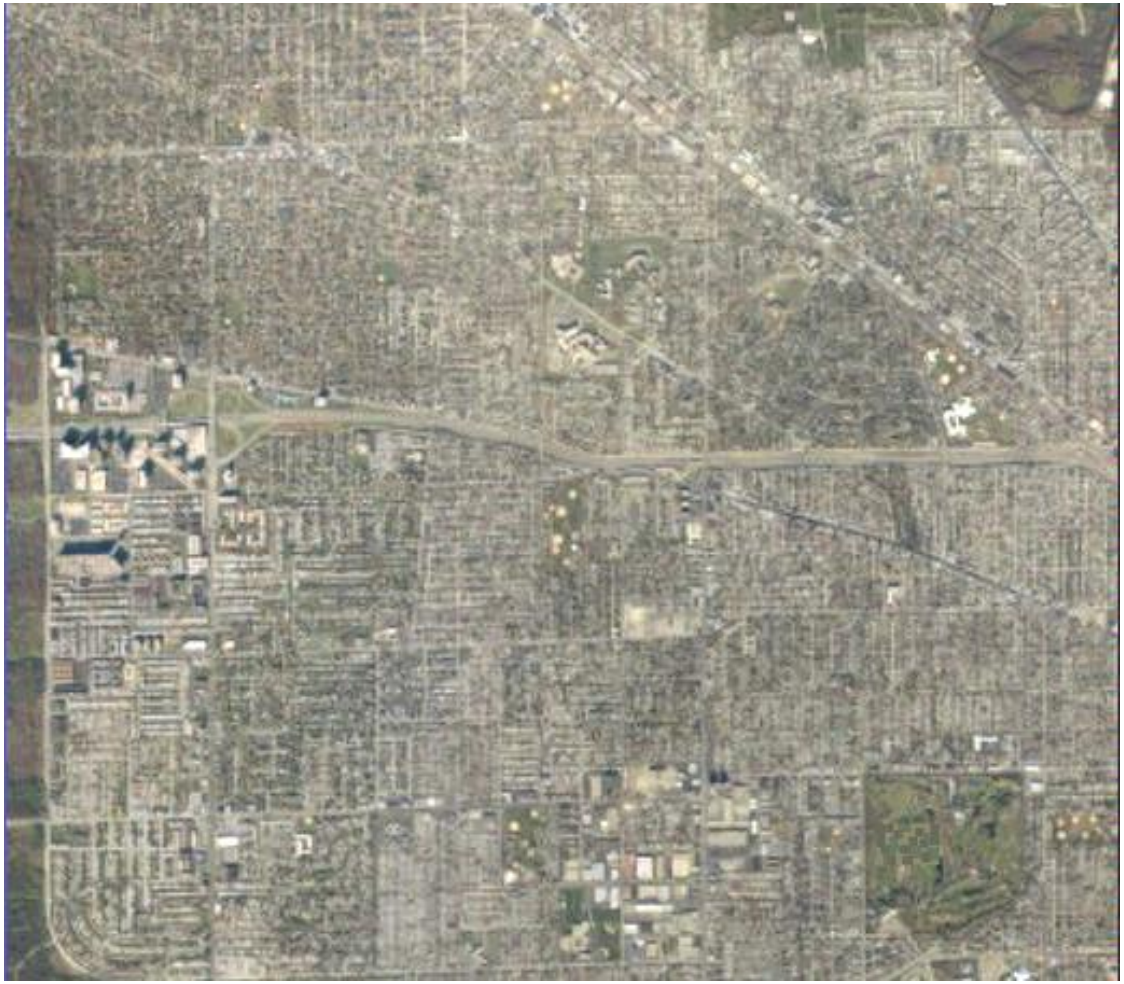
ComEd and the Coop see mutual benefit to a load reduction project here

Substation X	
Nameplate	2 x 50 MVA
Allowable	81 MVA
Projected load	106.0%
Growth rate	1.0%
Substation Y	
Nameplate	4 x 40 MVA
Allowable	185 MVA
Projected load	101.0%
Growth rate	1.0%
Substation Z	
Nameplate	3 x 40 MVA
Allowable	123 MVA
Projected load	102.5%
Growth rate	1.0%



This area is a typical dense, older, urban neighborhood

- Load growth due more to higher usage than new customers, since area is already fairly saturated
- Area will probably stay moderately overloaded, gradually growing without load reduction
- Would take 10 years to grow into a 40 MVA transformer
- Likely to be amenable to neighborhood-based load reduction programs



Capacity expansion for this area greater than $3 million

Station	Overload (MW)	Proposed Projects	Cost ($000s)
X	6.3	Build feeder to transfer load to Z	520
Y	2.0	Build feeder to transfer load to Z	800
Z	0.0	Add 4th 40 MVA transformer at Z	2,000
	8.3		3,320

- If 8.3 MW of load reduction could be accomplished for 2002, the projects could be deferred, saving the carrying cost on $3.32 million, which at 12% per year would be almost $400,000, or about **$48 per year** per kW of load reduction
- In addition there could be avoided transmission and supply costs.

Distribution Economics Summary

- Economics are driven by the “lumpy” nature of distribution investment in transformers and feeders
- The best opportunity for load reduction strategies:
  - low future load growth
  - significant investment in capacity is required
- Using load reduction strategies can defer costly distribution investment indefinitely if expected load growth never materializes

Case Study Summary

(two-thirds through the three-year pilot)

- Communities can be organized to reduce load using curtailment and long term load reduction programs
- The DR/DG alternative is most competitive in targeted locations and specific situations.
- The economics of deferral can be sufficient for the DR/DG alternative
- The pilot has demonstrated that community based load reductions are effective
- The best opportunities are in carefully selected niches