Aggregating Distributed Generators

Presentation to

DOE DP & Industrial DG

Quarterly Review Meeting

October 23, 2001

Electrotek Concepts

- Engineering, consulting and software development
- Significant history supporting EPRI, IEEE
- Core competencies
  - Power Quality
  - Power system consulting
  - Distribution planning, DG, T&D
  - Telecommunications
  - Energy management; DG Aggregation
- Key customers - TVA, Con Ed, Detroit Edison

Project Goals

- To demonstrate the aggregation of backup generators by adding controls to make them immediately dispatchable from a single control point when required to provide spinning reserve, interruptible load and peak power to the utility grid.

Project Objectives

- Base Year: Develop monitoring/controls; conduct feasibility analyses, design Field Test and survey backup generators in LIPA territory.
- Option Year 1: Develop, Install and Conduct Field Test; Develop Commercial Design.
- Option Year 2: Procure, Install and Operate a 30 MW commercial aggregation/dispatch service.

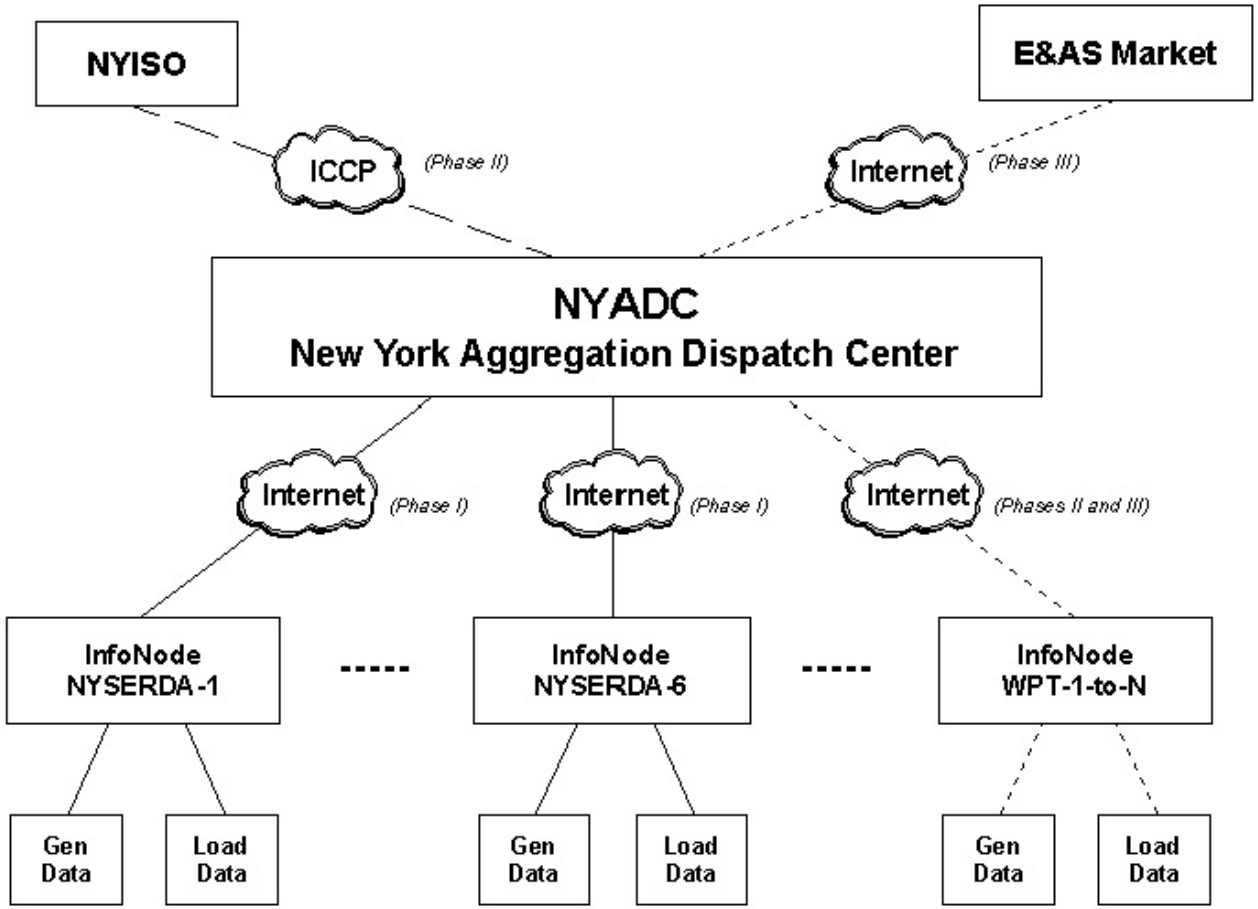
New York Aggregation Dispatch Center

Design Specifications

Prepared by:

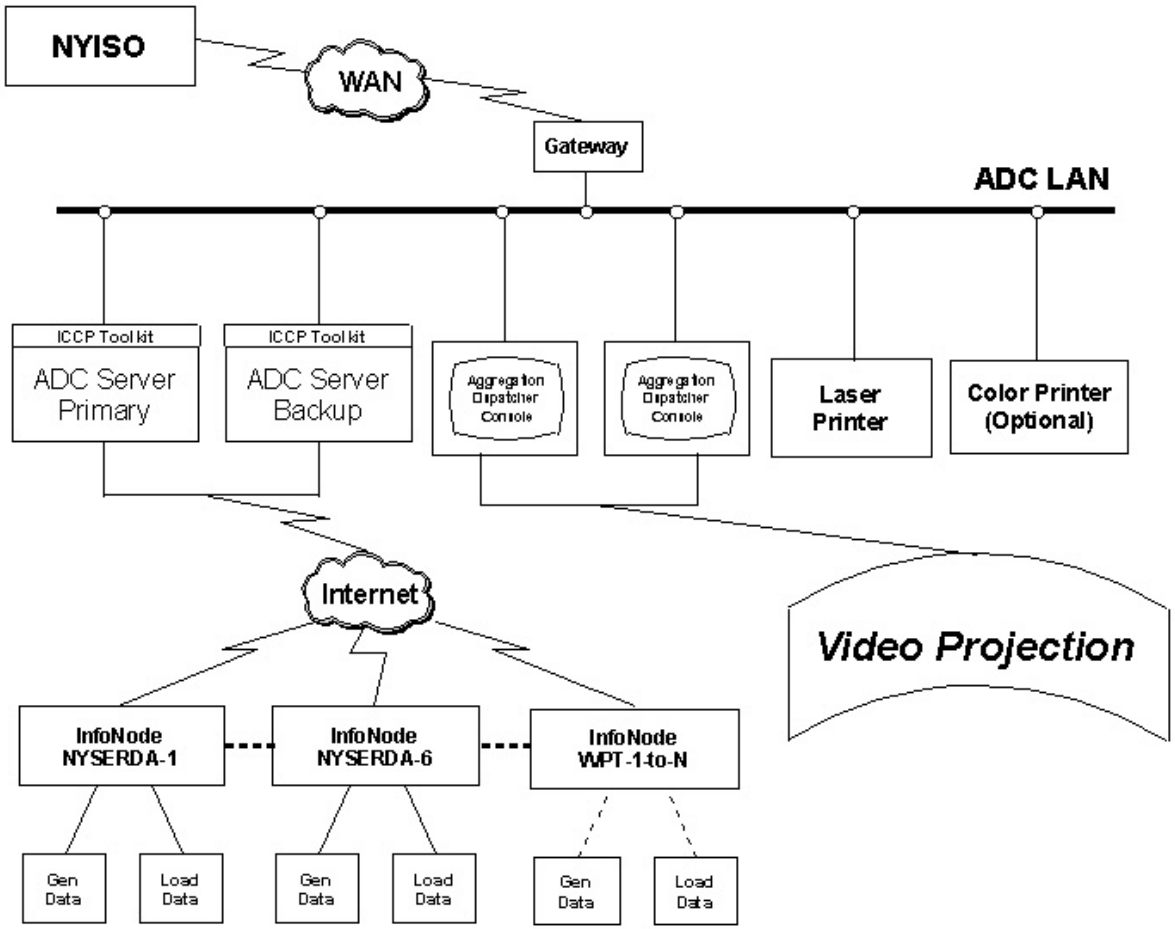
New York Aggregation Dispatch Center

Conceptual Architecture



New York Aggregation Dispatch Center

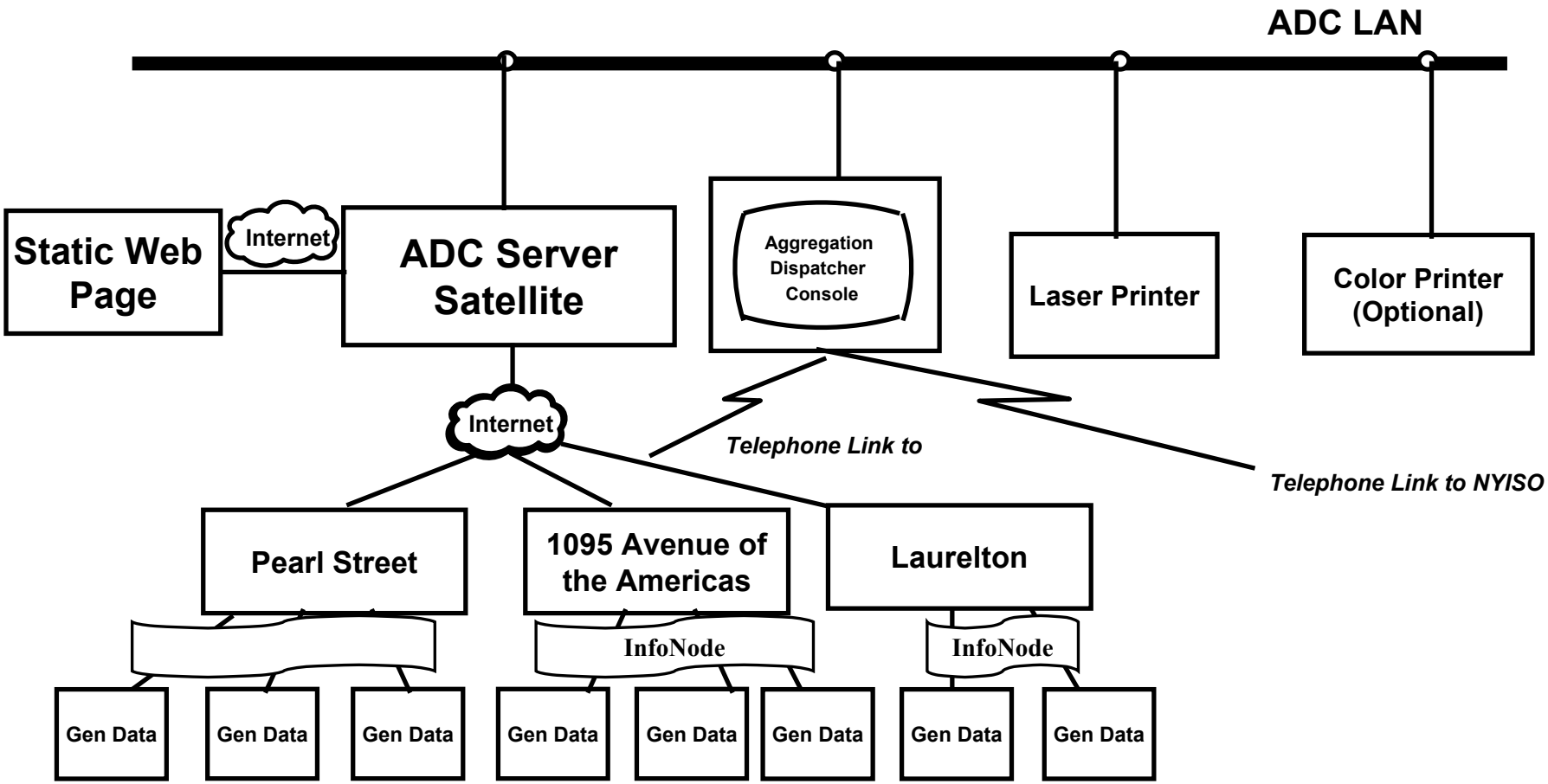
Implementation Architecture Phase Two

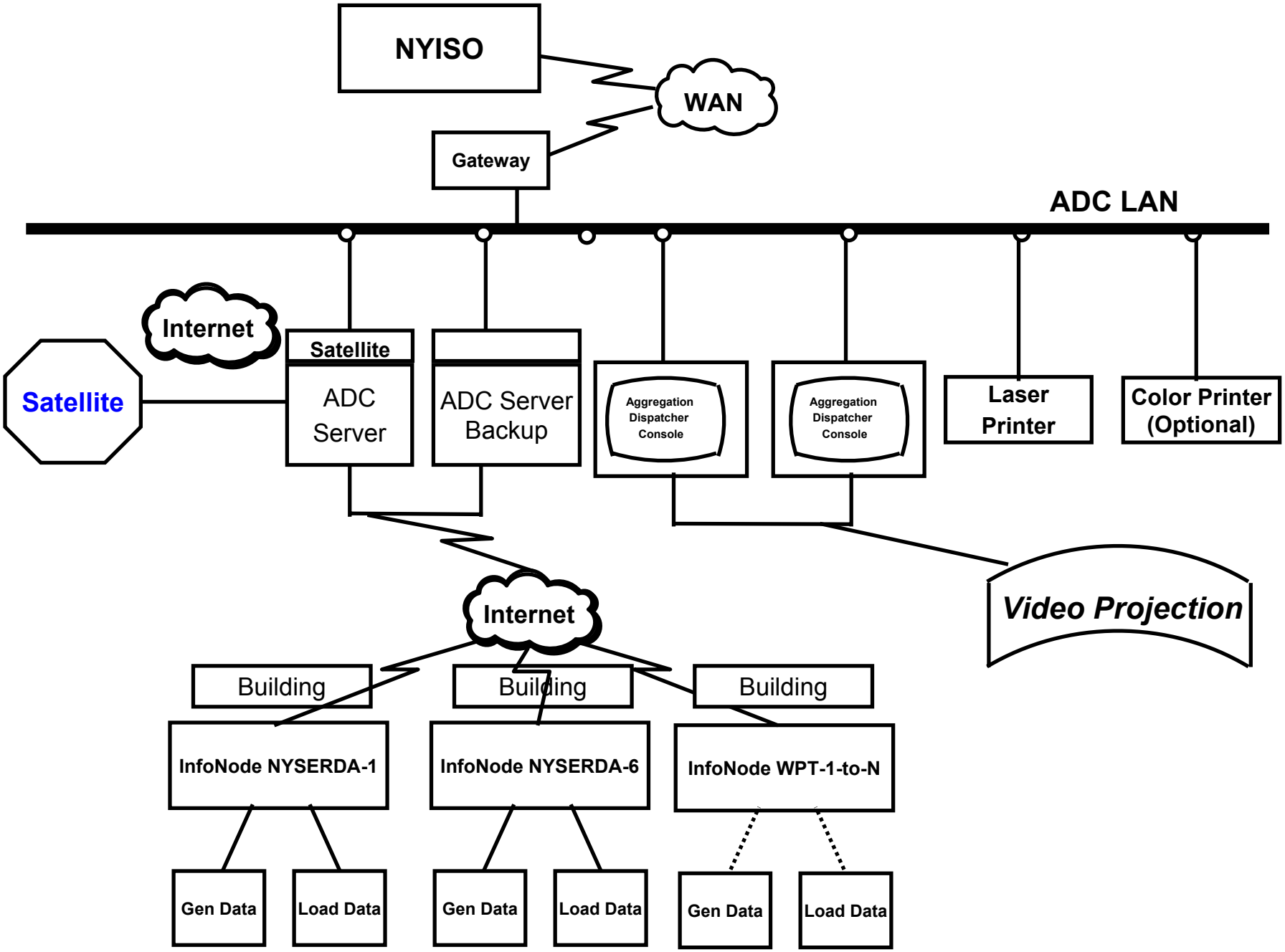


ELECTROTEK CONCEPTS

Implementation Architecture Phase One

(NYSERDA – EDRP Market)




NYISO
WAN
Gateway
ADC LAN
Internet
Satellite
Satellite
ADC Server
ADC Server Backup
Aggregation Dispatcher Console
Aggregation Dispatcher Console
Laser Printer
Color Printer (Optional)
Video Projection
Internet
Building
Building
Building
InfoNode NYSERDA-1
InfoNode NYSERDA-6
InfoNode WPT-1-to-N
Gen Data
Load Data
Gen Data
Load Data
Gen Data
Load Data

Field Test: YR1 Design; YR2 Operate

- Technical design for isolated and parallel operation:
  - * Monitoring/aggregation; Interconnection; Protection; Communication; Controls
- "Rules of engagement":
  - * Permitting; Marketing capacity /energy; Labor issues;

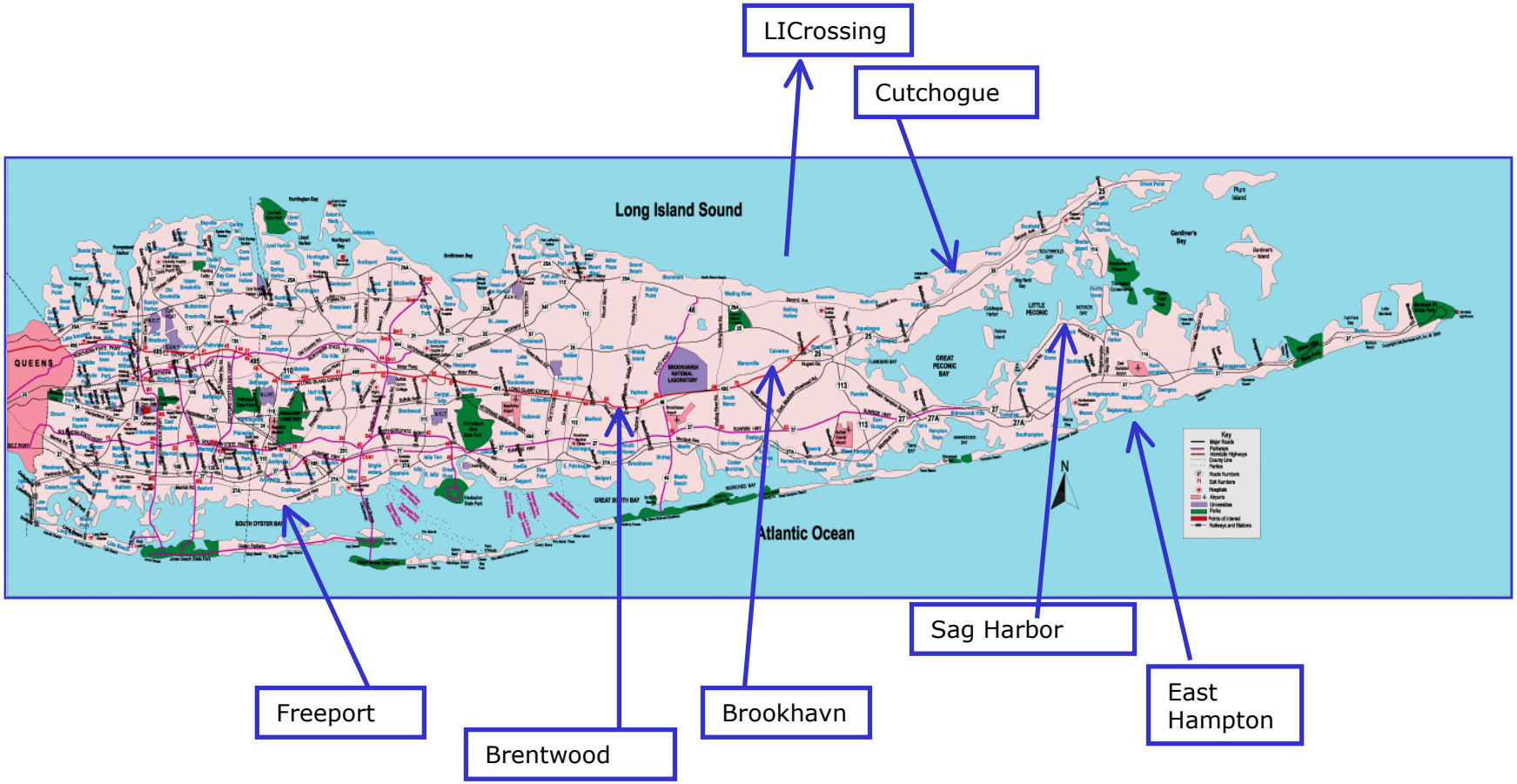
Field Test:YR1 Design; YR2 Operate

- Freeport Electric; parallel operation within distribution planning area.
- Verizon/Brentwood; isolated/parallel operation to support distribution system.
- Brookhaven; Inter-connected operation, within BNL distribution planning area.
- Verizon/Long Island; multiple office operation;aggregate loads &aggregate DG units; participate in wholesale markets; support transmission system.

Map Of Long Island

ELECTROTEK CONCEPTS

Locating Participating DG Locations



Field Test

Demonstrate the Use of DG

To

Minimize COE

And

Improve System Reliability

Approach to Minimize Cost of Electricity (COE)

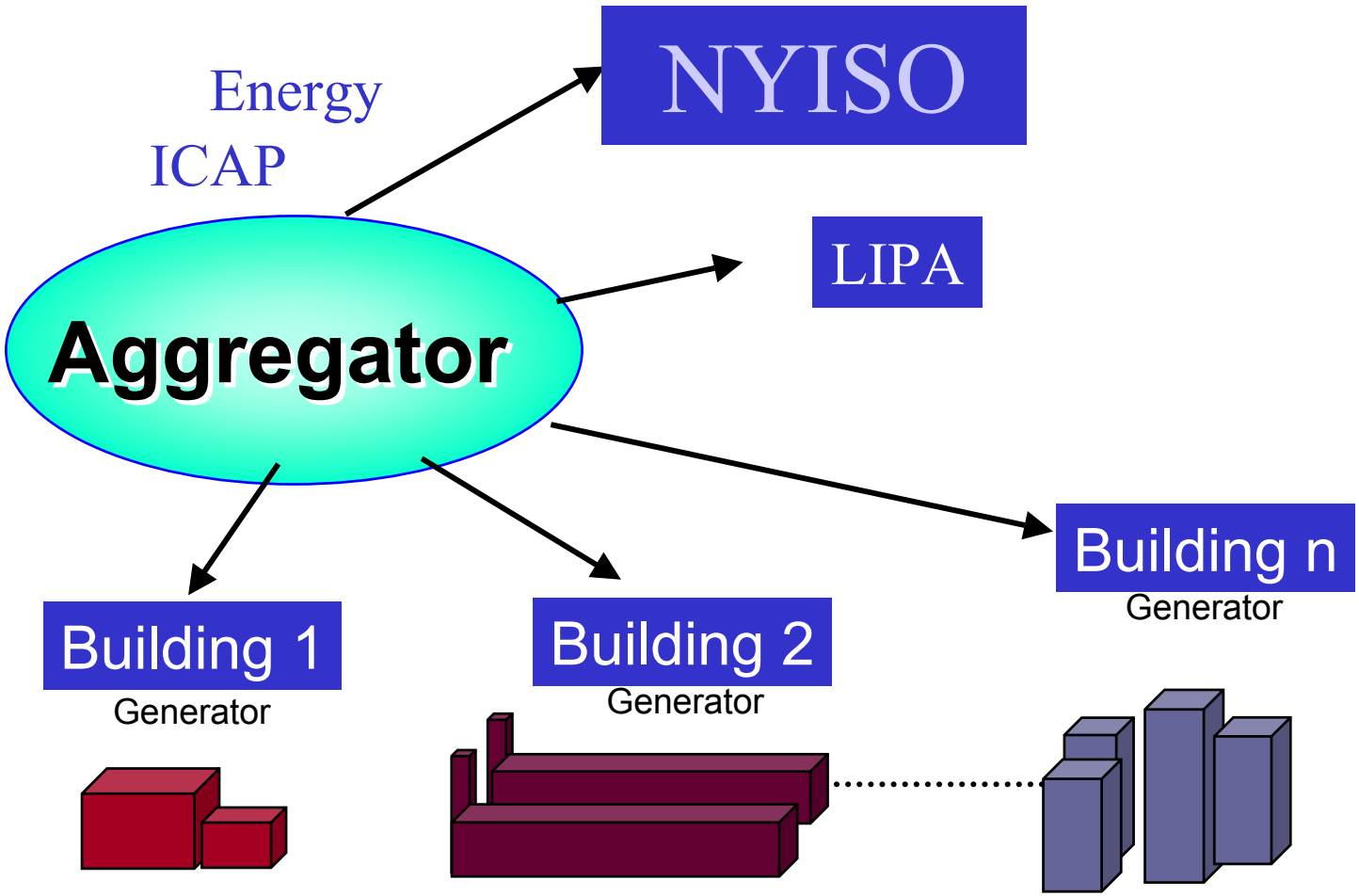
Aggregate Existing Loads and DG

Use DG as ICAP & Buy Energy

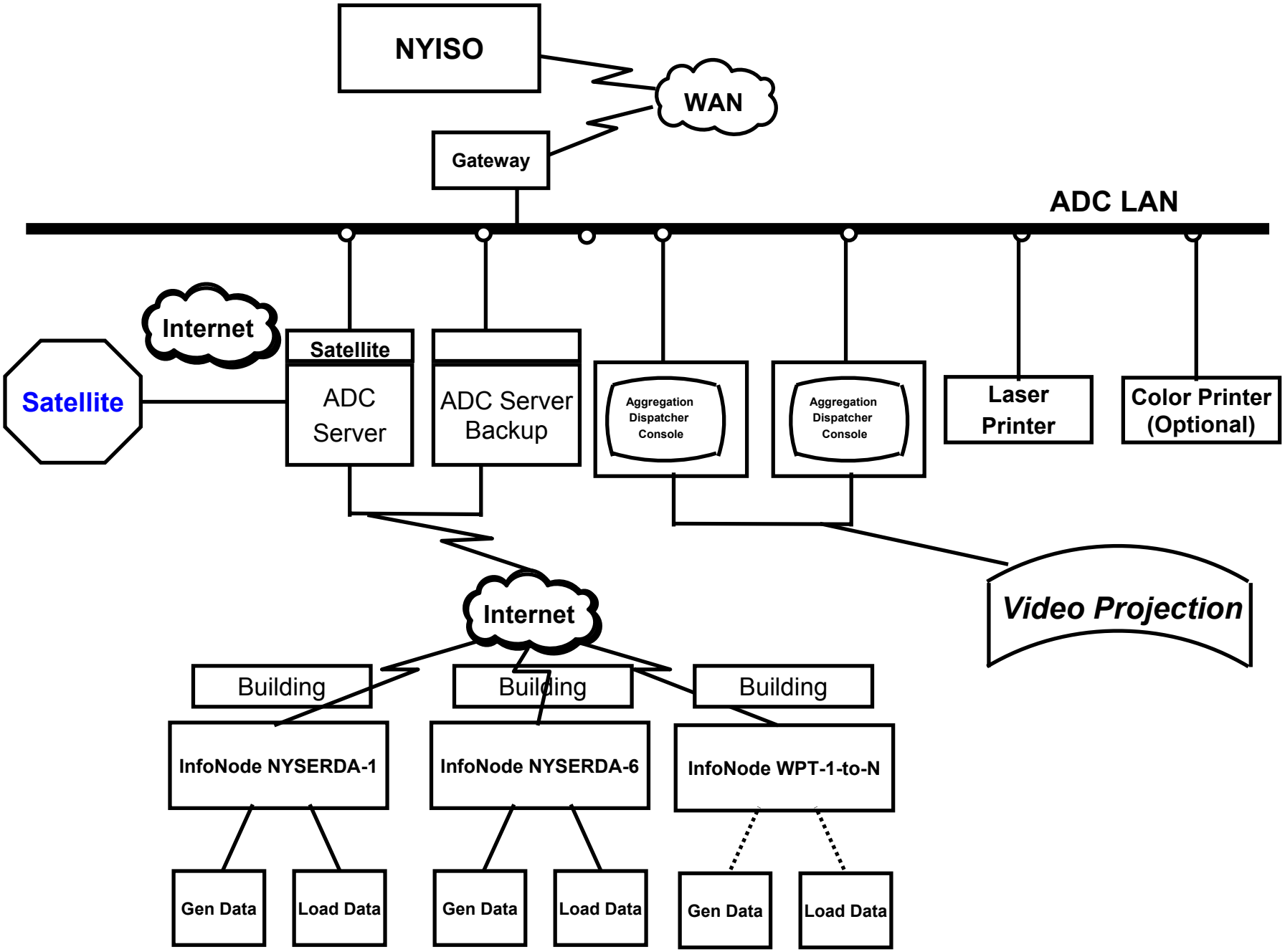
How will this lower electricity costs?

- By using GT/generators to supply ICAP and increase operating reserves;
- By using Diesel/generators to minimize ICAP;
- By using Engines to minimize the need to purchase of electricity when energy prices are high; and
- By using DG to support feeder voltage.

Managing Verizon Demand



ELECTROTEK CONCEPTS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InfoNode NYSERDA-6
InfoNode WPT-1-to-N
Gen Data
Load Data
Gen Data
Load Data
Gen Data
Load Data

Signature System NodeCenter - Microsoft Internet Explorer

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Address http://www.powermonitoring.com/ncenter/default_aggregation.asp Go

DRANETZ BMI

Signature System NodeCenter™

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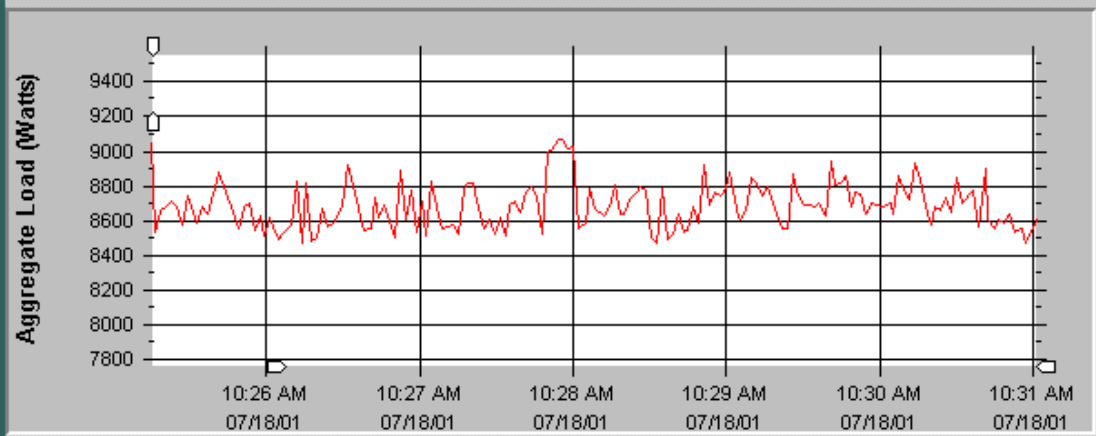
- Aggregation Groups
  - Standard 1
  - Contingency 1
  - Contingency 2
  - All Available Generation
- Help Desk
  - Maps Topics
  - Index

Click the aggregate checkbox in each row to include it in the graph and total at the end of the table.

	Voltage			Current			Power				
Site Name	**Phase A**	**Phase B**	**Phase C**	**Phase A**	**Phase B**	**Phase C**	**Phase A**	**Phase B**	**Phase C**	**Total**	**Aggregate**
Avenue of the Americas	122.1	122.2	122.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	☐
14h Street	122.2	122.8	122.3	2.9	3.0	6.0	182.9	203.1	498.8	884.8	☑
Broadway	121.7	121.6	120.5	2.8	3.0	4.0	177.6	202.2	434.1	813.8	☑
Marriot	282.7	281.7	281.1	12.1	12.1	10.8	2319.5	2408.4	2180.3	6908.2	☑
Aggregated Load										**8606.9**	

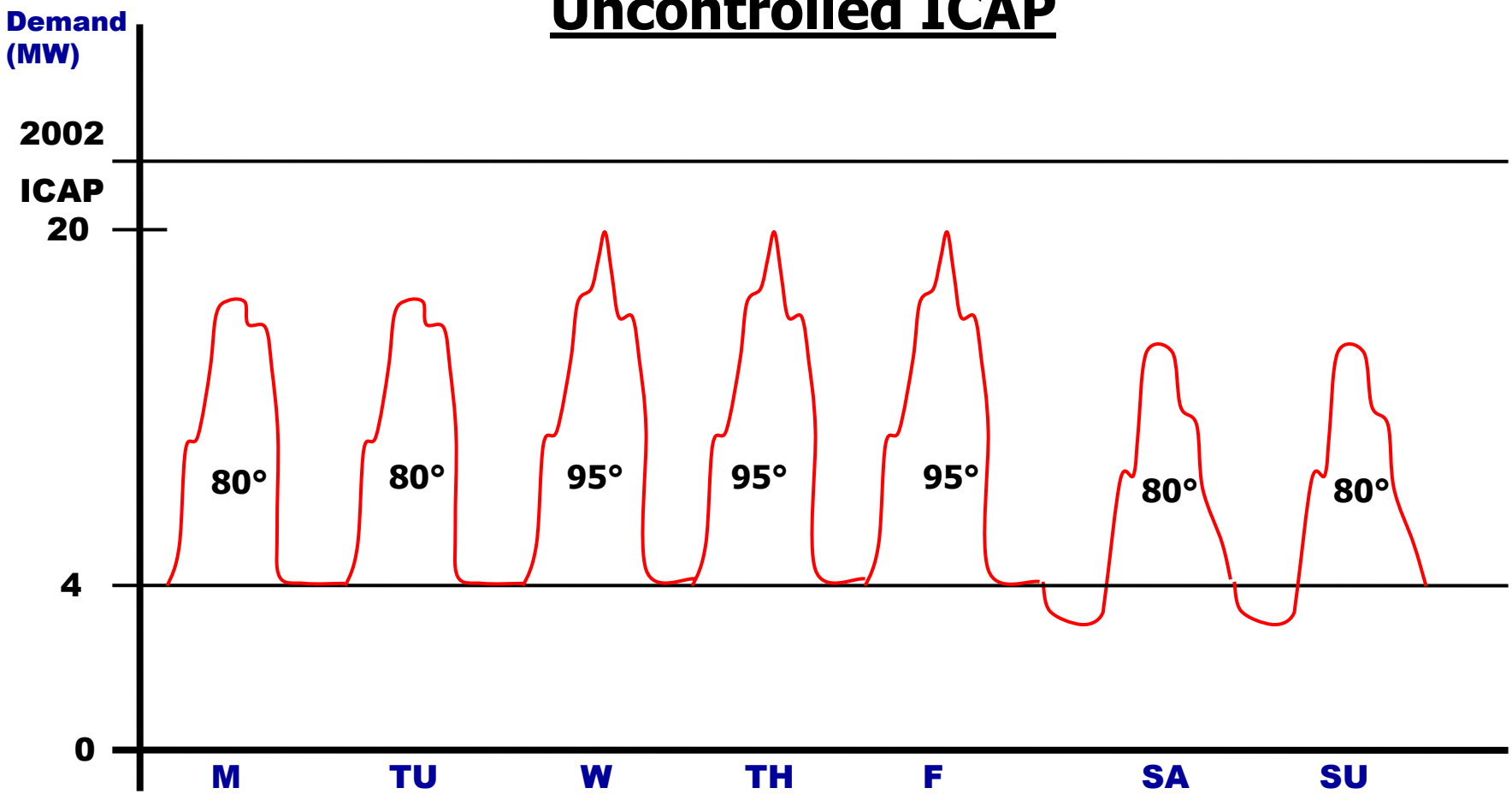


Internet

How ICAP Is Determined

- Since LIPA is a summer peaking utility,the Verizon aggregated demand at the time of the LIPA coincident peak determines the Verizon ICAP obligation for the following year.
- For summer 2002 the Verizon ICAP will be based upon the Verizon demand recorded from 2-3 PM on 8/09/01.
- Therefore, the ability to forecast the LIPA coincident peak and to operate Verizon engines at the coincident peak can significantly reduce the ICAP requirement.

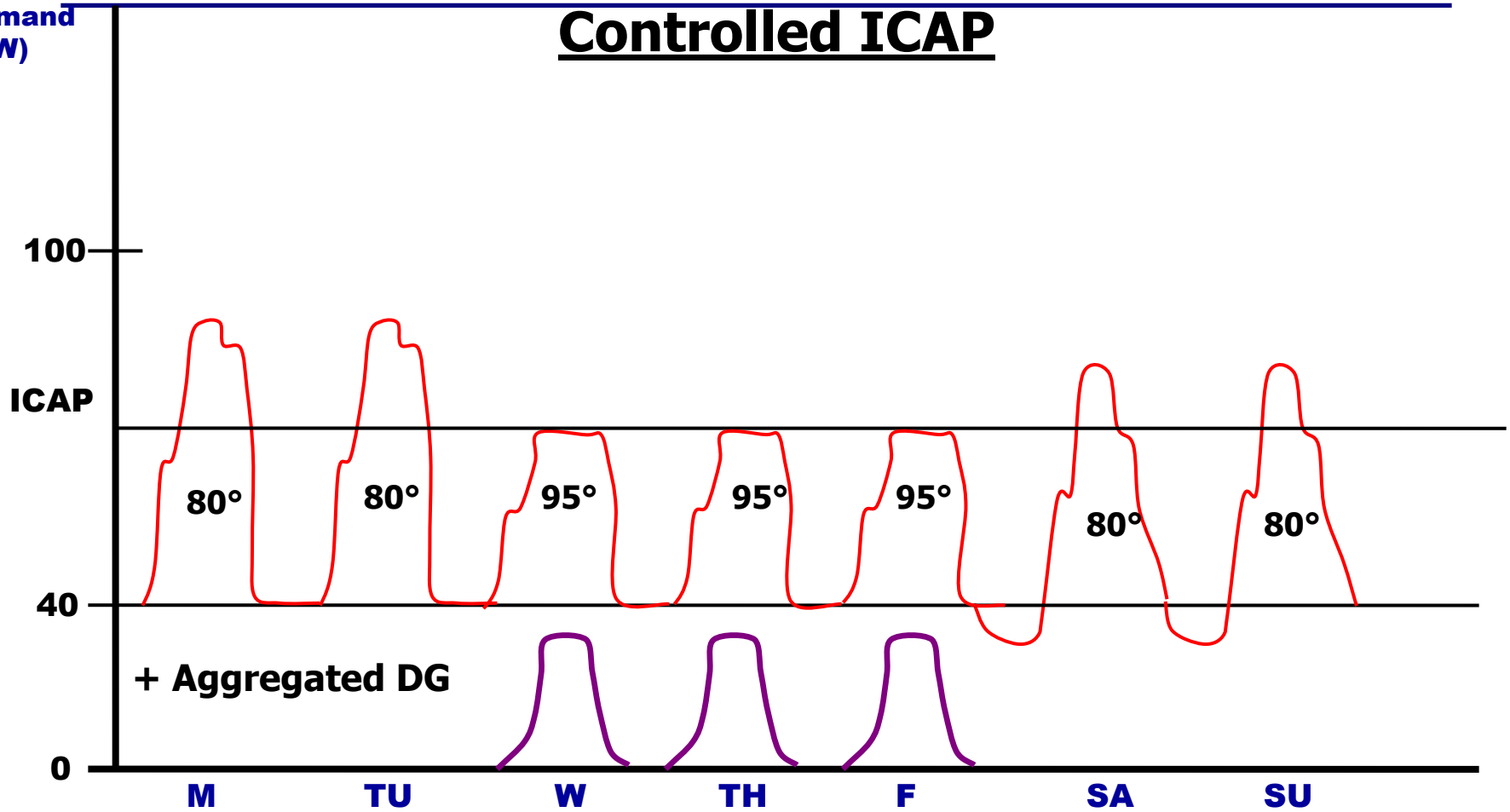
AGGREGATED LOADS; Uncontrolled ICAP



Week of August 7-10, 2001

ELECTROTEK CONCEPTS

AGGREGATED LOADS; Controlled ICAP

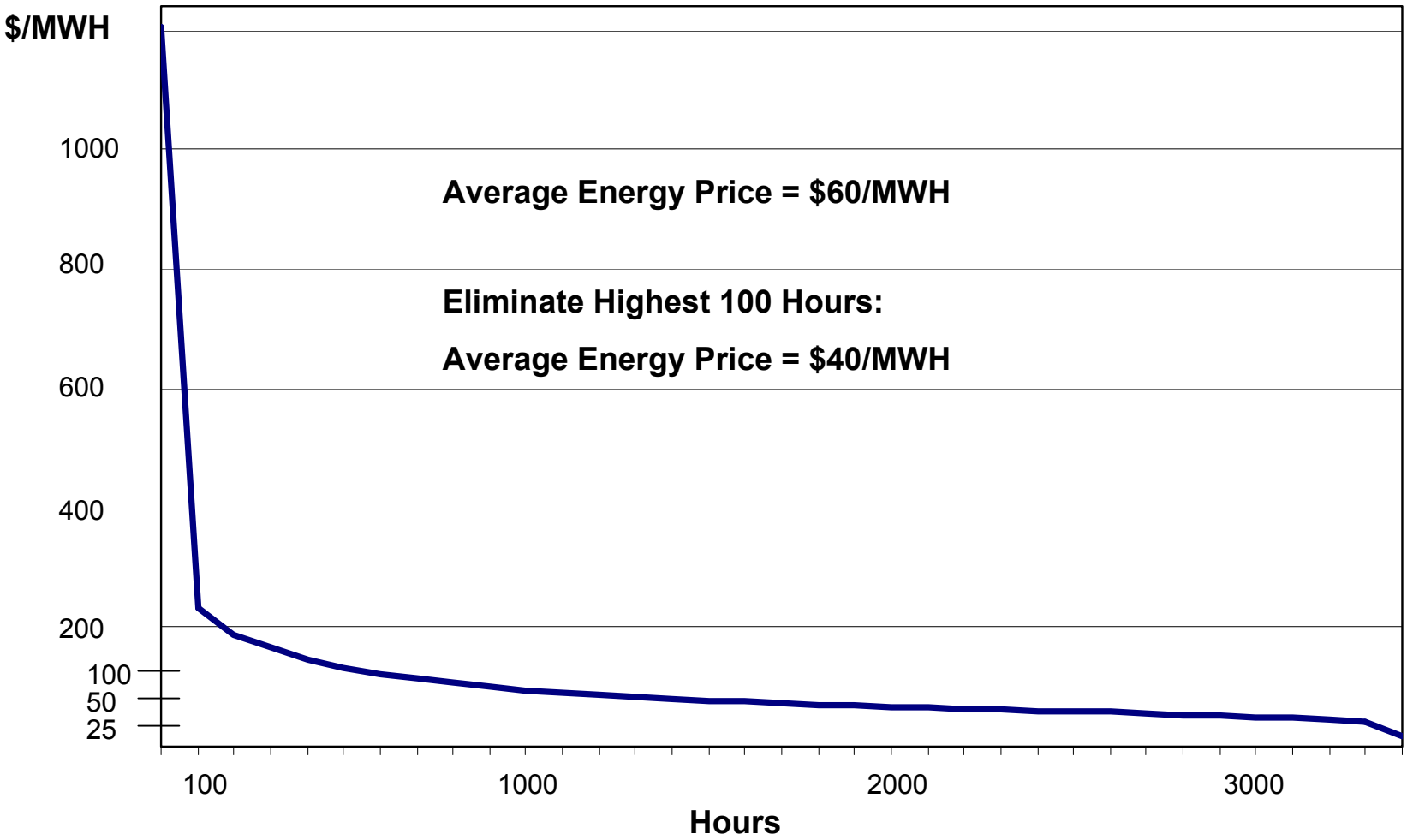


COE = 0.4 x $35/MWH + 0.05 x $350/MWH + 0.55 x $50/MWH + 0.9 x Delivery

ELECTROTEK CONCEPTS

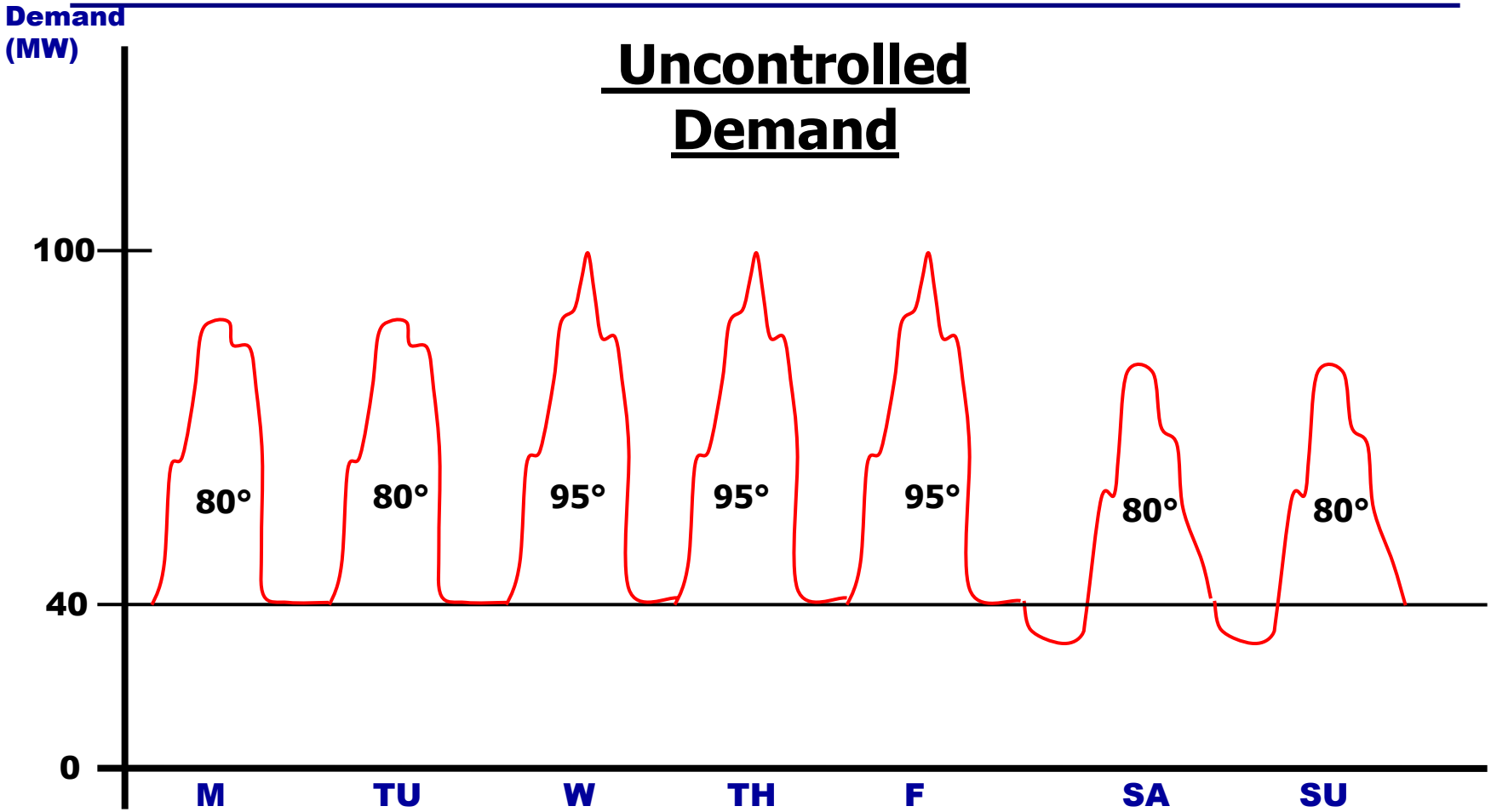
To Illustrate

- Today, Verizon purchases energy from LIPA at an average price of $0.085/kWh.
- However, Verizon can purchase electricity from the market at less than $0.045/kWh, as shown in the next chart.
- And, Verizon can lower its long term electricity costs, by using its generating assets to avoid buying when prices are high.



ELECTROTEK CONCEPTS

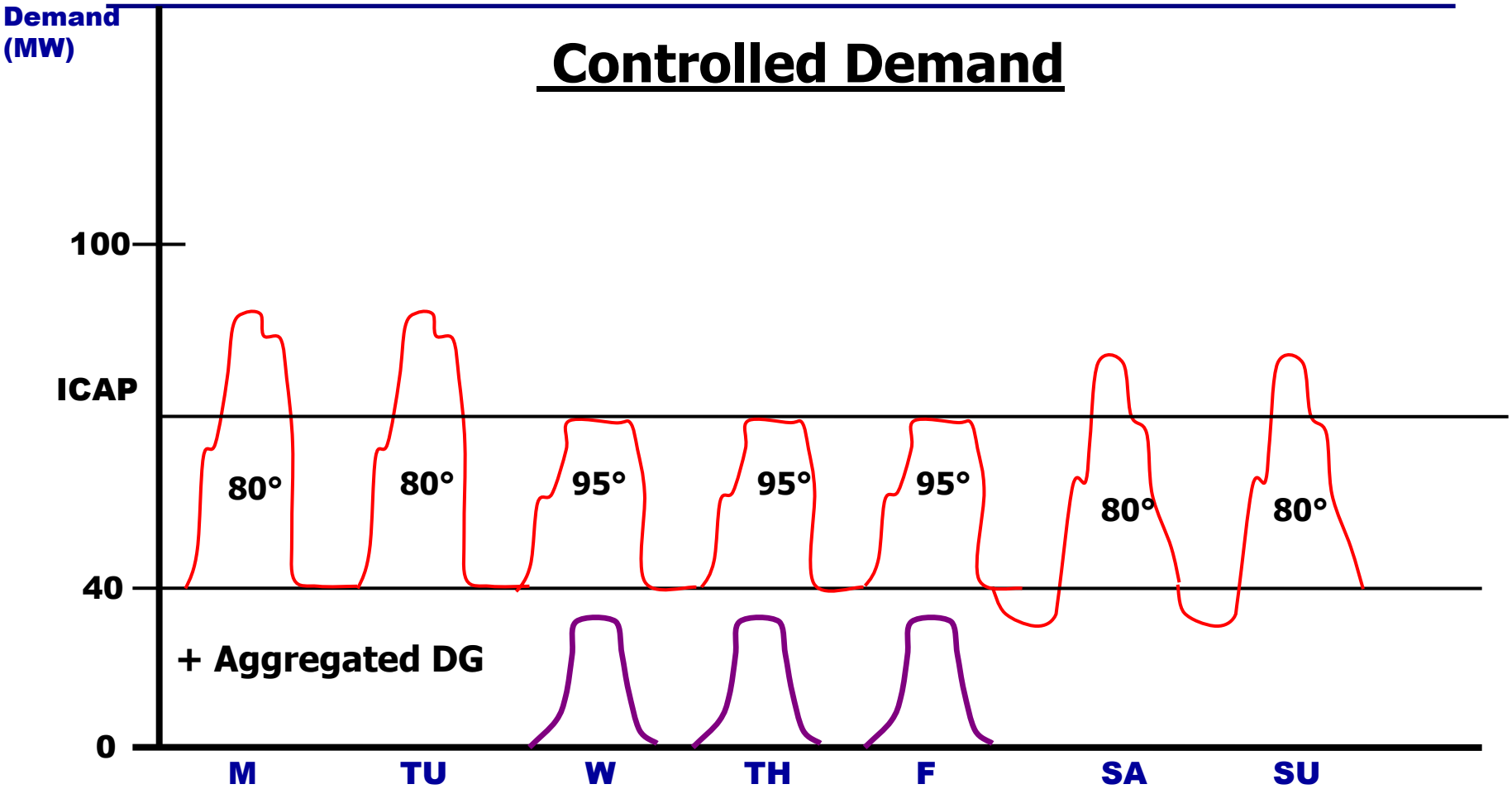
AGGREGATED LOADS;



ELECTROTEK CONCEPTS

AGGREGATED LOADS;

Controlled Demand



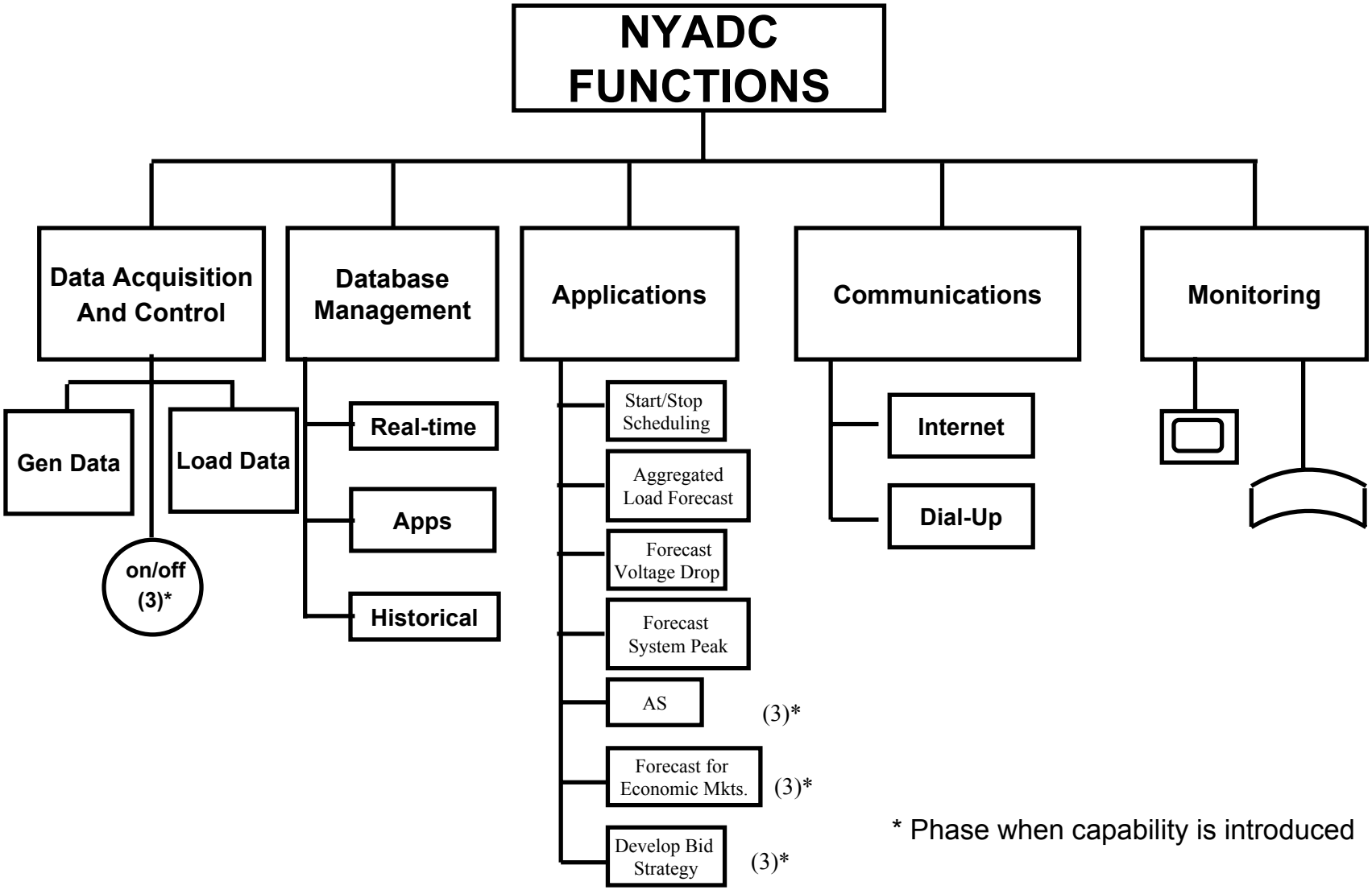
Energy = $200/MWH-$1000/MWH @ 95F; = $25/MWH to $55/MWH below 90F

ELECTROTEK CONCEPTS

Capabilities Required

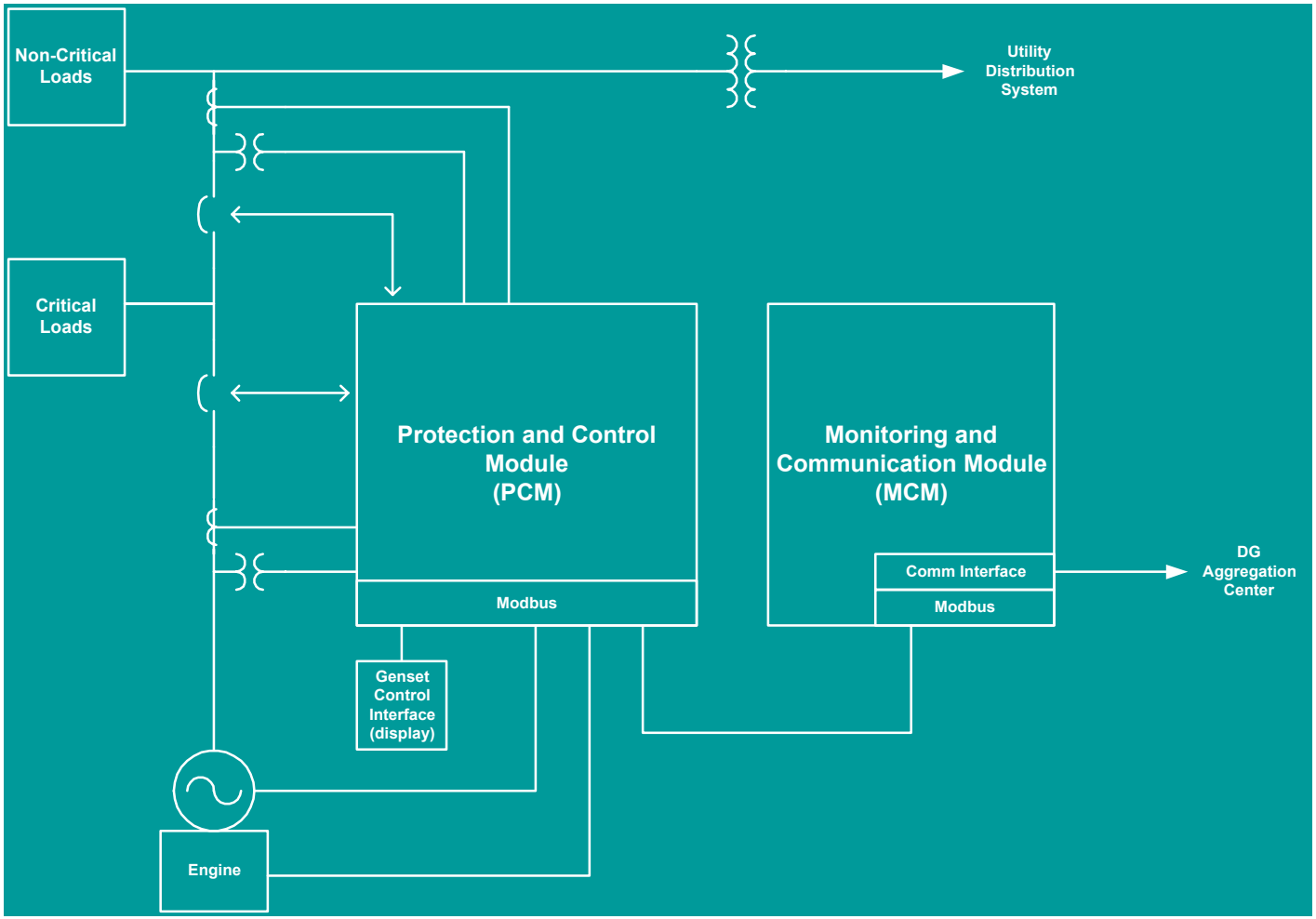
- The ability to monitor and predict aggregated load as a function of temp, humidity, day of week, hour of day and bid (DA, HA).
- The ability to forecast curtailable loads and curtail them when prices are high. (DA, HA)
- The ability to forecast the coincident peak for each zone and curtail loads at peak time. (DA,HA)

New York Satellite Aggregation Center Functional Architecture

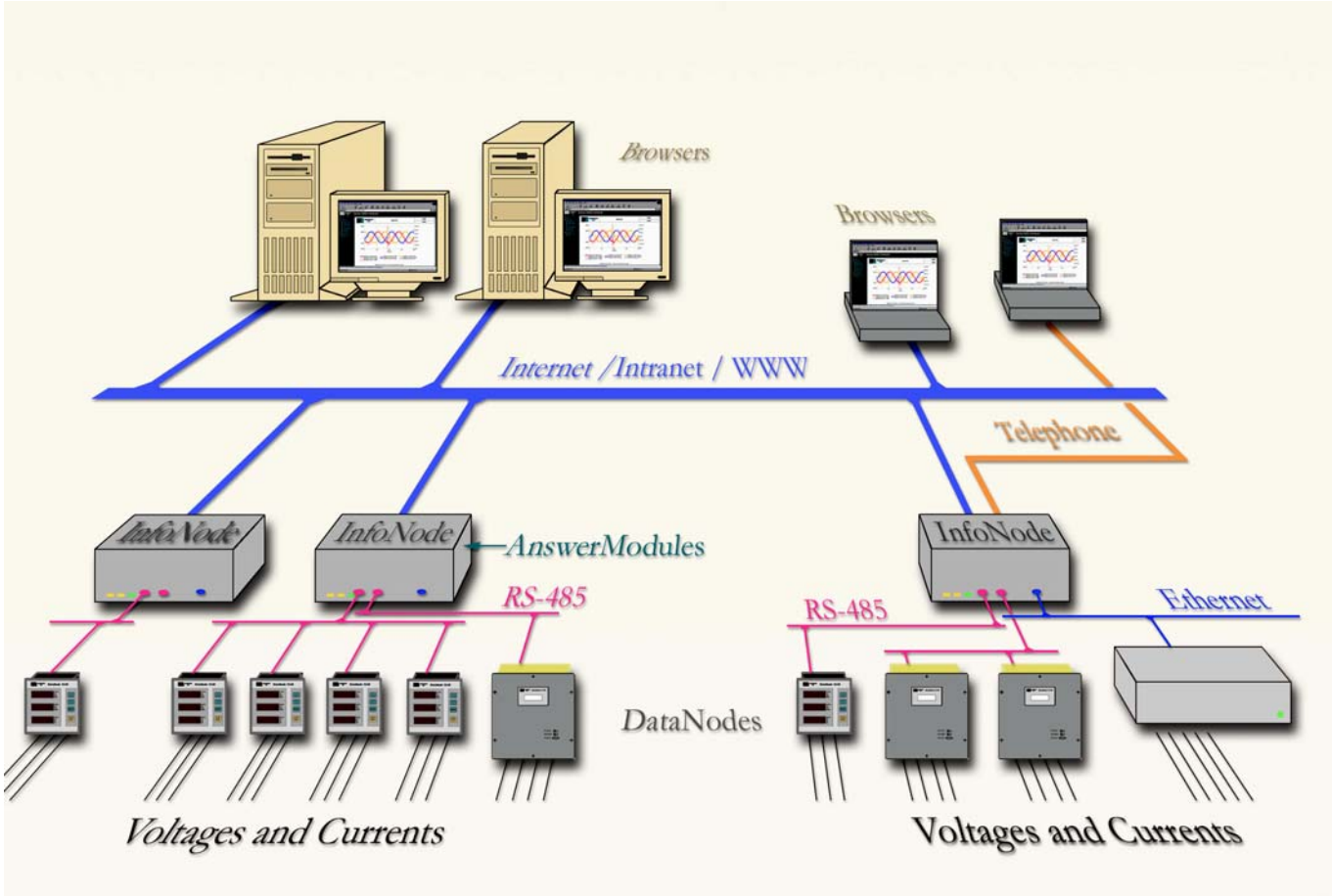


* Phase when capability is introduced

PCM and MCM One Line



Signature System Architecture

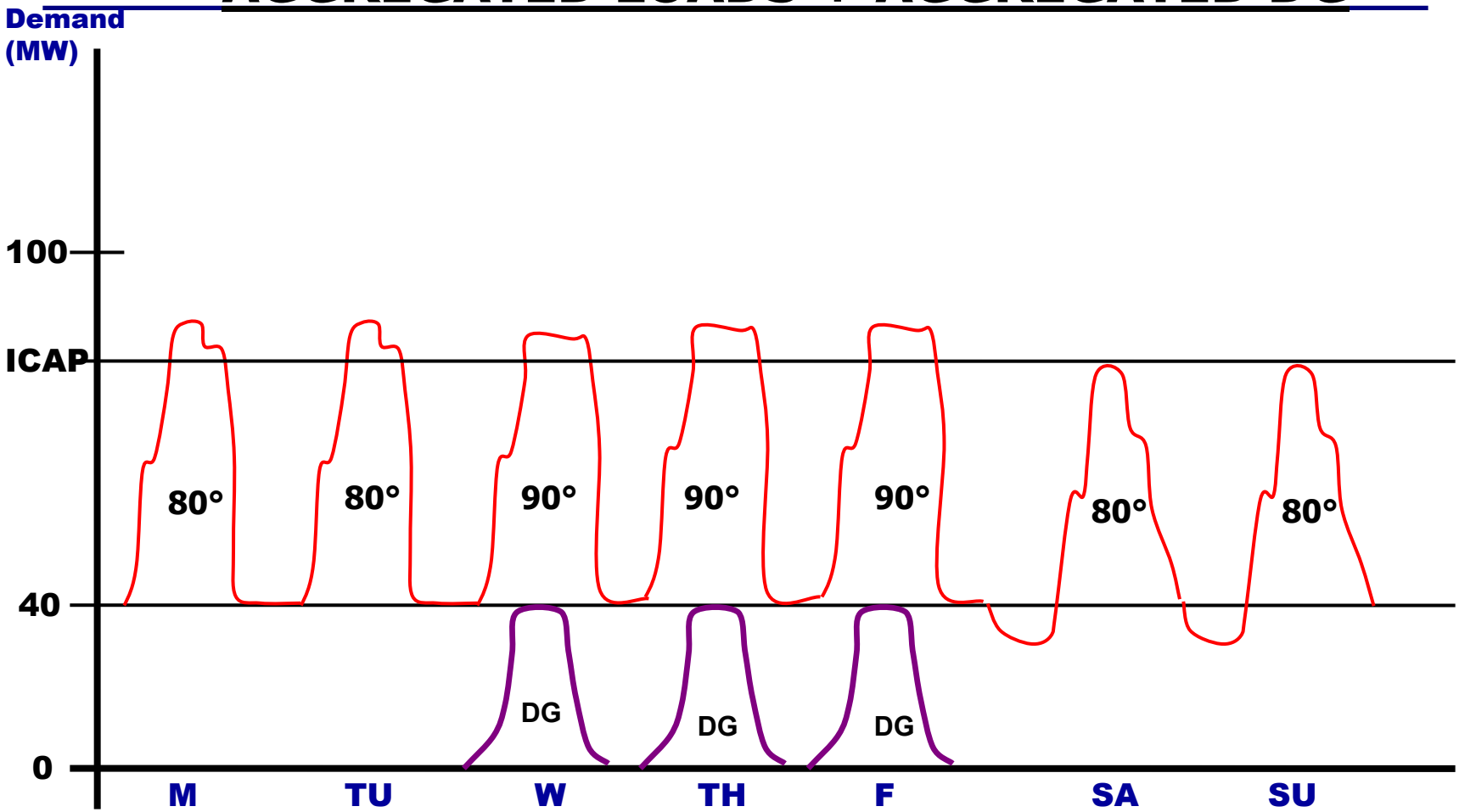


ELECTROTEK CONCEPTS

NodeCenter Capabilities

- Monitor DG units and be able to aggregate loads and predict HA & DA Prices.
- Be able to select DG units by address (for each zone).
- Be able to predict Coincident Peak for each zone, bid in DA market at the hours of coincident Peak, and call engines to operate.
- Provide data to NYISO for settlement.

AGGREGATED LOADS + AGGREGATED DG



COE = 0.4 x $30/MWH + 0.05 x $350/MWH + 0.55 x $50/MWH + $25/MWH (ICAP) + Del

ELECTROTEK CONCEPTS

Benefits

- Today,

  Coe = 0.4 x $35/MWH + 0.05 x $350/MWH + 0.55 x $50/MWH + $25/MWH(ICAP)+ delivery

  COE = $ 84/MWH + delivery

- To be demonstrated in field test,

  Coe = 0.4 x $35/MWH + 0.55 x $50/MWH + 0.9 x delivery

  Coe = $ 42/MWH + 0.9 delivery

Benefits

- For a 1 MW peak, 50% Load Factor;
- Backup Capacity = 2 MW
- Today,

  Coe = 1 MW x 0.5 x 8760H x $90/MWH + delivery

  COE = $400k + delivery

- To be demonstrated in field test,

  Coe = 0.4 x $35/MWH + 0.55 x $50/MWH + 0.9 x delivery

  Coe = $ 180k/MWH + 0.9 delivery

Capabilities Required To Capture Benefits

- The ability to monitor and predict aggregated load, and purchase needed energy supplies when prices are low.
- The ability to forecast curtailable loads and curtail them as needed.
- The ability to forecast the coincident peak for each zone.
- The ability to forecast the voltage drop on a feeder.

SUMMARY

- Project has been approved for Option year 1; conduct field test.
- Field Test is scheduled to begin April ‘02.
- However, interconnection design issues/utility approvals have delayed the completion of Base Year final report (Design of Field Test).

Locating Where Voltage Drop is High

LICrossing

Northport

Cutchogue

Smithtown

Sag Harbor

Freeport

Brentwood

Brookhavn

East Hampton

Field Test

Field Test

Field Test

ELECTROTEK CONCEPTS