CONSTRUCTION OF NUCLEAR POWER PLANTS

A Workshop on

“NUCLEAR ENERGY RENAISSANCE”

Addressing the Challenges of Climate Change and Sustainability

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ATHENS, GREECE

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CONSTRUCTION OF ST. LUCIE-2
at
FLORIDA POWER & LIGHT COMPANY

- **Robert E. Uhrig 1974-1986**
  - Vice President, Nuclear Affairs
    - Nuclear Licensing
    - Nuclear Safety Analysis
    - Nuclear Fuel Analysis
    - Quality Assurance
    - Corporate Research and Development
    - Chairman: Corporate Nuclear Safety Board
    - Environmental Affairs
      - Including siting of power plants and transmission lines

- **YOU WILL NOTE THAT**:
  - I DID NOT HAVE TO **BUILD** THE PLANTS
  - I DID NOT HAVE TO **OPERATE** THE PLANTS

- SO WHY AM I TALKING ABOUT BUILDING THE PLANTS?

- I WAS DEEPLY INVOLVED IN ALMOST EVERY ASPECT OF BUILDING THE PLANTS THROUGH

  - **Quality Assurance**
  - **Nuclear Licensing**
  - **Nuclear Safety Analysis**
  - **Environmental Affairs**

HISTORY OF ST. LUCIE-2

- 1968 St. Lucie 1 and 2 ordered as identical units
- 1969 St. Lucie-2 was cancelled due to low load forecasts
- 1972 St. Lucie-2 order reinstated when load increased
  - PSAR for Saint Lucie-2 was the FSAR fir St. Lucie-1
  - However, NRC ordered changes in St. Lucie-2 Design
    - Replace 14 x 14 fuel lattice with 16 x 16 lattice
    - Increase the number of control rods—some drives moved 2 control rods
  - NRC declared St. Lucie application to be a new license application
    - Several determined interveners opposed St. Lucie-2
    - Proceedings went all the way to the US Supreme Court twice
- 1975 Florid initiated a State construction licensing process
  - Caused 15 months delay
- **Finally construction started in June 1977**

FINALLY, CONSTRUCTION BEGAN IN APRIL 1977

- Operating License was issued 71 months later—in March 1983
- St. Lucie-2 reached full power and was declared to be “Commercial” in July 1983, only 4 months after receiving its Operating License

HOW DOES ST. LUCIE-2 COMPARE WITH OTHER PLANTS OF THAT ERA?

PLANT	FUEL LOAD	NUMBER OF MONTHS
McGuire 1	1/81	117
San Onofre 2	2/82	102
LaSalle 1	4/82	103
Grand Gulf 1	5/82	92
Susquehhanna	8/82	100
Summer 1	8/82	100
Shoreham 1	2/83	124
St.Lucie 2	3/83	71
Waterford 3	5/83	102
Enrico Fermi 2	6/83	169
Comanche Peak 1	6/83	104
Midland 2	7/83	124
Byron 1	8/83	100
Watts Bar 1	8/83	127
Palo Verde 1	8/83	87
Washington Nuclear 2	9/83	133
Perry 1	11/83	109
Seabrook 1	9/84	99
Wolf Creek 1	10/84	93
Limerick 1	10/84	173
Catawba 1	10/84	125
Harris 1	12/84	131

70 MONTHS:

START OF CONSTRUCTION TO OPERATING LICENSE

- DIFFICULTIES ALONG THE WAY
  - 2 Strikes associated with union organizing
  - Hurricane DAVID came directly over the site
    - Top 265 feet of tower crane crashed through Auxiliary Building
  - Inclusions found in Reactor Coolant Loop
  - Implement “Lessons Learned” from TMI and Browns Ferry fire
  - We had disagreement with NRC on schedule for completion
  - We had office in Bethesda, adjacent to NRC Headquarters
- HOW DID FPL COMPLETE ST. LUCIE-2 WITHIN TWO MONTH OF THE SCHEDULE SET SIX YEARS EARLIER?
- FPL HAD A COMPREHENSIVE MANAGEMENT SYSTEM

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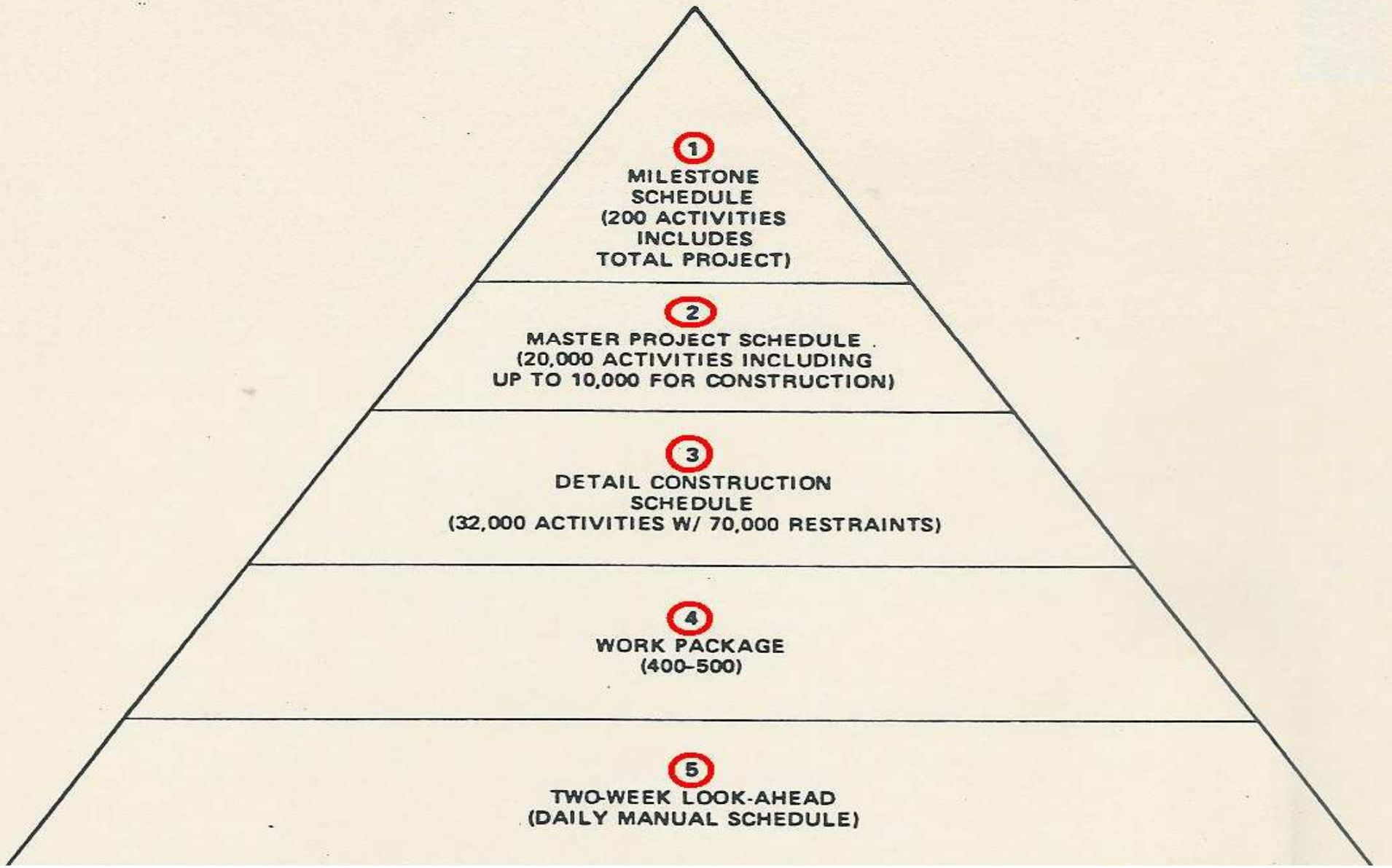
CONSTRUCTION SCHEDULING FORMAT



ADDIONAL STEPS TAKEN BY FPL TO CONTROL CONSTRUCTION OF ST. LUCIE-2

FPL assumed the role of CONTRACTOR

EBASCO (the Architecht-Engineer) provided technical and managerial expertise and served as the LABOR BROKER

START-UP planning initiated early—65 technicians assigned to St. Lucie site 3 years ahead of start-up

EVERYTHING worked at Start-up

FPL used innovative construction techniques

"Tops off" construction for Reactor Auxiliary Building

"Slip Form" used on reactor Containment Building

Highly reinforced concrete structure (10,000 cubic yards)

132 ft outer diameter, 3 ft thick, 192 ft high

Form moved up 1 ½ inches every 15 minutes

Containment building completed in 16 ½ days

PROGRESS IN CONSTRUCTION OF ST. LUCIE-2

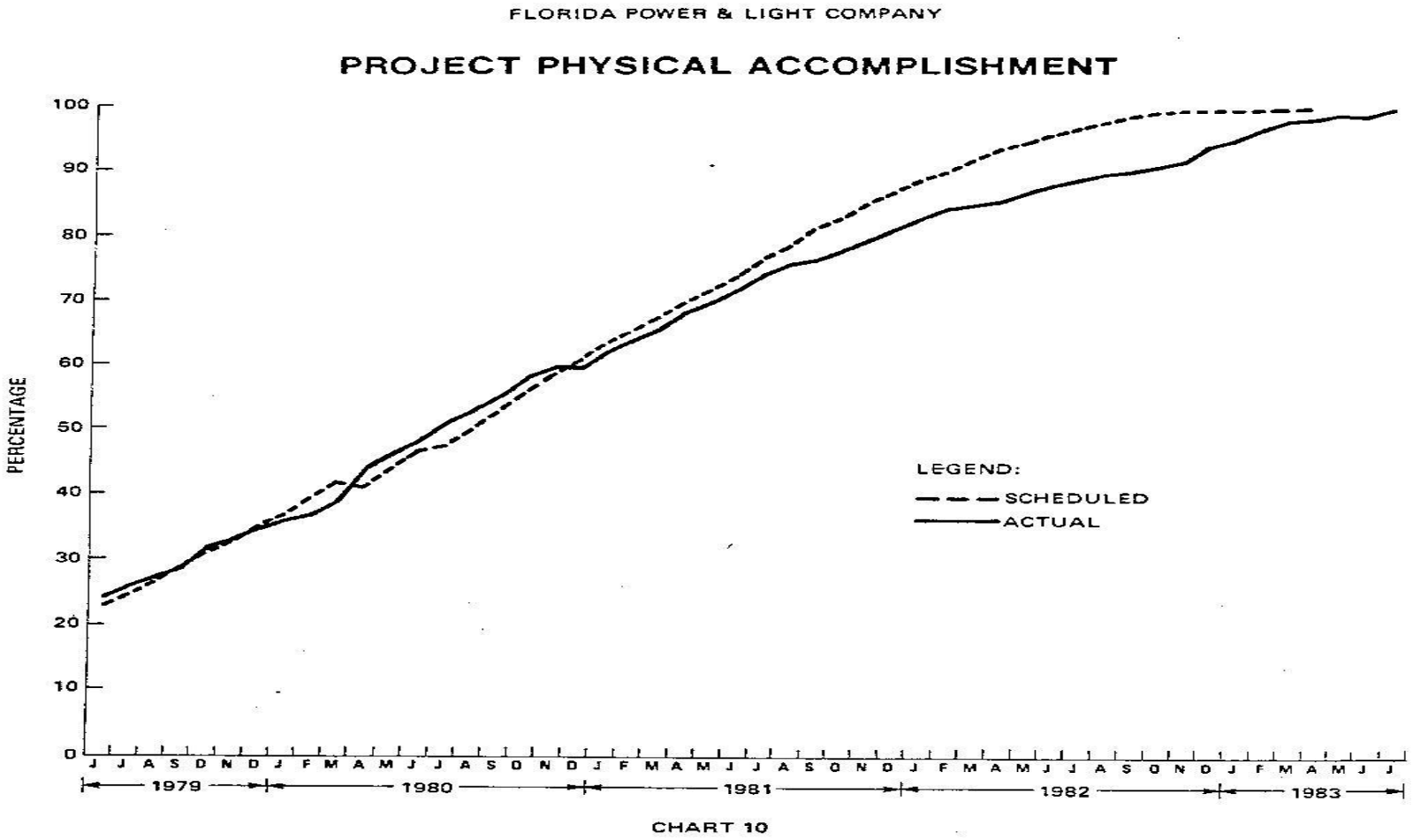


CHART 10

LESSONS LEARNED FROM St. Lucie-2

NUCLEAR POWER PLANTS CAN BE BUILT IN A REASONABLE TIME

CONSTRUCTION MANAGEMENT TOOLS ARE AVAILABLE

JAPANESE FIRMS BUILD “N-th of a kind” NUCLEAR PLANTS IN 4 YEARS

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SHORTER CONSTRUCTION TIMES MEANS LOWER CONSTRUCTION AND OPERATING COSTS

OTHER BENEFITS INCLUDE MORE RELIABLE OPERATION AND DETAILED KNOWLEDGE OF THE PLANT WHICH CAN LEAD TO FASTER MAINTENANCE AND SAFER OPERATION

OPTIONS AVAILABLE TO GREECE

- **Contract for "Turnkey" Construction of a Plant**
  - Vendor commits to all responsibility of construction
  - Price may be fixed or negotiable
    - NRC may require costly "Upgrading"
    - Greece would certainly want to "monitor" construction

- **Alternative: Greece may direct Construction**
  - Then Greece would need to secure an independent "Monitor"
  - Management and Monitoring must be separated

- **First Nuclear Plant should probably be "Turnkey"**
  - **It should be a proven design that has been built previously**

Greece will probably also need to hire expertise for "Monitoring

CURRENT SITUATION IN GREECE

- **Greece has about 12,000 Megawatts of Generation**
  - Public Power Corp (PPC) has 12,276 MW Today
  - Plant should not be large than 10% of Generation [1200 MW]
  - Smaller plants may be desirable—3 400 MW plants
  - Should select “proven” designs—PWRs or BWRs

- **Assume load grows at 2% per year**
  - In 5 years, the load will be 13,250 MW—it grew by 1250 MW
  - All of the original 1200 MW will have been used
  - The next generation of power plants will be needed

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INGREDIENTS FOR A SUCCESSFUL PROJECT

- MANAGEMENT COMMITMENT
- FINANCIAL RESOURCES
- REALISTIC & FIRM SCHEDULE
- CLEAR DECISION MAKING AUTHORITY
- FLEXIBLE PROJECT CONTROL TOOLS
- TEAMWORK – INDIVIDUAL COMMITMENT
- ENGINEERING AHEAD OF CONSTRUCTION
- EARLY STARTUP INVOLVEMENT
- ORGANIZATIONAL FLEXIBILITY
- ONGOING CRITIQUE OF THE PROJECT
- BETHESDA OFFICE FOR LICENSING
- OWNER TAKES THE PROJECT LEAD