Don’t Ask Me What I Want, Ask Me What I Do: The Key To Valid Requirements Documentation

Mary Altalo

CORE/Ocean.US

m.altalo@ocean.us

Understanding How Climate Information is used- Getting to Requirements

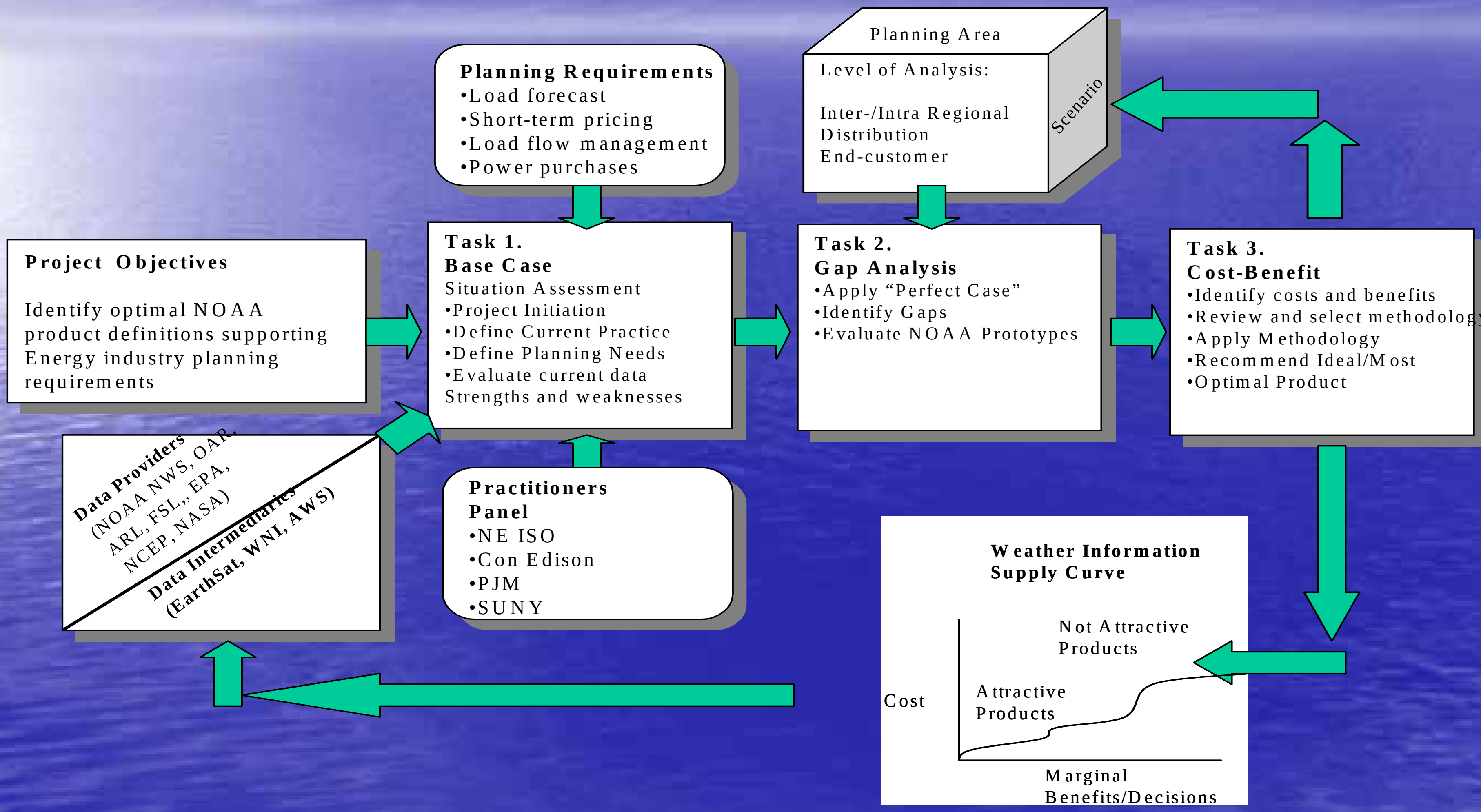
- Climate Information in Federal Resource Management Decisions
  - Setting codes and standards- building safety
  - Management of natural resources-water, forests
  - Regulatory oversight of social systems: energy, transport, water, health
- Climate Information in International Trade/Aid Decisions
  - Treaty and Trade Agreements –Canada Northern Trade Route
  - Aid priorities and planning- Zimbabwe Power, resettlement issues
- Climate in Industry Operations and Planning Decisions
  - Tactical Operations
  - Strategic Planning
- From Mitigation to Adaptation
  - From Way of Life (practice) to Business Process Reengineering (new tools and practices)

Getting at the Need

The "worst nightmare" according to head of the PUC is that the Governor's office calls and asks "what is going on and when will services be restored?" and they don't know

- Thus the need for "Situational Awareness"
- More than just environmental awareness-It is the status of the operations of power, water, communications, police, pipeline, toxic spill etc.
- Need probabilities of strikes for action
- This is where climate information is most useful

Diagnostic Approach to Assessing Vulnerability and Risk



From SAIC technical report to NOAA

Who are the users?
Why do they use it?
How are they organized?
How do they use it?

Uses for environmental information products

In Energy Industry Operations

- Energy load forecasting across grids
- Fuel mix determination
- Thermostat control
- Wind farm siting

In the Health Industry

- Health forecasts
- Spread of toxins and pollutants both airborne and waterborne
- Famine, flood, and drought climate forecasts
- Health facility scheduling

Other sectors---other uses

In the Transportation Industry

- Ship route optimization and planning
- Aviation routing and planning
- Intermodal transportation optimization
- Trucking industry logistics

In the Finance Industry

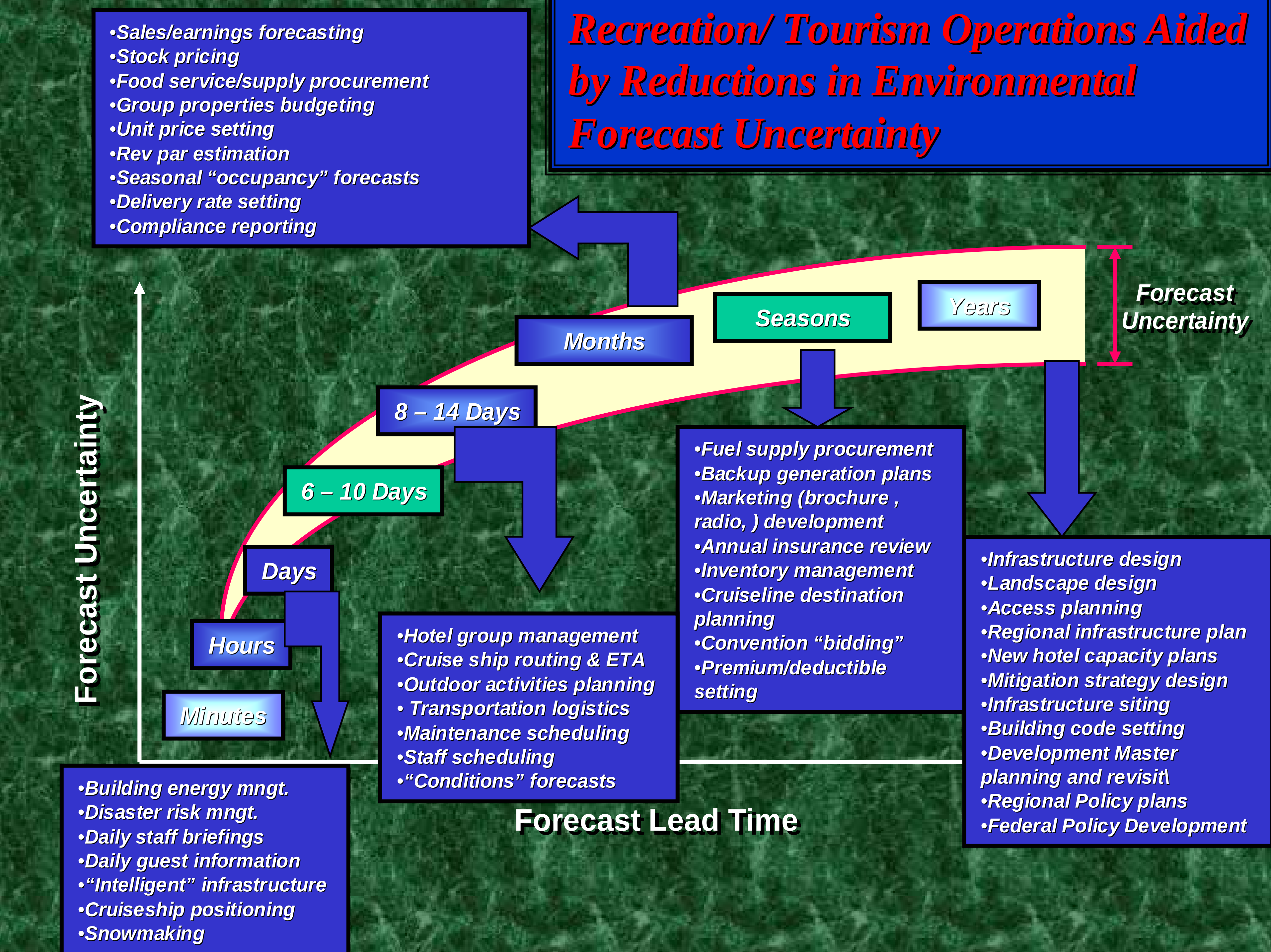
- Risk rating for compliance
- Weather derivatives for trading, futures and hedging
- Environmental evaluation for asset managers

In the Tourism and Leisure Industry

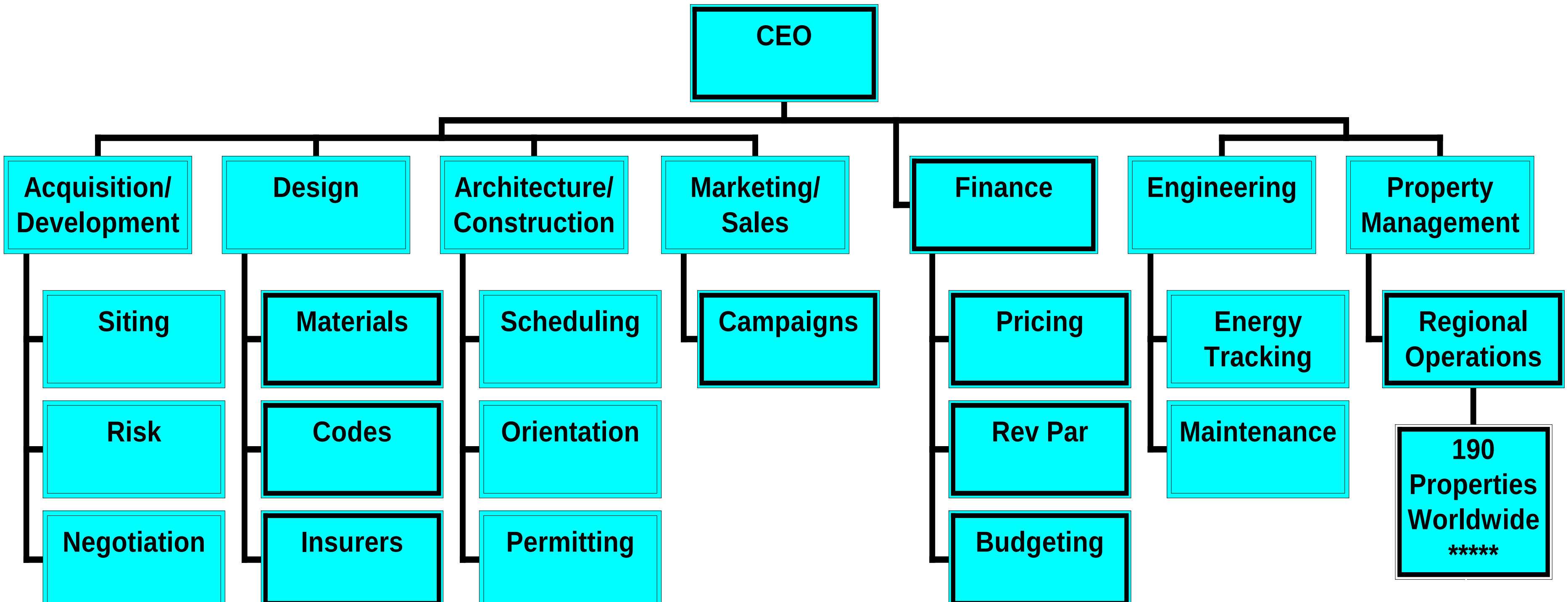
- Infrastructure planning for new construction
- Training courses for staff development programs
- Seasonal planning for resort load capacity
- Hazard and risk management preparation
- Leisure line route planning and recreational boating

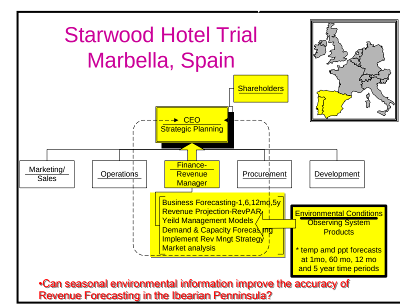
Driving Principles for Managing with Environmental Information

- Regulatory
- Decision Accountability/Shareholder Value
- Safety of Life and property
- Market Economics & Competitive Advantage
- Risk reduction
- Reliability, Efficiency, Sustainability
- Corporate Social Responsibility- Indices


Recreation/ Tourism Operations Aided by Reductions in Environmental Forecast Uncertainty
•Sales/earnings forecasting
•Stock pricing
•Food service/supply procurement
•Group properties budgeting
•Unit price setting
•Rev par estimation
•Seasonal "occupancy" forecasts
•Delivery rate setting
•Compliance reporting
Forecast Uncertainty
Minutes
Hours
Days
6 – 10 Days
8 – 14 Days
Months
Seasons
Years
Forecast Uncertainty
•Building energy mngt.
•Disaster risk mngt.
•Daily staff briefings
•Daily guest information
•"Intelligent" infrastructure
•Cruiseship positioning
•Snowmaking
•Hotel group management
•Cruise ship routing & ETA
•Outdoor activities planning
• Transportation logistics
•Maintenance scheduling
•Staff scheduling
•"Conditions" forecasts
•Fuel supply procurement
•Backup generation plans
•Marketing (brochure , radio,) development
•Annual insurance review
•Inventory management
•Cruiseline destination planning
•Convention "bidding"
•Premium/deductible setting
•Infrastructure design
•Landscape design
•Access planning
•Regional infrastructure plan
•New hotel capacity plans
•Mitigation strategy design
•Infrastructure siting
•Building code setting
•Development Master planning and revisit\
•Regional Policy plans
•Federal Policy Development
Forecast Lead Time

R&T: Value Chain Organization of Starwood: Business Units & Functions Requiring Environmental Information

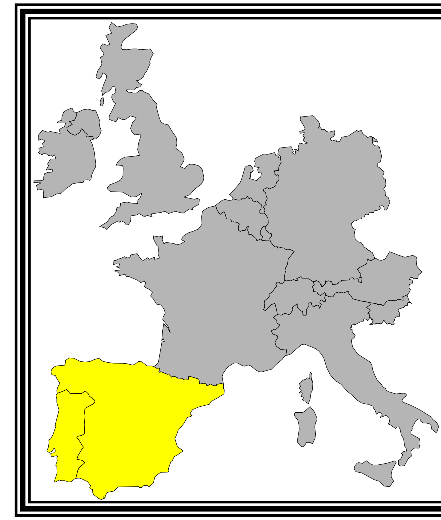


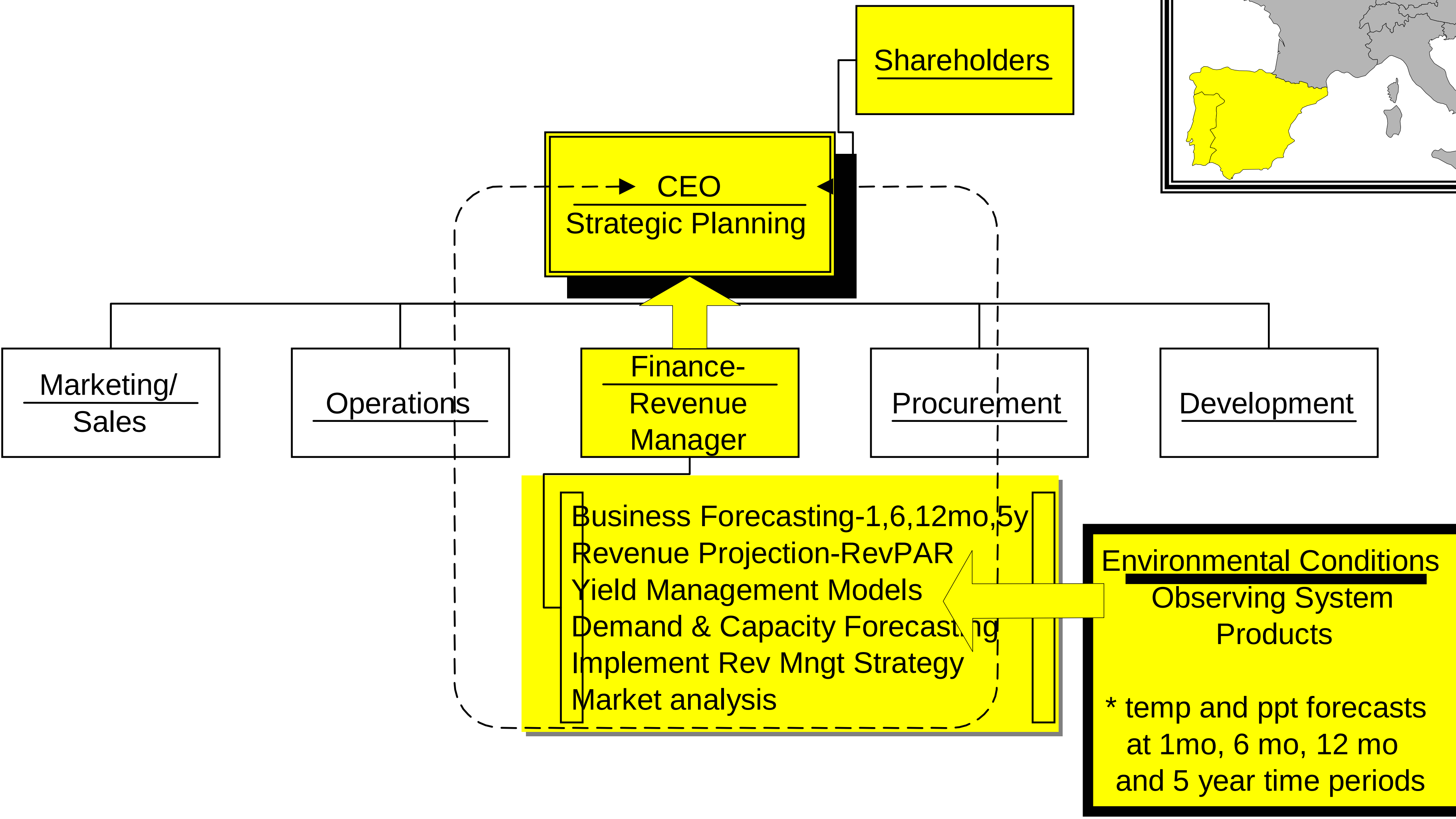


RECREATION & TOURISM INDUSTRY PERFORMANCE METRICS:The Business Models

Revenue per available room (RevPar)	Accommodation sector
Occupancy rates	Accommodation sector
Occupancy percentage	Accommodation sector
Average Daily Rates (ADR)	Accommodation sector
Comparative Operating Rates (COR)	Accommodation sector
Gross Operating Profit (% before fees)	Across the industry
Economic Impact Assessment	Across the industry
Financial rate of Return (FRR)	
Economic Rate of Return (ERR)	
International arrivals[1]	Travel sector
Journeys made	Travel sector

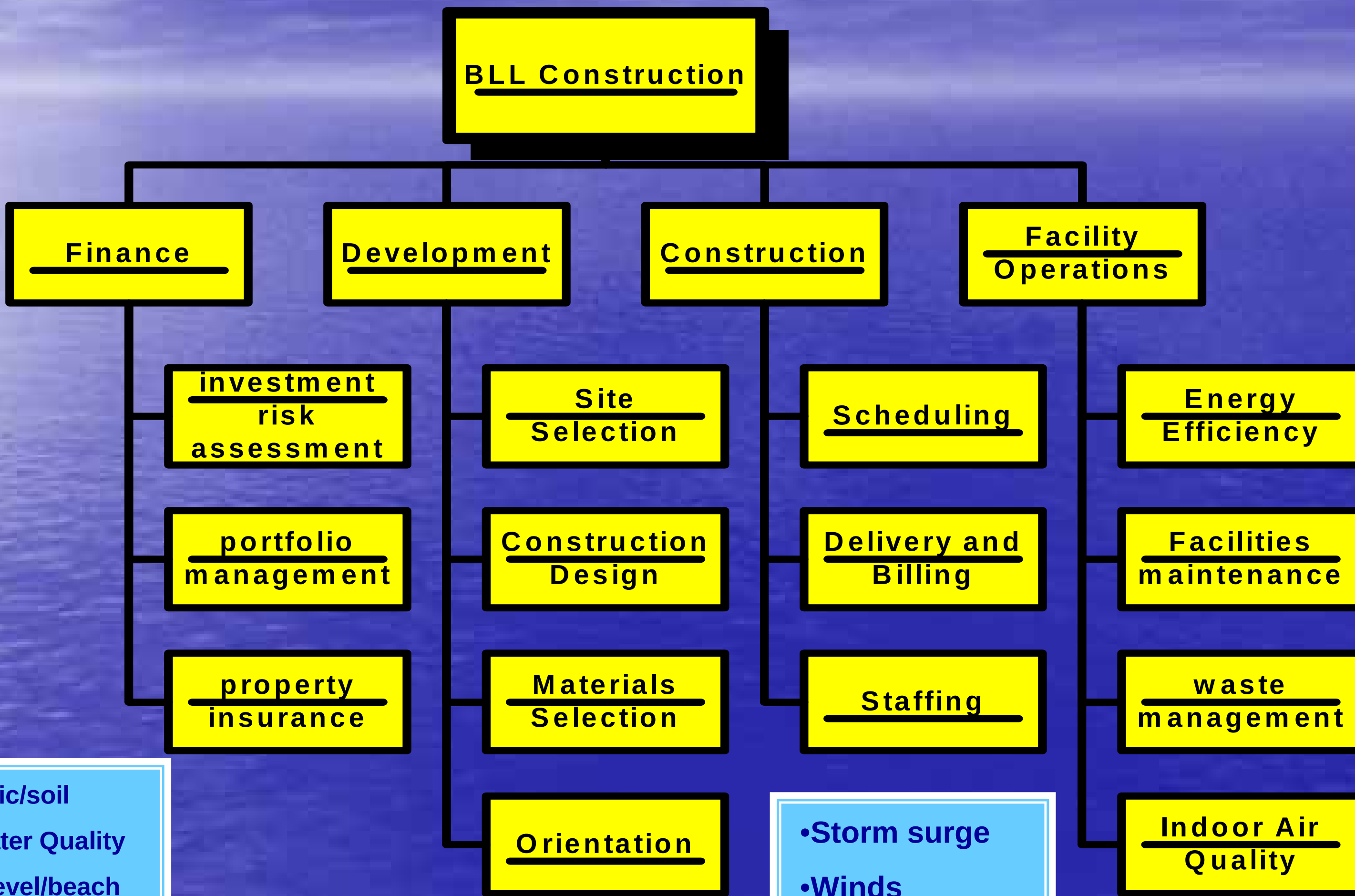
Starwood Hotel Trial
Marbella, Spain





- Can seasonal environmental information improve the accuracy of Revenue Forecasting in the Iberian Peninsula?

Building Industry Decisions Requiring Environmental Information



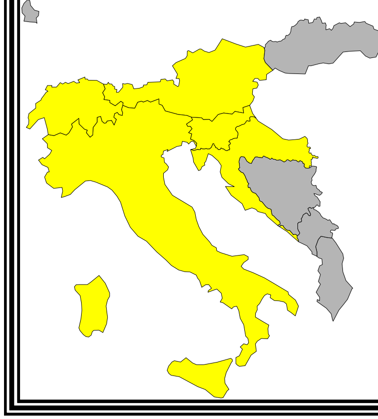
- Seismic/soil
- Air/water Quality
- Sea Level/beach
- SST
- Red tides
- Ppt/temp

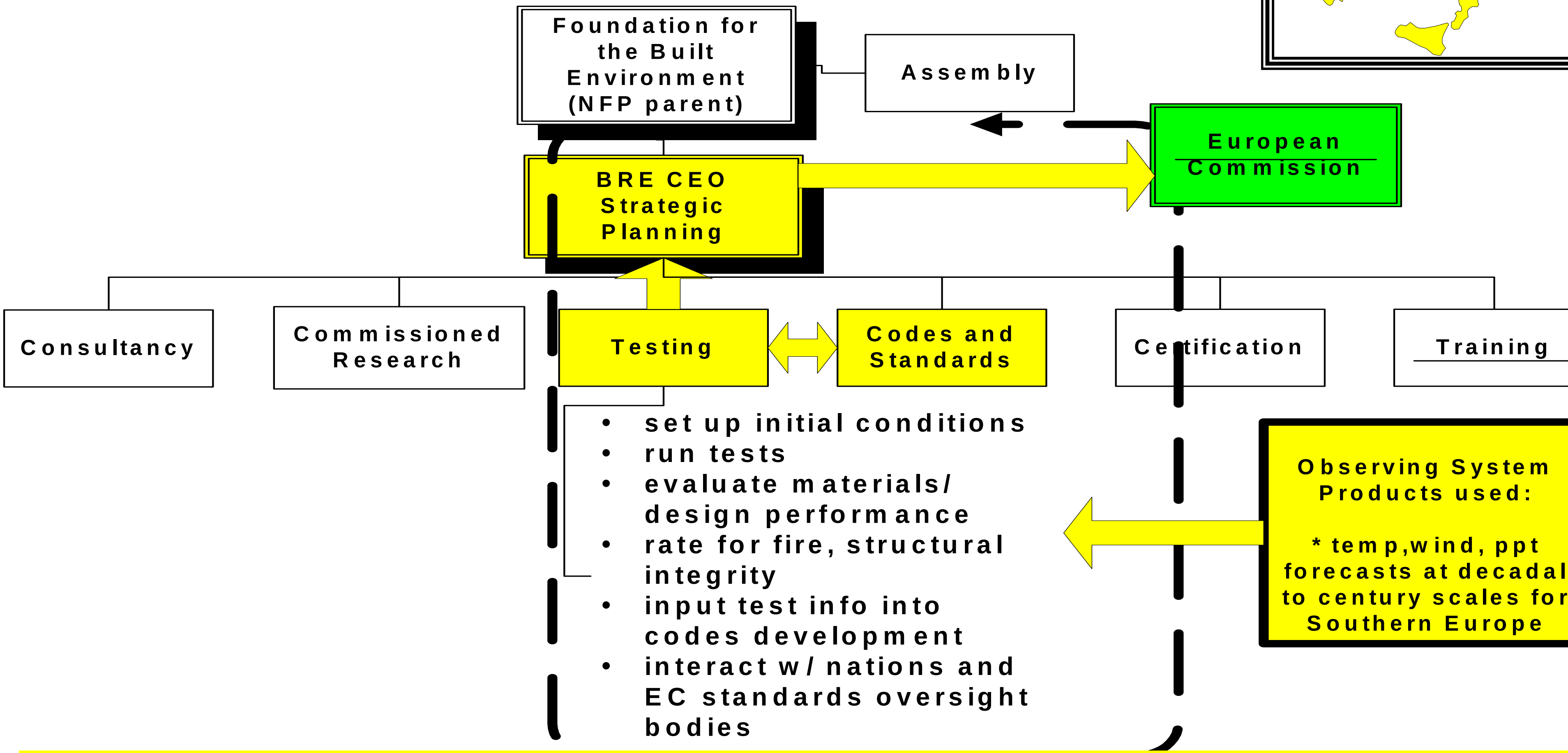
- Climate, ppt, temp, winds
- Fire risk

- Storm surge
- Winds
- Sea breeze
- Precipitation

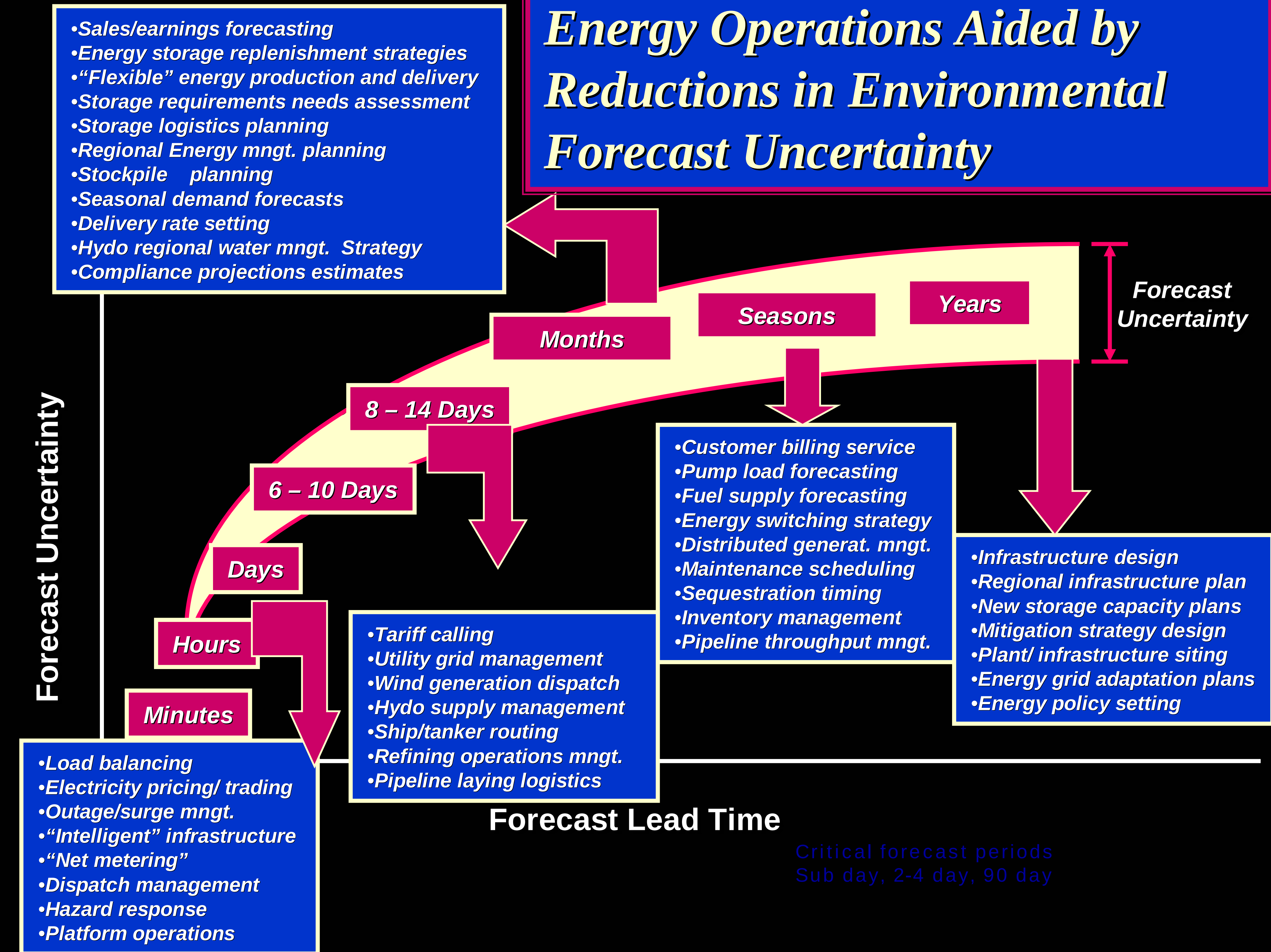
- T,humidity,cloud cover, ppt
- Air quality
- Emissions/air and water

BRE Trial to Inform Sustainable Construction Policy

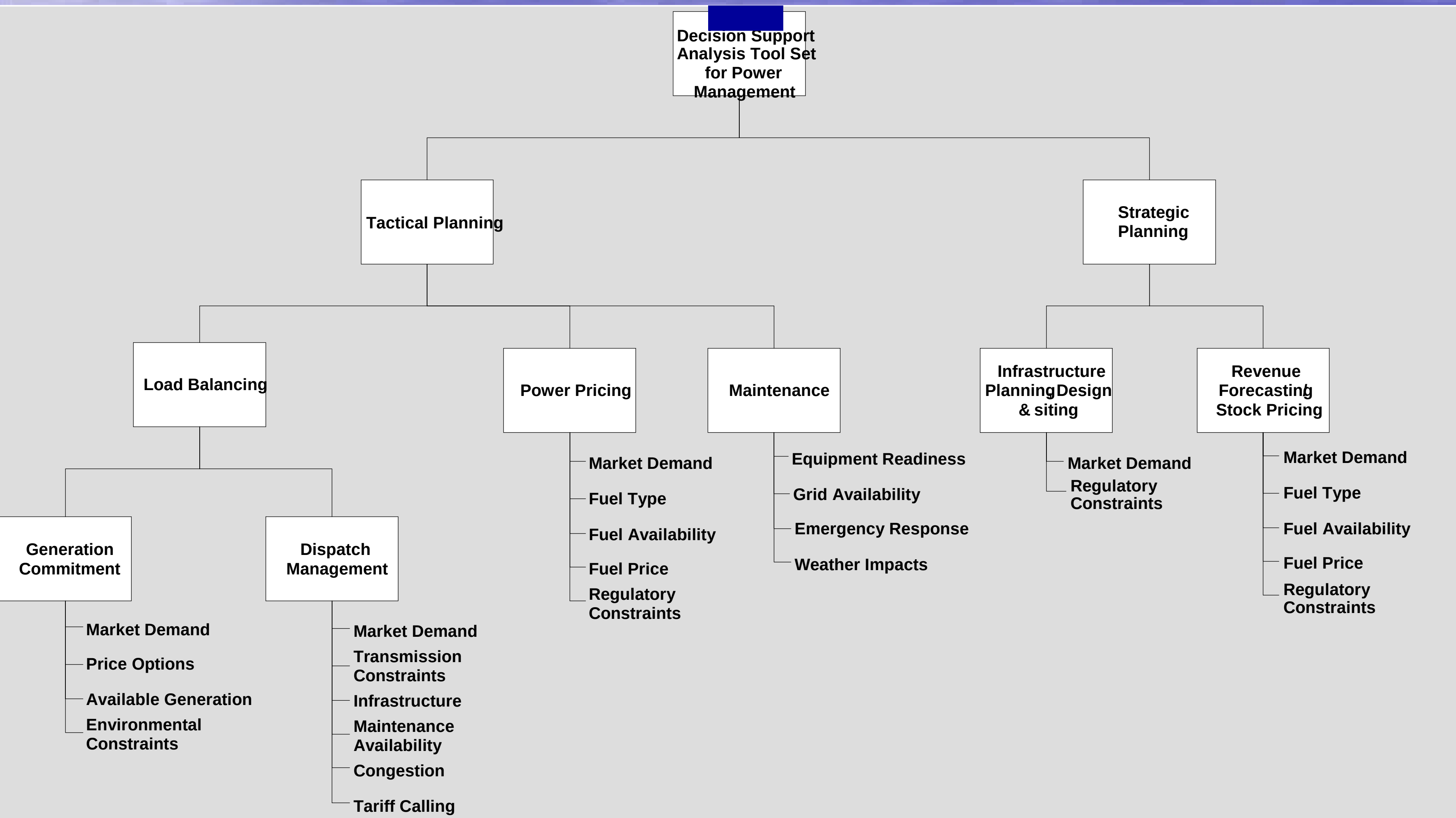




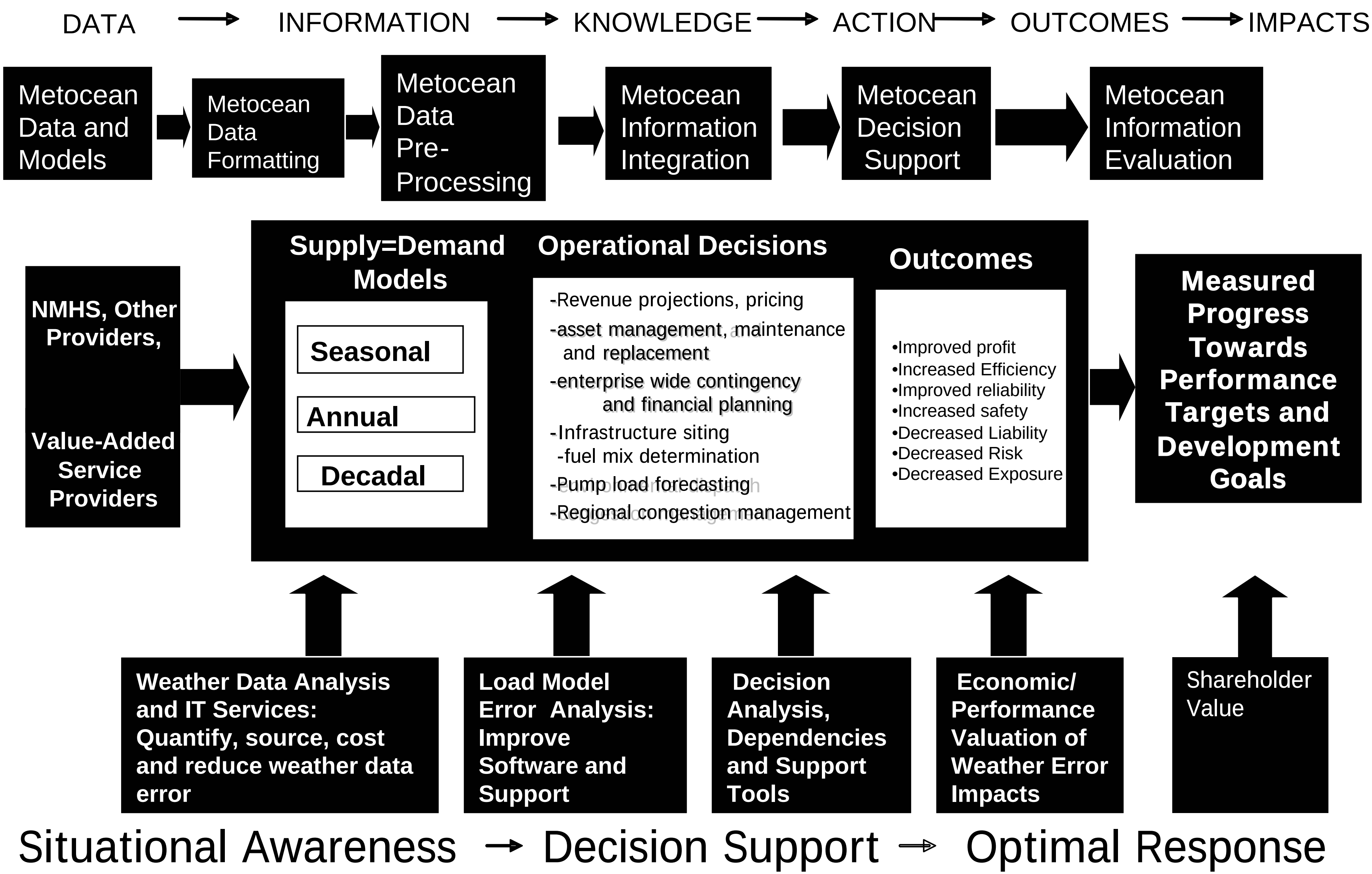
Q? Can the improved regional decadal scale climate forecasts of heat, ppt and wind improve the codes and standards for urban construction in Southern Europe resulting in more sustainable shelter?


Energy Operations Aided by Reductions in Environmental Forecast Uncertainty
•Sales/earnings forecasting
•Energy storage replenishment strategies
•“Flexible” energy production and delivery
•Storage requirements needs assessment
•Storage logistics planning
•Regional Energy mngt. planning
•Stockpile planning
•Seasonal demand forecasts
•Delivery rate setting
•Hydo regional water mngt. Strategy
•Compliance projections estimates
Months
Seasons
Years
Forecast Uncertainty
8 – 14 Days
6 – 10 Days
Days
Hours
Minutes
Forecast Uncertainty
•Customer billing service
•Pump load forecasting
•Fuel supply forecasting
•Energy switching strategy
•Distributed generat. mngt.
•Maintenance scheduling
•Sequestration timing
•Inventory management
•Pipeline throughput mngt.
•Infrastructure design
•Regional infrastructure plan
•New storage capacity plans
•Mitigation strategy design
•Plant/ infrastructure siting
•Energy grid adaptation plans
•Energy policy setting
•Tariff calling
•Utility grid management
•Wind generation dispatch
•Hydo supply management
•Ship/tanker routing
•Refining operations mngt.
•Pipeline laying logistics
•Load balancing
•Electricity pricing/ trading
•Outage/surge mngt.
•“Intelligent” infrastructure
•“Net metering”
•Dispatch management
•Hazard response
•Platform operations
Forecast Lead Time
Critical forecast periods
Sub day, 2-4 day, 90 day

Power Industry Decision Aid Architecture



Climate Information "Flow" on the Operational Decision Process: Risk Reduction Areas



Activating the Information

Link to an Engineering Requirement

"Codifying"

Turning a "Parameter" into a "Factor" in an Engineering Equation

The key to "activating" observing system Information

Case study 1: Activating rain and wind data in reservoir management. Improved precipitation, and winds feed into actions for runoff conservation, reservoir management, water quality

- The Revised Universal Soil Loss Equation (RUSLE) due to rainfall

$$A = \mathbf{R}KLSCP$$

R rainfall erosion index, which includes the amount as well as the "force" of the precipitation

Better ocean observations and Ocean-atmospheric models lead to better precipitation forecasts

- soil erosion the equation due to Wind

$$E = f\,(I\ K\ \mathbf{C}\ L\ V)$$

Climatic factor C determined by wind velocity and soil surface moisture

Better ocean observations and models lead to better wind forecasts

Activating Inundation and Sea Level Information

Case Study Two: Wave, sea level, storm surge, wave height and Beach Erosion and sediment transport

4 Affected Hydrodynamic Processes which are measures by GOOS

- Storm Surge
- Tidal Ranges and Currents
- Waves

With rising sea level, there is increased impact of coastal storms. Improved wave prediction as well as the “inundation” parameters are required in the mitigation strategies of beach nourishment and armament

Consider wave generation across a continental shelf. Wave growth will be enhanced by deeper water (due to sea level rise) because of the reduced effect of bottom friction. An estimate of this effect can be obtained through the shallow water forecasting relationships provided in the *Shore Protection Manual* (U.S. Army Corps of Engineers, 1984). For the case of a very long fetch (the distance over which the wind blows) and shallow water, the equation can be expressed as

$$\frac{gH}{w^2} = 0.15\left(\frac{gh}{w^2}\right)^{0.75},$$

where w is the wind speed. An increase in water depth S gives the following change in the wave height H:

$$\frac{\Delta H}{S} = 0.75\frac{H}{h}.$$

For the same values as in the last example:

$$\Delta H = 0.15 \text{ m},$$

or a 7.5 percent increase in wind-generated wave height as a result of the movement of the offshore region due to sea level rise. The effects of reduced wave damping and augmented wave generation would be combined in an approximate linear manner.

Larger wave heights in the surf zone will result in greater amounts of sediment movement, as most transport formulas include wave height to some power, and greater wave forces and potential for overtopping.

The relationship between sea level rise and waveheight (Dean,1986)

A very approximate measure of the increased rate of losses can be developed by considering that the transport of sand away from the nourishment site is proportional to the wave height to the 2.5 power (Dean, 1976). The resulting percentage increase in beach nourishment volumes due to a sea level rise is

$$\left[\frac{(1+F)^{2.5}}{(1+F')^{2.5}} - 1\right] \times 100\% = 7\% \text{ (Case A)}$$

and

$$\left[\left(\frac{1+\Delta H}{H}\right)^{2.5} - 1\right] \times 100\% = 200\% \text{ (Case B)},$$

accounting for the effects of increased wave heights in the two examples presented in Chapter 4 (pp. 38-39).

Relationship between wave height and beach erosion Dean (1986)

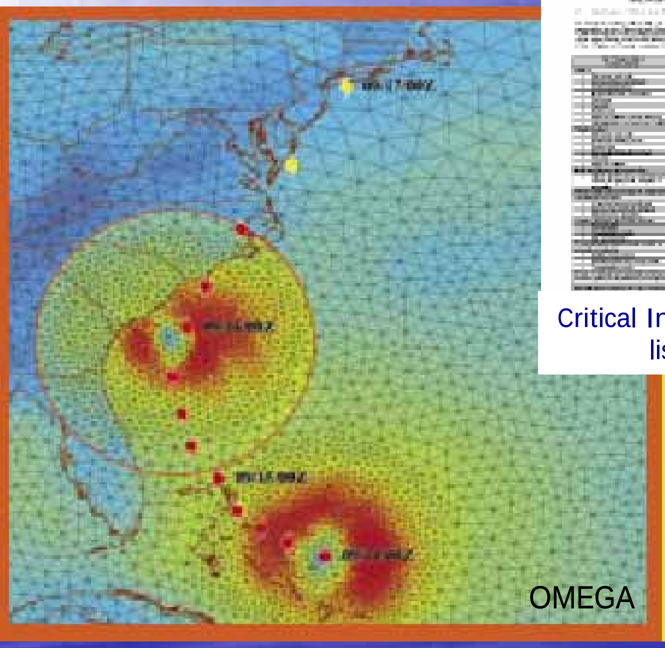
Link to Decision Support Tools and Management Scenarios

Linking Forecast Simulation Tools with Emergency Response Simulation Tools can aid in Severe Weather Emergency Energy Management

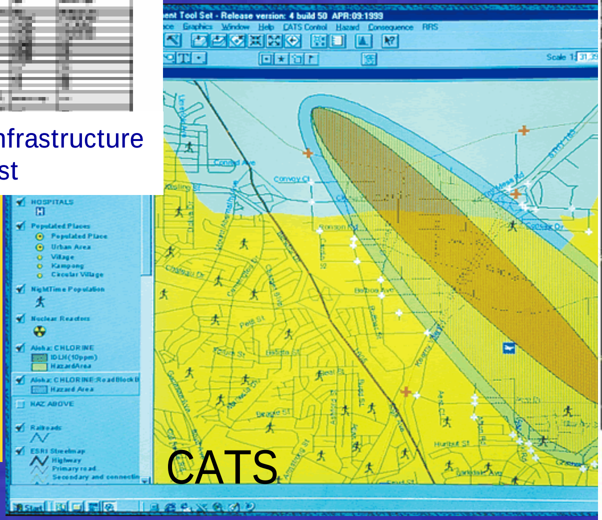
Storm Tracking with simulation tool-predict hurricane landfall

Emergency preparedness with “**CATS” (consequence assessment tool set)** Locate critical energy assets, estimate damage and position for relief

“Expert Grid” Situational Awareness and Power Restoration Management Decision Tool



Critical Infrastructure list

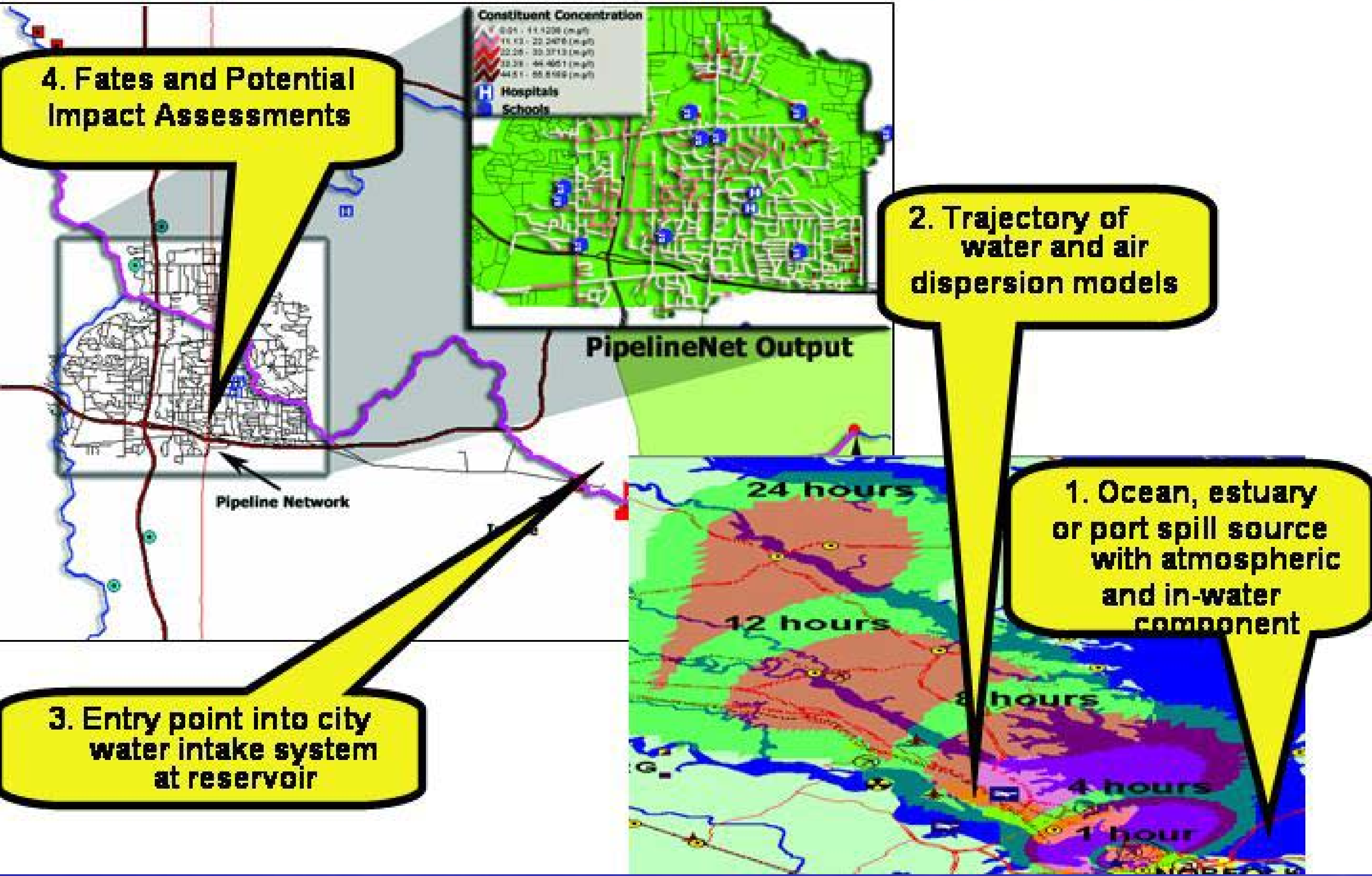


Data-Information

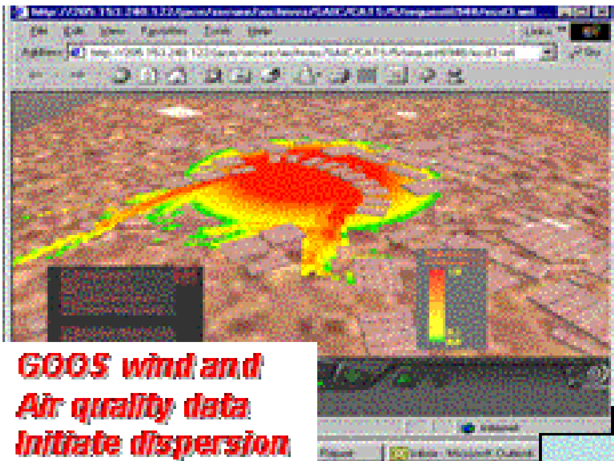
Knowledge

Action and Outcomes

2. *Impact of Linking Dispersion Modeling Tools for Protecting Port Waters and Coastal Water Supplies*



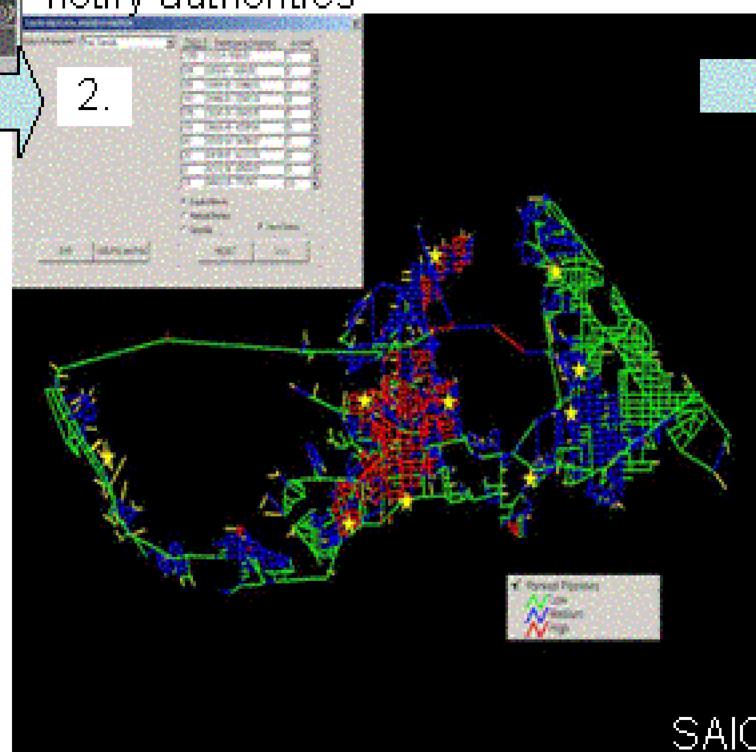
3. Informing Water Management Scenarios: Impact of Linking Atmospheric Pollution Dispersion Prediction Tools over Ports, Lakes and Reservoirs with Emergency Response Protocol Decision Tools for Contamination Threat to City Water Supply

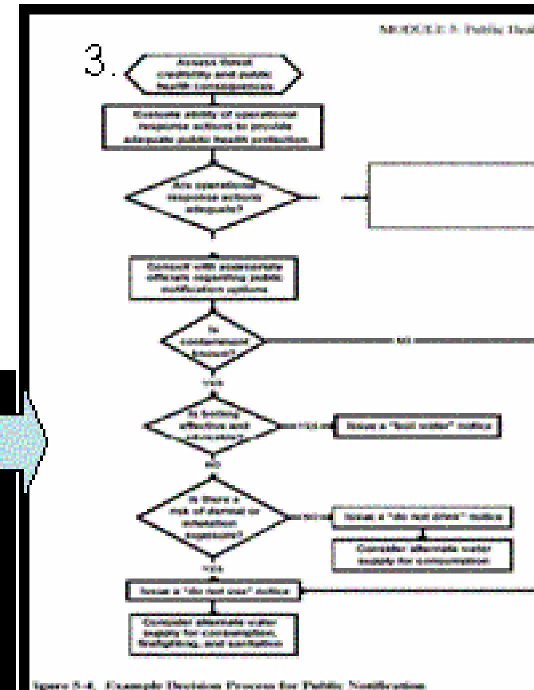


GOOS wind and Air quality data Initiate dispersion model

1. Locate critical energy assets in atmospheric pollutant dispersion track, estimate potential damage to reservoir supply and position emergency responders for relief efforts using JACE and CATS (SAIC) (consequence assessment tool set Decision Support Tool

2. Track health threat of chemical from reservoir throughout City water system, locate areas of greatest potential for poisoning, with DST such as Pipeline.net (SAIC), notify authorities





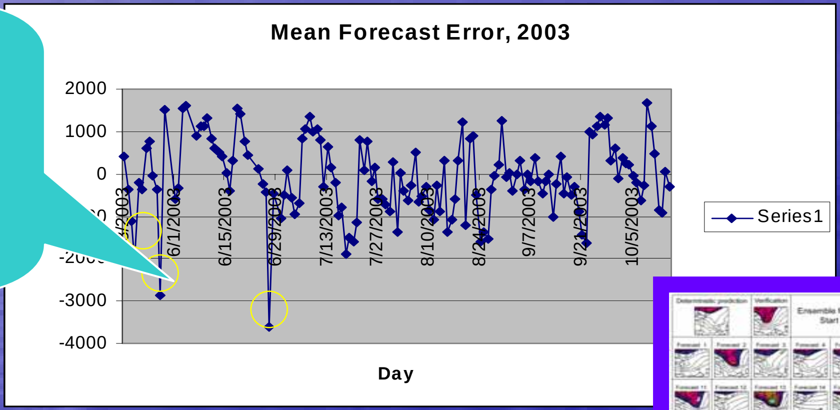
3. Assess health risk, shutdown vulnerable pipelines (schools, hospitals) and issue public safety measures such as "boil water orders" as per protocol response tool box

Economic Valuations for Risk Reduction

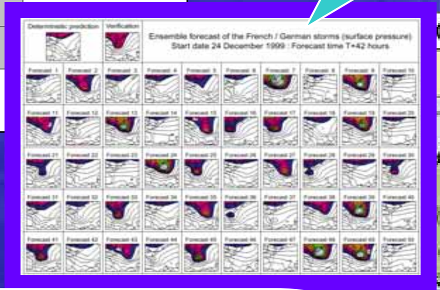
The Value of a Seasonal Seabreeze Forecast to Energy Demand Forecasting

1. Major sea breeze events (May-September) are not captured adequately in the day ahead temperature forecast

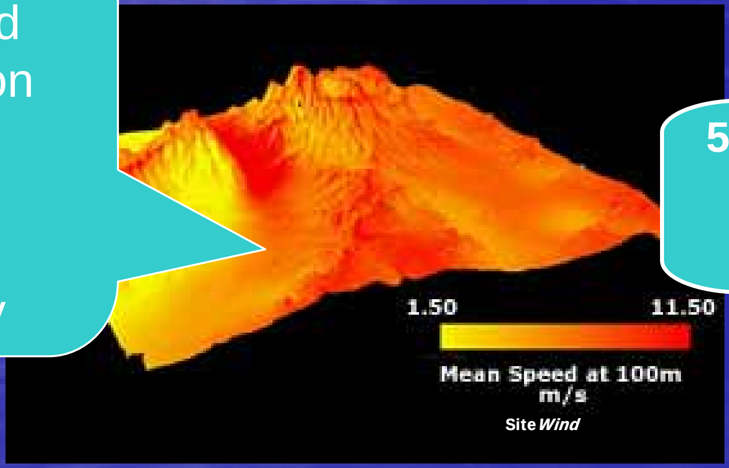
2. Major Sea Breeze Events Cause Significant Electricity Demand Error as power demand drops. Savings of up to 2 million per year for increased accuracy of forecast



4. Using ensemble forecasting techniques can enhance information content of the forecast (probabilities) adding “spread” around forecast (LSE/ L. Smith)

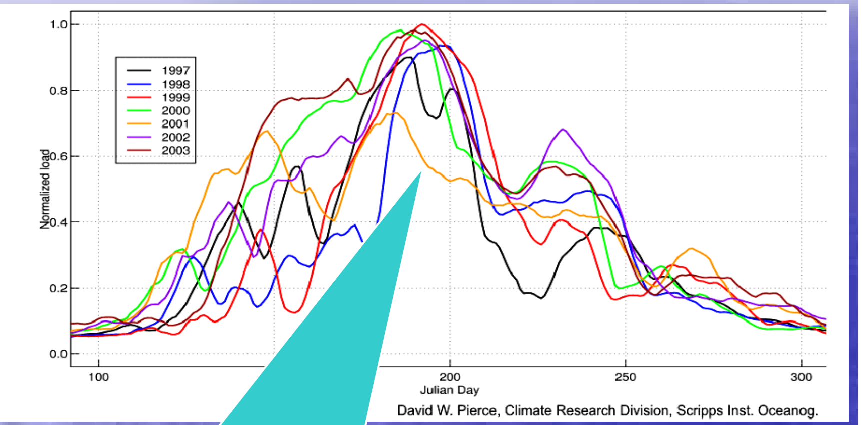


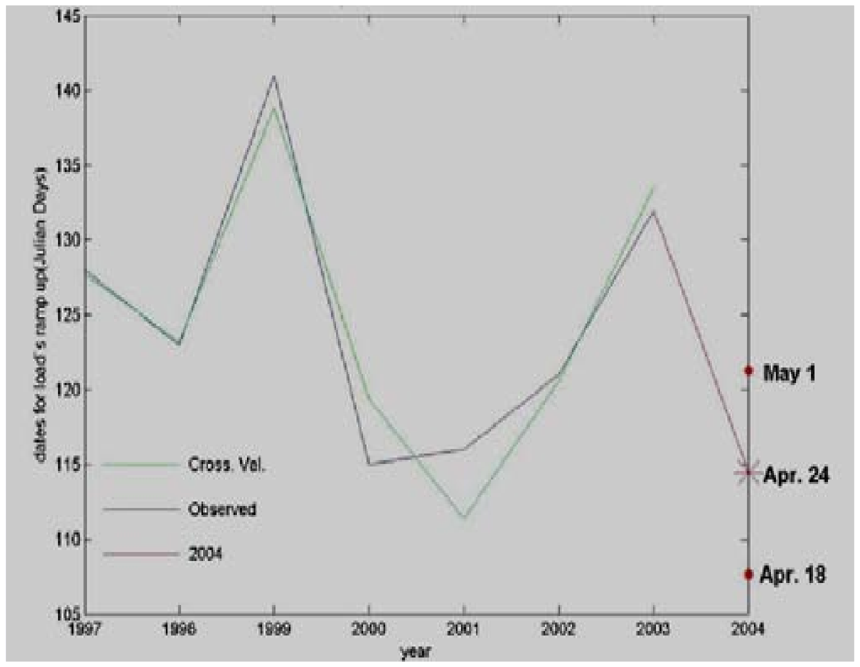
3. Bringing in more wind observation data can enhance forecast accuracy



5. Improving power management for national grid operators

Value of Improved Seasonal Precipitation Forecasts to Agriculture Irrigation Pump Load Forecasting and Power Grid Stability





1. Timing and total irrigation time varies from season to season depending on soil moisture causing unpredicted draw on electricity grid due to start of pumps

Ocean Obs/ Models/Thorpex type experiments enter here

T &Ppt forecast

Soil moisture

Crop type

Planting time

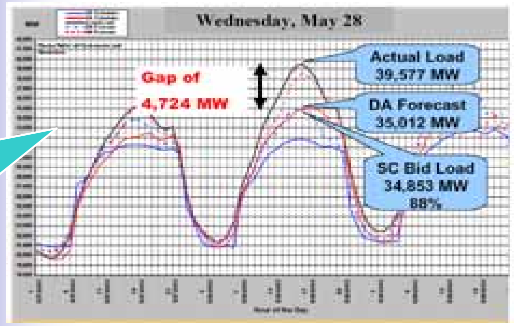
Prediction of Power and Water Demand from Irrigation Load

Power Purchasing on contract vs spot

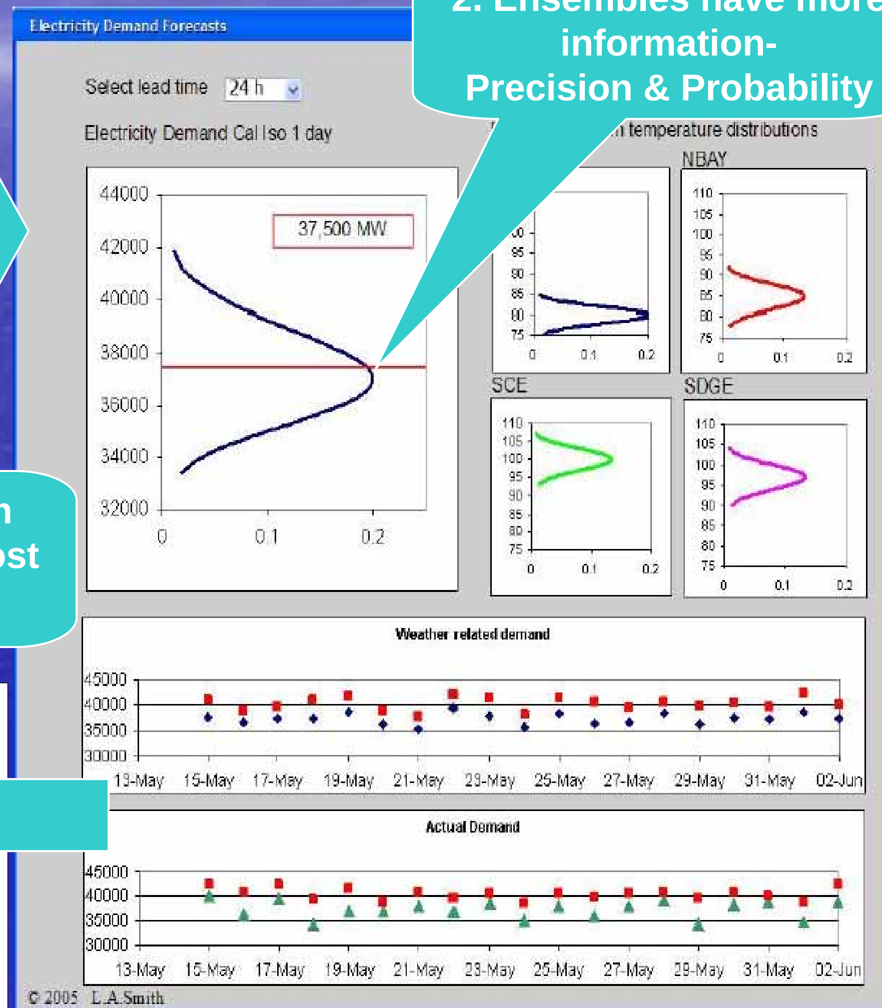
Grid stability and Cost savings (.25M/yr for I utility)

Value of Ensemble Forecasting to Electricity Load Forecast Accuracy

- Underforecast T Case Study . Weather forecast error of 4% leading to a demand forecast error of nearly 5,000MW from a Weather Forecast Error withPotential Cost $4-7M/day

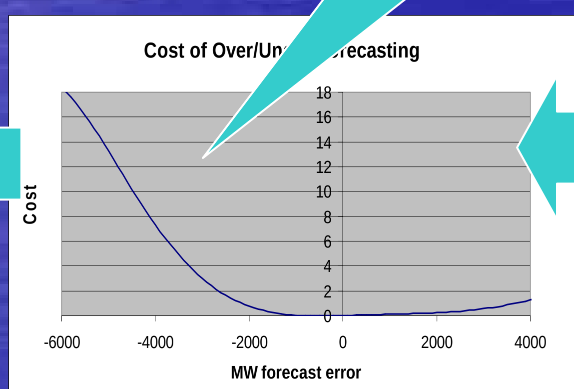


1. Existing weather error is costly



2. Ensembles have more information- Precision & Probability

3. Works with asymmetric cost curve



4. Saves Utility network operator $15M during summer peak period over present method

Further Thoughts…

- Sustainable development = economic, social and environment prosperity
- In developing nations its about installing capability, in developed its about performance improvement, efficiency, reliability, risk (vulnerability) reduction,
- Eliminate the industry bias-Business may go from culprit to saviors through innovation
- Engage the Business Schools and Schools of Management/ Economics- they are academics training the “informed” CEOs of tomorrow--they are missing!!
- Develop curricula on using environmental information for operational optimization and competitive advantage, using probabilistic information in Decisions, improving decision support tools, scenarios, BPR, adaptive management practices, “Science to solutions”
- Make Knowledge Transfer on par with Technology Transfer with performance metrics
- “Beta test” (industry trial) new environmental Information in business operations
- Present in their medium-business congresses, trade journals,
- Follow the business champions from WSSD- Industry and NGOs aligned with action plans, governments did not
- Follow the regional champions- Western Governors, Drought Information