OPTIMAL TECHNOLOGIES

Automated Demand Response System and Advanced End-Use Services Platform

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Introductions

Optimal Technologies International Inc.

- Founded in January of 2000 to provide the next generation of global electric power services infrastructure required to supply the economy of the 21st century
- Optimal has developed unique software and hardware to improve the analysis, management and operation of complex electric power networks.
  - Optimal systems are powered by breakthrough network analysis and optimization algorithms that allow previously not possible end-to-end efficiencies while meeting next generation network class and quality of service needs.
- Proprietary mathematical approach offers new opportunities for end-to-end analysis, optimization, and management that goes far beyond traditional OPF.
  - Optimal was nominated for 2003 World Technology Award.

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Why Optimal

Industry leader in Energy Management and Efficiency

State of the Art Hardware and Software

Extensive background in Retail and Wholesale energy markets

Optimal's technology creates new opportunities to provide several highly desirable value added services to utility customers

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SMARTGRID

Targeted, Optimized Interaction of Supply with Demand

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SmartGrid Components ….

AEMPFAST

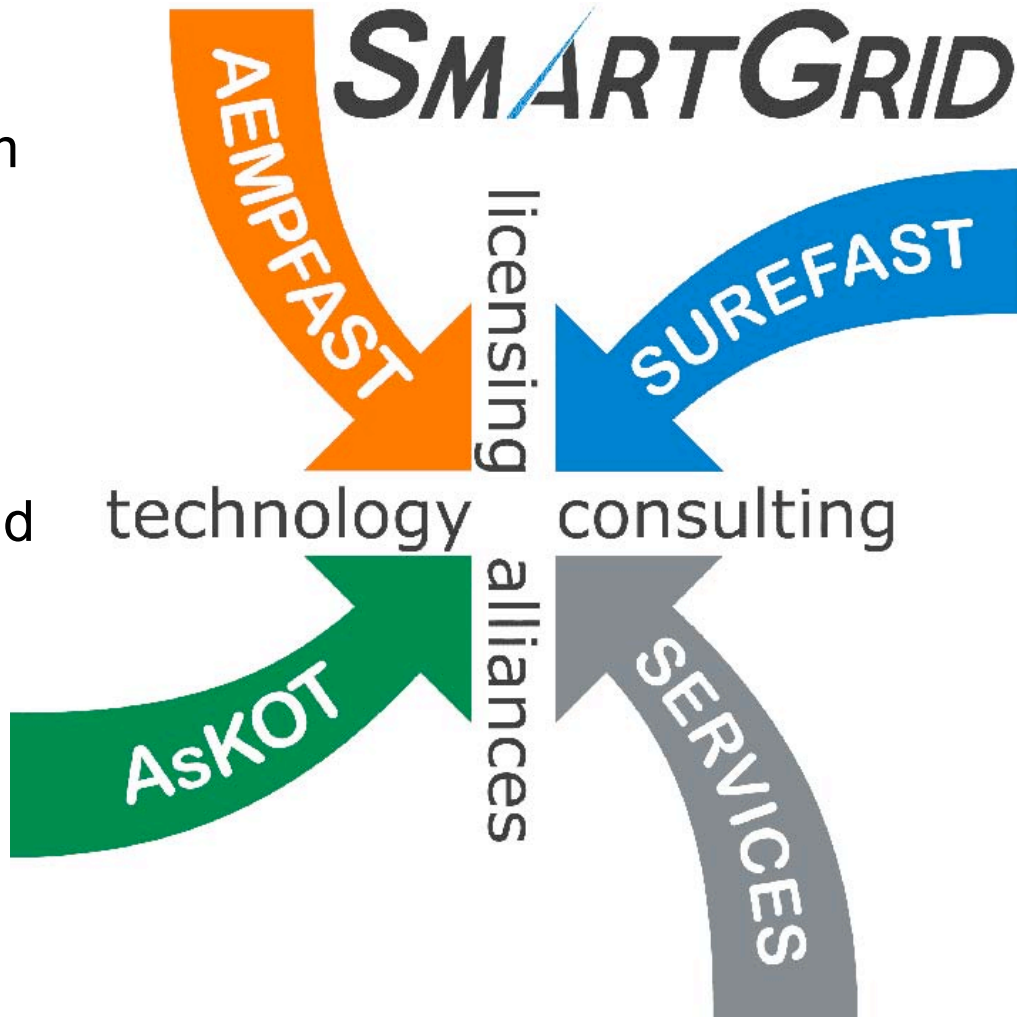
- Advanced Energy Management and Power Flow Analysis System Technology
  - Multi-purpose optimization core - applicable to other industries.

SUREFAST

- Advanced backbone **sensing** and **feedback control** system.

AsKOT

- Web-based management, aggregation, services, and risk management platform.



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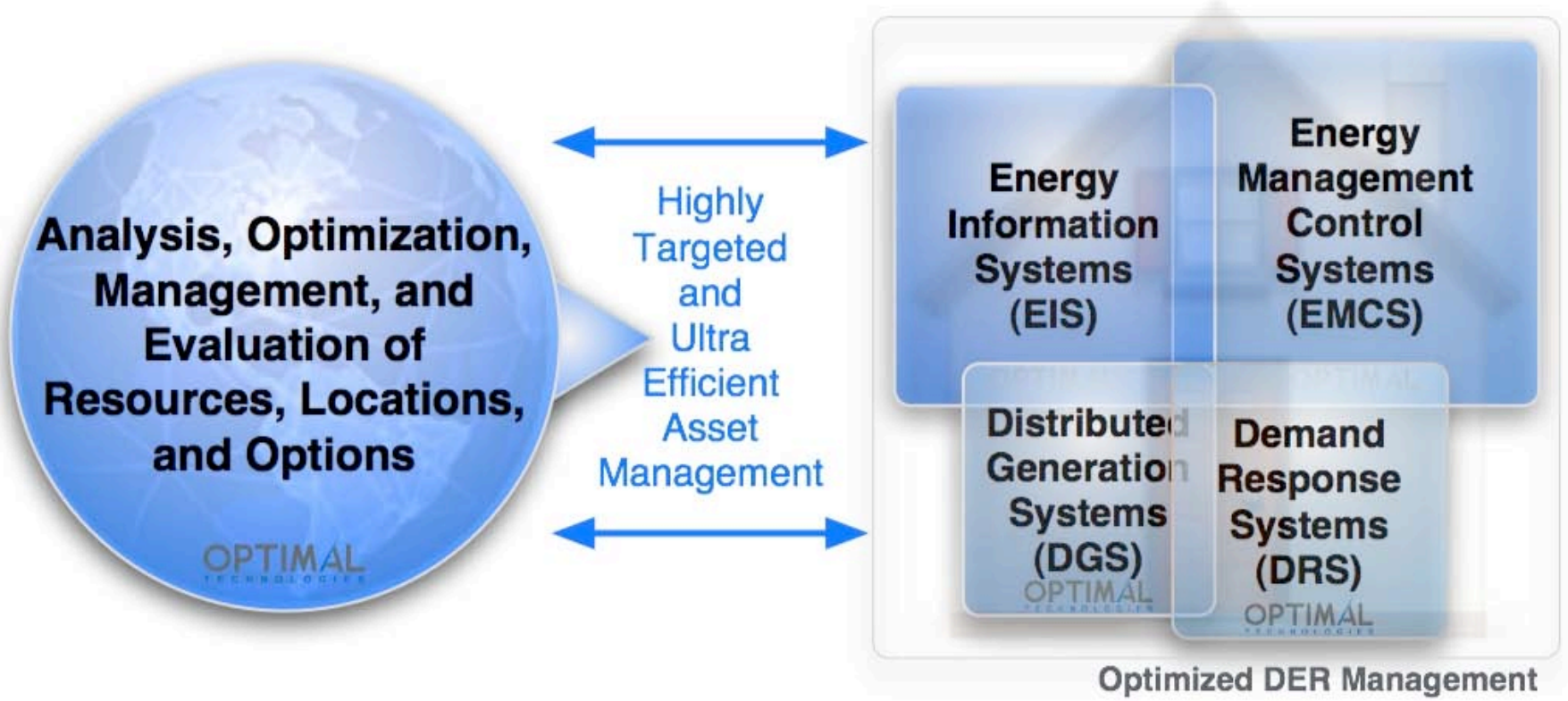
Optimal's SmartGrid Accurately, Efficiently, and Uniquely Connects Supply with Demand

There are few vendors that offer an integrated approach to grid and demand-side energy management, and none that also precisely understand and target T&D grid constraints.



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SmartGrid Delivers …

Reliability and enhanced “Smarts”

- with sensors & system wide information processing that also encourages “plug & play” distributed resources.
- with integrated generation, transmission, distribution, and Distributed Energy Resource operations

Flexibility and resiliency

- with clear operational controls and responsibilities.
- with real-time monitoring & control that restricts operations to “N-1” problem space and also reduces reliance on “Must Run” generators.

Security

- with the ability to predict and determine whether to immediately contain outages with adaptive islanding, fast isolation, or sectioning.

Symmetric market design

- where both supply and demand can be responsive to market prices

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… SmartGrid Delivers

"Optimal provides a new toolkit capable of solving previously "unsolvable" problems, allows changing the objective function, it is fast and handles discrete parameters. These capabilities make many interesting applications possible, such as finding remedial actions, automated network (G,T,D, and DER) planning, emergency control, system restoration, etc."

"Optimal offers capabilities that are very efficient and robust and dramatically improved over available response capabilities; hence, Optimal's unique technologies can solve grid problems even when the network is operating in an "infeasible region" or "past the point of collapse." Furthermore, the "Optimal Solution" is more than a single solution (operating) point as it also includes defendable information of the "region" and the various assets around the solution point."

"Wow! This works across many technical and business regimes and really opens up a bunch of new opportunities not possible from our standard vendors."

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For Demand-Side Concerns, SmartGrid Provides New Opportunities For:

- Energy management
- Excess Demand trading
- Standby Generation Dispatch and Control
- Automated Billing and Streamlined Settlement
- Creation of dynamic load and virtual power plants
- Shared savings and “security dividend payments”
- Advanced metering and time of use rates
- Equipment and power quality monitoring
- Building zone occupancy monitoring
- Advanced local and wide area network load optionality
- Predefinition of a load profile for emergency response
- Device information on energy use in each unit or local conditions in building zones
- Numerous new high demand services

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SmartGrid Components

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AEMPFAST: New Optimization Technology

- Optimal has developed the first accurate high-speed analysis and optimization technology that handles modern complex power networks.
  - Near real-time – seconds vs. hours or days.
  - Domain-independent – always finds the best global answer.
  - Non-linear – accurately represents the real world.
  - New algorithms converge where traditional methods cannot.
  - Ability to handle very large amounts of data.
    - Could analyze the entire US grid.
      - End-to-end functionality from RTO to appliance.
  - Open architecture for additional subsystems, agents, and objectives.
  - Enforces multi-objective inequality constraints.
    - – Competitors defeat the possibility of conducting true system optimization by assigning fixed values to factors that in actuality are dynamically varying.
      - » (Competitors change inequality objectives to equality constraints.)

Better Use of Better Data = Unique New Opportunities

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AEMPFAST CEC/LBNL/CAISO/PG&E Verification: AEMPFAST Would Have Prevented Blackouts

California Energy Commission/California ISO verification:

- Optimal reviewed June 14, 2000 SF Bay Area system conditions that resulted in unscheduled rotating blackouts:
  - Cutoff of power to more than 97,000 SF Bay Area power customers.
  - Estimated cost of $160+ million to Bay Area and Silicon Valley economy.

If June 14, 2000 system had been optimized with AEMPFAST:

- Blackouts avoided, system stabilized, power quality increased.
- Available power increased – without new generation – by optimizing existing resources.
  - AEMPFAST can typically find 5%-6% additional grid efficiencies.
- In addition to avoiding blackouts, AEMPFAST found an additional 130 Megawatts (MW) of generation that were available at the time, though not visible to system operators while also improving power quality.
  - Enough to power approximately 130,000 more homes (i.e., in addition to avoiding the blackouts).

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SmartGrid Components

SUREFAST

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SUREFAST Energy Optimization Platform Provides for:

Automated and TOU Metering

- Electricity (Soon: Gas, Water)
- Remote disconnect/reconnect
- No Upgrade Penalty

Energy Management

- Dynamic Management and Aggregation of Load and Virtual and DG Power Plants
- Shared savings and “security dividend payments”
- Energy information for each appliance, room, or building

Energy Provider

- Standby Generation Aggregation, Dispatch, and Control
- Power Quality Monitoring
- Automated Billing
  - Streamlined settlement
- Equipment and Building Monitoring
  - Predefinition of a load profile for automated application in system emergency conditions

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Highly Advanced Power Automation Technology

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SUREFAST Offers Superior Solutions:

SUREFAST is a low-cost, highly reliable, continuous local and remote monitoring, control, and response system. SUREFAST works to balance local load with DG and/or grid-supplied power.

- Plug & Play design is simple to install yet provides rich functionality to meet present and future customer needs.
- Meets all State, Federal, and Utility Automated Response requirements.
- Exceeds all Utility and End-User Modeling/Profiling requirements.
- Provides superior Operator and Consumer Control Flexibility.
- Offers low-cost, high-reliability, continuous local and remote monitoring and control of real and reactive power use at customer and device level.
- Can work with other systems (e.g., ModBus, Lonworks, Cebus, X10, etc.)

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SUREFAST "SmartGrid" Dispatch Manager provides:

- Ability to monitor energy prices, provide higher greater reliability
- Ability to create revenue by selling excess power from power generators now owned by clients.
- Ability to manage energy consumption.
- Reduced energy costs.
- Ability to sell load reduction and/or distributed generation into the market.
- Unprecedented real-time integrated management and automation of aggregated distributed load and/or generation. SUREFAST Summary

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SUREFAST provides the following functionality:

- Flexible, integrated communication with meters and sub-meters
- Flexible meter data collection and management
  - Both polled and real-time access to meter data
  - Intelligent remote connect and disconnect
  - Supports dynamic tariffs, tampering detection, and trouble alarming.
- Open platform for industry-accepted communication protocols
- Unequalled integrated program evaluation and management
  - Supports multiple options for sophisticated comparison analysis.
- Price and Consumption awareness for customers.

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SmartGrid Capabilities Extend to T,D, Load, and DG

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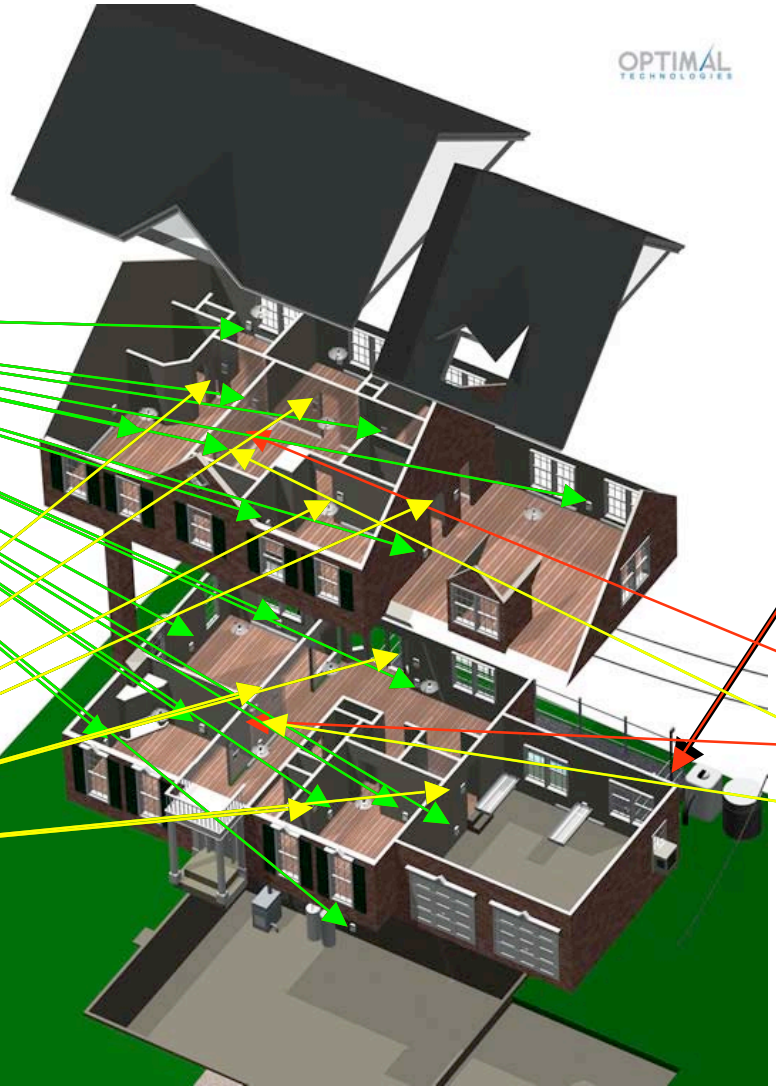
SUREFAST Capabilities for Automated Demand Response

Power Meter

Temperature

Occupancy

Light



Power Meter

Temperature

Power Meter

Temperature

Occupancy

Light

Temperature

Occupancy

Light

ModBot designs TM protected

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SUREFAST/E System Example – Energy Plus Others

- LAN/Wireless Broadband
- Medical Monitoring
- Equipment Monitoring
- Security Camera(s)
- Safety-Fire Protection
- Premise Automation
- Remote Secure Data Storage
- Digital Entertainment

Thermostat ModBot (not required)

SUREFAST ToTo

(Custom GUI c/w Smart Card/Credit Card Reader)

Plug-in ModBot

Also Remote Mount Option)

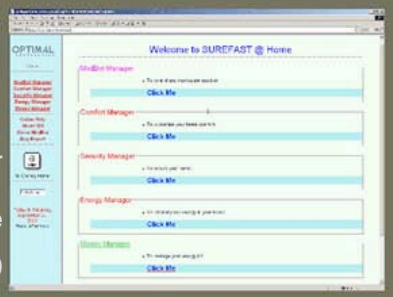
Wire-in Lighting ModBot

SUREFAST/E

(ISD w/Revenue Generating Services)

AskOT

(Web Interface to SUREFAST)



SM3 AMR ModBot

ModBot designs TM protected

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Hardware: Round Base (2S) Revenue Meter ModBot

Ultra-Reliable AMR Meter (ModBot)

- Operates as standalone or aggregated high quality revenue grade electronic meter – all without changing meter.
- Remote Disconnect and Reconnect
- Theft and trouble alarming and reporting
- Flexible communications capability.
  - Communication to ISD is built-in at no extra charge.
  - Legacy communications are supported via plug-in modules.
    - Cannot be “stranded”.
- Supports dynamic tariffs.

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SUREFAST Summary

SUREFAST provides the following functionality

- Pinpoint Control of Multiple Appliance Loads and DG Units
- Customer Override
- Ability to Receive/Send Signals on virtually Unlimited Parameters
- Handles Pricing and or Emergency Curtailment Signal
- Confirms Level of Load Reduction with Unprecedented Detail
- Uses Existing Communication Lines
- Provides Flexible, Integrated Communication with Meters/Sub-meters
- Provides Flexible Meter Data Collection and Management
  - Provides Both Polled and Real-time Access to Meter Data
  - Intelligent Remote Connect and Disconnect -- Supports Tamper Detection
- Open Platform for Industry Accepted Communication Protocols
- Integrated Program Evaluation and Management
  - Supports numerous options for Sophisticated Comparison Analysis

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Information and Management Hub for SUREFAST

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AskOT Portal View for Advanced Demand Response

Discussion Groups/ Chat Rooms

Knowledge Management

Utility/Corporate Communications

Learning & Development

Sophisticated Comparisons Using Same System

Competitive Intelligence

Cross Functional Integration Of Transactions & Information

User Approved Personal Information

AskOT Portal

Corporate Programs

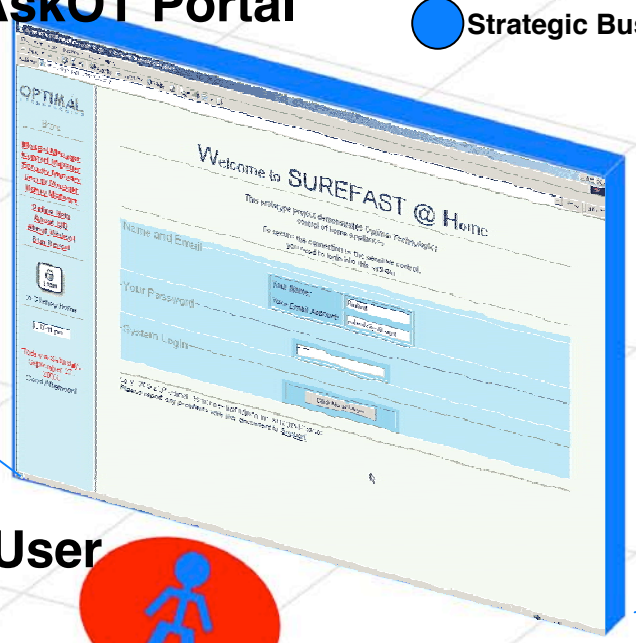
Strategic Business Teams

Real-time Collaboration & Feedback

Virtual Project Teams

IT Support

Information & Opportunities



Other Applications

User

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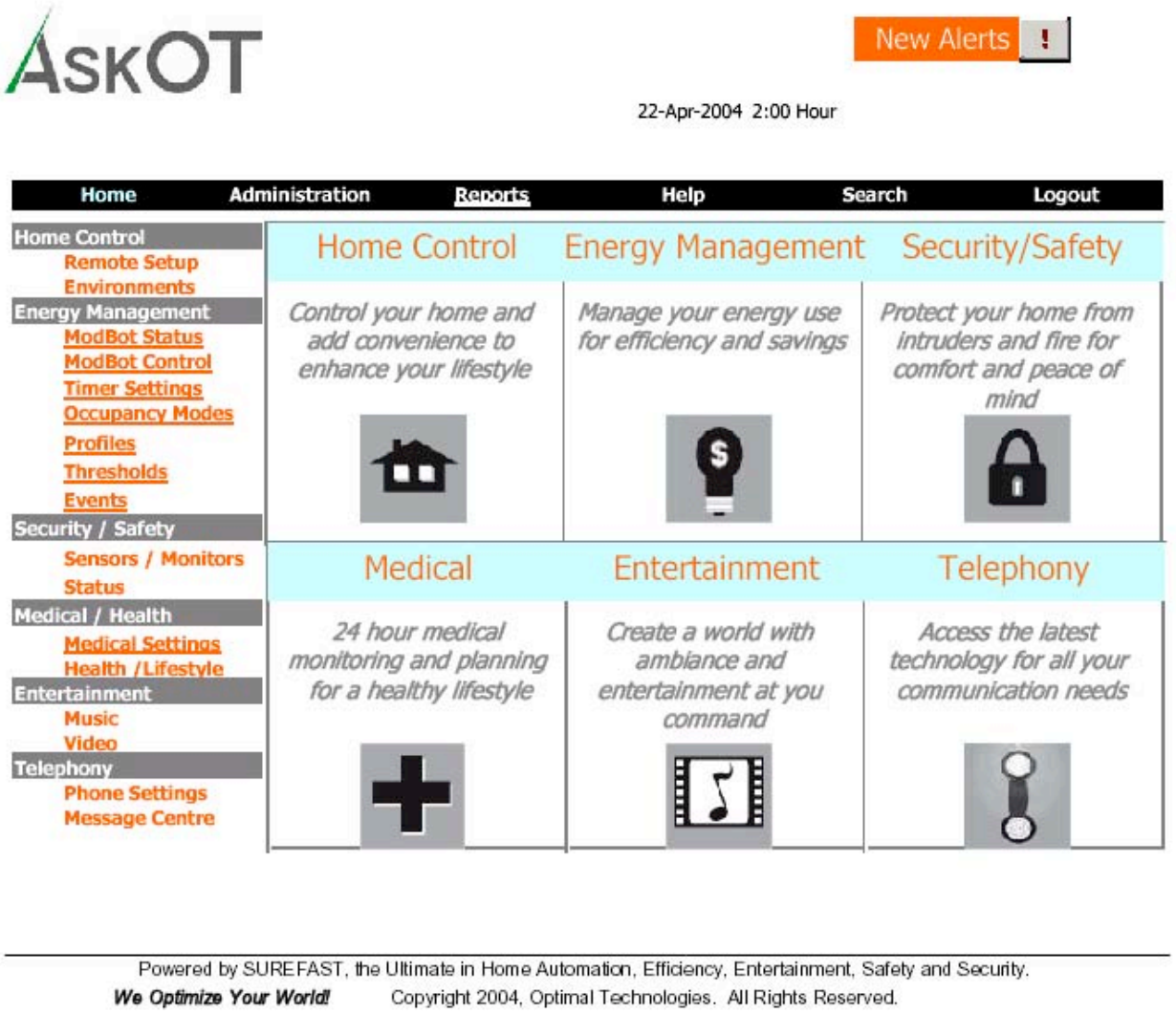
Dedicated Interface to SUREFAST



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SMARTGRID

Summary

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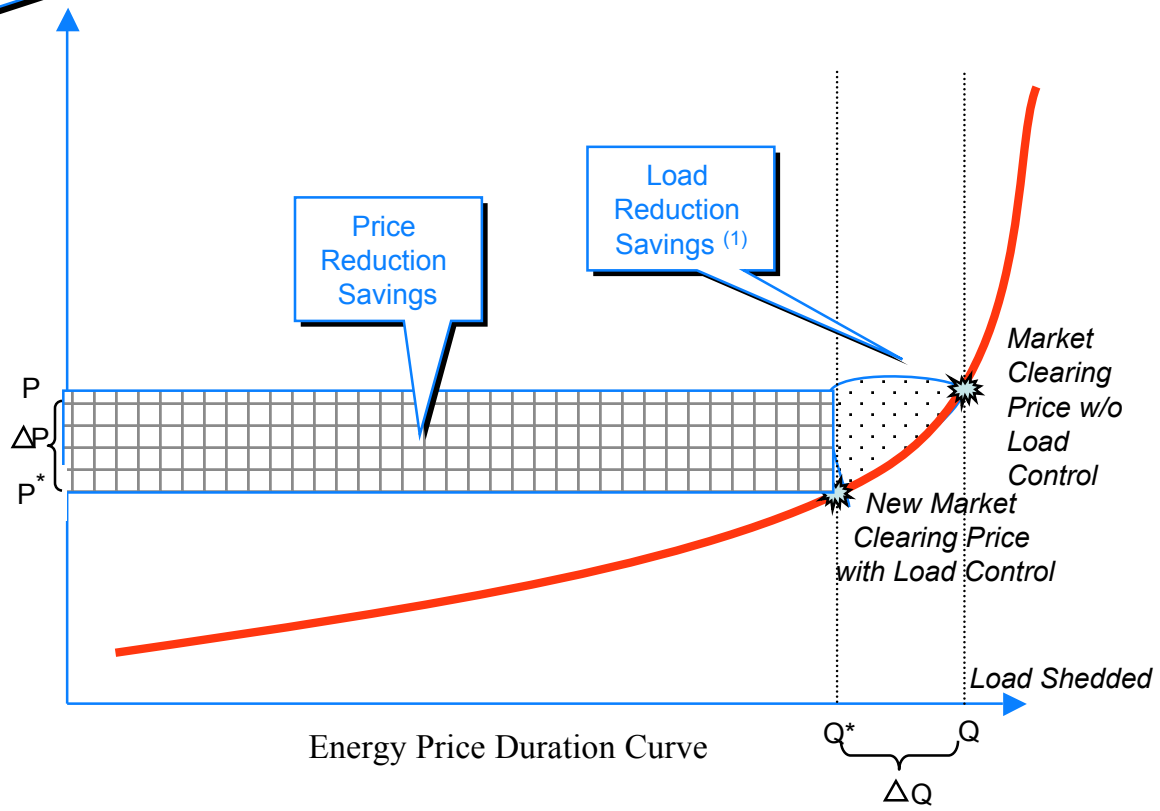
Real Value of SmartGrid = Lower Peak Market Prices

ILLUSTRATIVE

Load Management Savings Diagram



Notes: Load Reduction Savings value includes the wholesale savings - the revenue that would have been generated for that hour.

Power Market Impacts

- When a large buyer reduces the amount of power it purchase in the wholesale market, this reduces the spot price for energy or ancillary services.
- The first 5-8% of demand reduction will reduce peak energy prices by $300-$600/MWh, since the slope of the wholesale supply curve is very steep in peak hours of consumption.
- The price reduction savings impact all power contracts that are linked (exposed) to the spot market price.
- Traders also could use negawatts to "short" the power markets.

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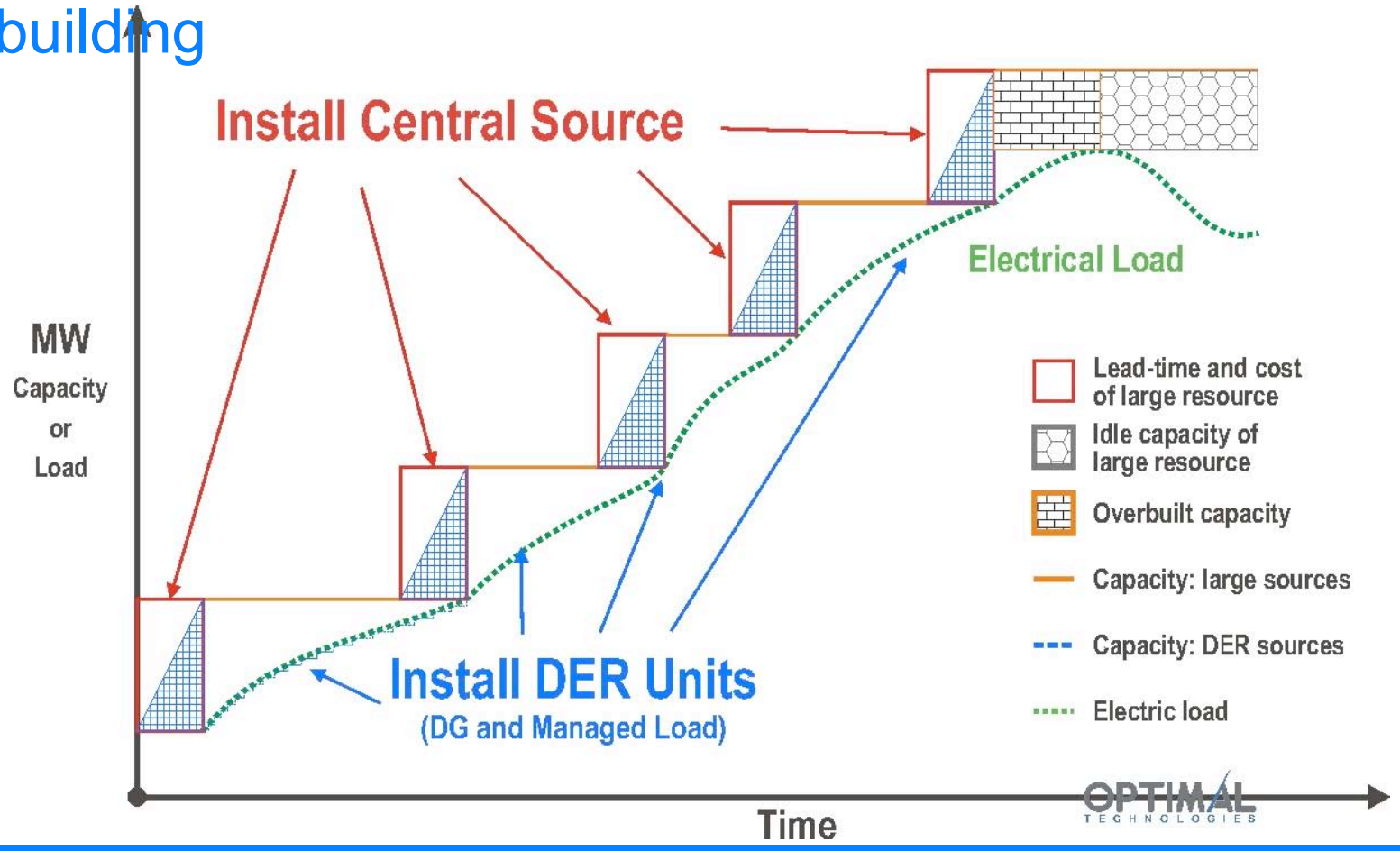
SmartGrid Provides Faster Response

SmartGrid scale and modularity provide an option value from increased flexibility, shorter lead-time, and decreased risk of overbuilding



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Optimal's unique technology and end-to-end approach provide the best possible platform for the 21st Century grid.

We Optimize Your World!

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Executive Summary: Optimal Highlights

BusinessWeek

commonwealthclub.org
the nation's oldest and largest public affairs forum

Forbes

San Francisco Chronicle

IPPSO FACTO
Magazine of the Independent Power Producers' Society of Ontario

Times-Herald

ACTION CABLE 6 36 The Bay Area's Action Channel

SILICON VALLEY / SAN JOSE
Business Journal

RED HERRING

ENERGY USER NEWS
ENERGY MANAGEMENT FOR THE COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL MARKETS

reforma.com

THE california REPORT

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ENERGY PROSPECTS

SVB
silicon valley business

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