



XA0400267

**APPENDIX I. PRESENTATIONS AT THE MEETING**

- (12) **The Electrical Power Sector in Turkey,**  
Nese Gençyılmaz and Nurettin Savruk, TEAS, Turkey



# **THE ELECTRICAL POWER SECTOR IN TURKEY**

**NEŞE GENÇYILMAZ - NURETTİN SAVRUK**

**TEAŞ / TURKEY**

**6-10 OCTOBER 1997 VIENNA**

# **MAIN POLICIES ON PRIMARY ENERGY AND ELECTRICAL POWER**

- ◆ **WHENEVER PROVES ECONOMICAL, FIRST PRIORITY IS GIVEN TO DOMESTIC RESOURCES,**
- ◆ **UTILIZATION OF IMPORTED ENERGY RESOURCES ARE CONSIDERED IN CASE IT IS PROVEN TO BE ECONOMICAL,**
- ◆ **DIVERSIFICATION OF RESOURCES ARE ALSO TAKEN INTO ACCOUNT,**

- ◆ **EFFICIENT UTILIZATION OF THE RESOURCES AND ENERGY CONSERVATION ARE ENSURED AND SUPPORTED,**
- ◆ **RULES AND MEASURES FOR ENVIRONMENTAL AND PUBLIC HEALTH PROTECTION ARE TAKEN INTO CONSIDERATION DURING ENERGY PRODUCTION,**
- ◆ **IN ENERGY INVESTMENTS, ALONG WITH PUBLIC SECTOR, THE PARTICIPATION OF FOREIGN CAPITAL AND DOMESTIC PRIVATE SECTOR ARE ALSO PROMOTED,**

- ◆ **A RATIONAL STRUCTURE IN ENERGY PRICING IS APPLIED WITHOUT ANY SUBSIDES,**
- ◆ **FEASIBLE INTERCONNECTIONS AND HIGHER ELECTRICAL ENERGY EXCHANGE WITH NEIGHBORING COUNTRIES ARE SUPPORTED,**

# **CURRENT STATUS BY THE END OF 1996**

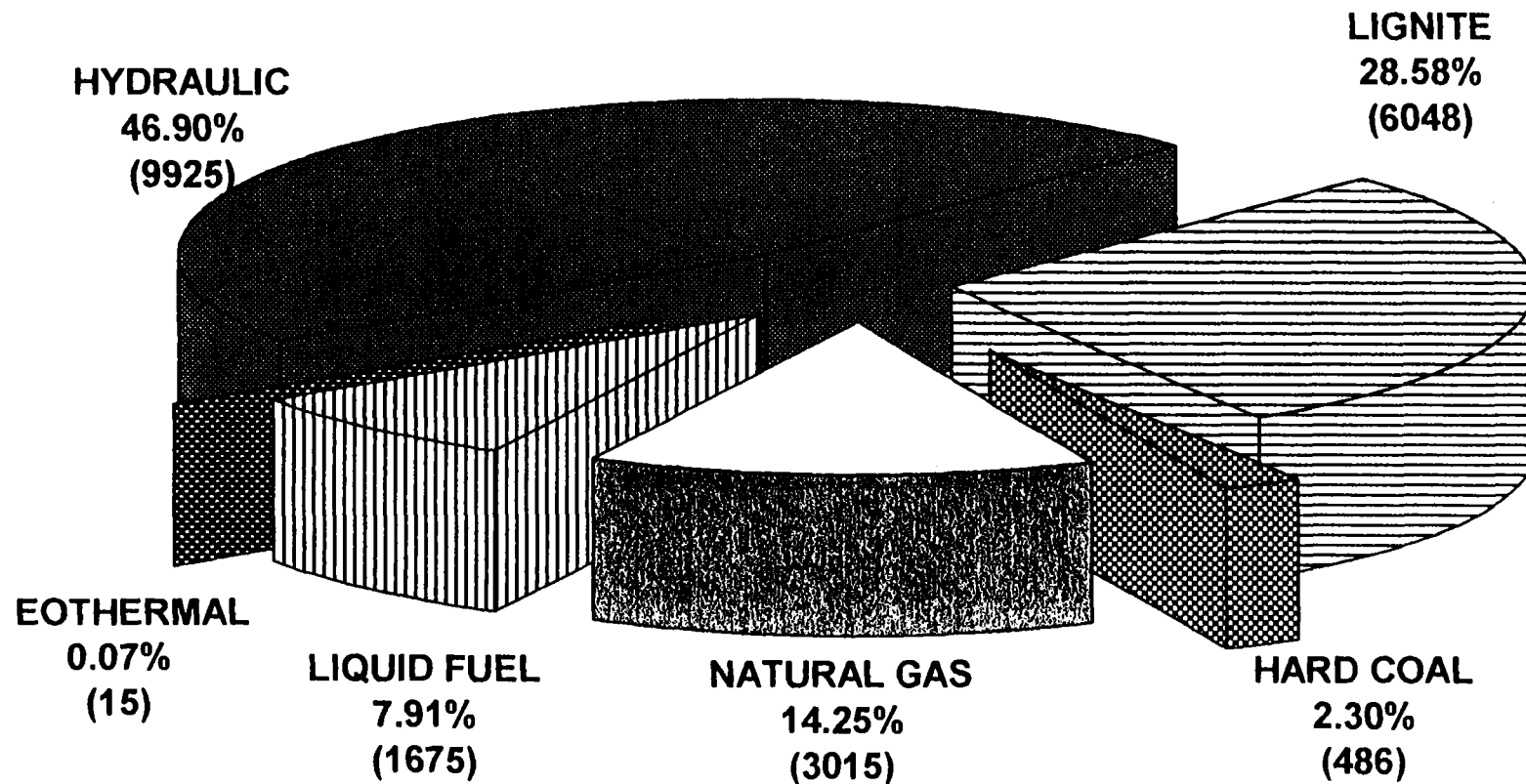
## **◆ Installed Capacity of Turkey**

<b>THERMAL</b>	<b>: 11239 MW</b>
<b>HYDRO</b>	<b>: 9925 MW</b>
<b>TOTAL</b>	<b>: 21164 MW</b>

## **◆ Electricity Generation of Turkey**

**95 Billion kWh**

# BREAKDOWN OF INSTALLED CAPACITY BY PRIMARY RESOURCES IN 1996 (MW)





# DEMAND FORECAST

YEARS	PEAK POWER (MW)	ENERGY (Billion kWh)	INCREASE (%)
1997	16,920	105.2	10
2000	21,588	134.3	8.4
2005	31,850	199.6	8
2010	46,219	289.8	7.7
2015	64,122	398.2	6.5
2020	88,100	547.1	6.5

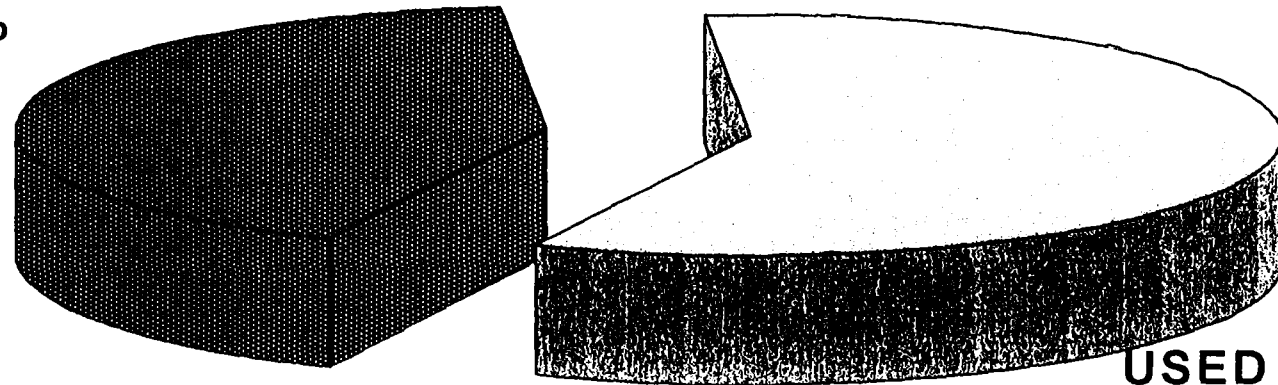
# **ANNUAL GENERATING CAPABILITY OF DOMESTIC RESOURCES (IF ALL UTILIZED)**

<b>HYDRAULIC (BILLION kWh)</b>	<b>THERMAL (BILLION kWh)</b>	<b>TOTAL</b>
<b>125</b>	<b>120</b>	<b>245</b>

# UTILIZATION OF DOMESTIC RESOURCES 2010

## HYDRO

REMAINING  
PART OF  
POTENTIAL  
42%

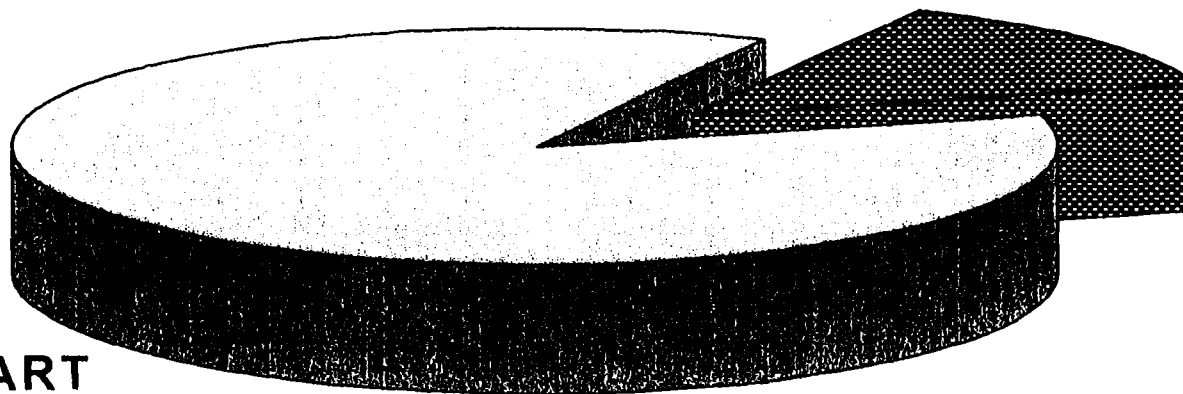


USED PART  
OF  
POTENTIAL  
58%

# UTILIZATION OF DOMESTIC RESOURCES 2010

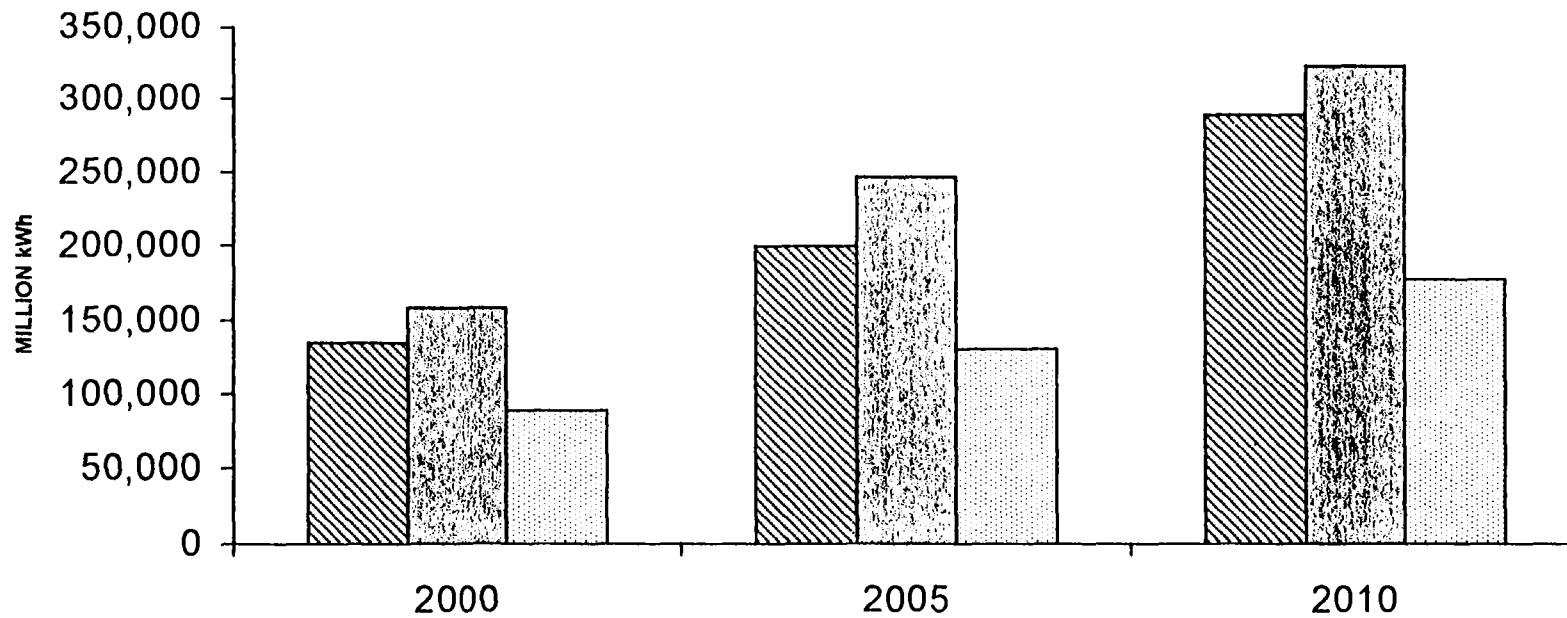
## LIGNITE + HARD COAL

REMAINING  
PART OF  
POTENTIAL  
14%



USED PART  
OF  
POTENTIAL  
86%

# DOMESTIC RESOURCES, TOTAL GENERATING CAPACITY AND ENERGY DEMAND



 **DEMAND**

 **GENERATING CAPACITY**

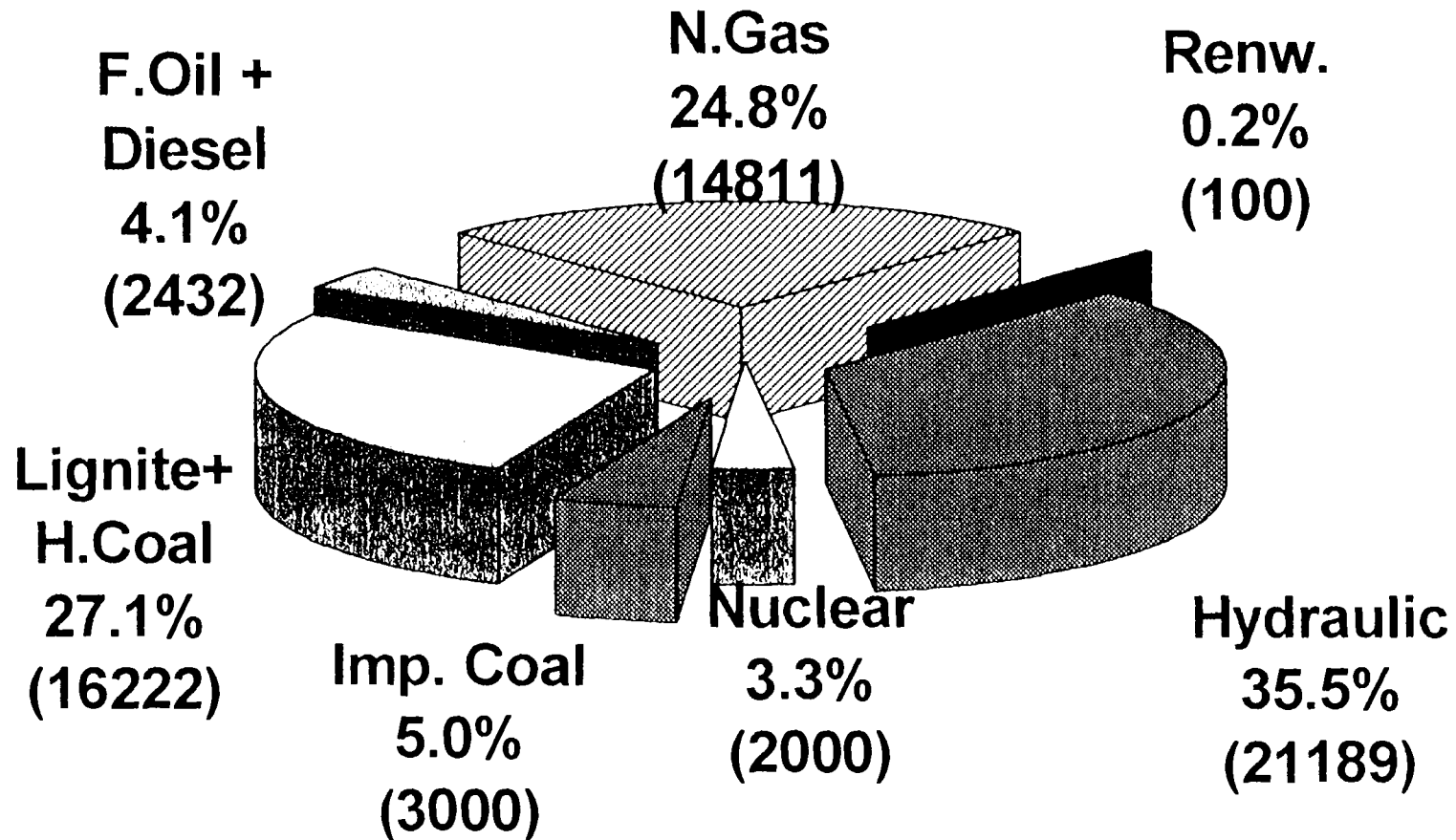
 **DOMESTIC RESOURCES**

# **ADDITIONAL CAPACITY BY FUEL TYPES TILL 2010**

<b>LIGNITE + H.COAL</b>	<b>NATURAL GAS</b>	<b>IMP. COAL</b>	<b>NUCLEAR</b>	<b>FUEL-OIL</b>	<b>HYDRO</b>
<b>33 Units</b>	<b>20 Units</b>	<b>6 Units</b>	<b>2 Units</b>	<b>1 Unit</b>	<b>75 Units</b>
<b>9687 MW</b>	<b>11927 MW</b>	<b>3000 MW</b>	<b>2000 MW</b>	<b>680 MW</b>	<b>11325 MW</b>

**TOTAL : 38619 MW**

# THE BREAKDOWN OF THE INSTALLED CAPACITY BY FUEL TYPES FOR THE YEAR 2010 (MW)



**SINCE THE SHARE OF SOLID FOSSIL (ESPECIALLY DOMESTIC COAL) FIRED POWER PLANTS IN TOTAL CAPACITY IS EXPECTED TO BE CONSIDERABLE HIGH, DETAILED ENVIRONMENTAL ANALYSES SHOULD BE PERFORMED FOR THE GENERATION SYSTEM.**



# **DECADES MODEL IS USED FOR PERFORMING GENERATION EXPANSION PLAN OF TURKEY WITH DETAILED ENVIRONMENTAL ANALYSES**

- **COMPLETION OF THE DATABASE**
- **ANALYZING THE AIRBORNE EMISSIONS  
ESPECIALLY SO<sub>x</sub> AND GREENHOUSE  
GAS EMISSIONS**
- **CALCULATION OF COST  
EFFECTIVENESS OF THE CONTROL  
TECHNOLOGIES**

# **ENVIRONMENTAL PROGRAMS FOR COAL-FIRED POWER PLANTS**

**THE CONSIDERATION OF ENVIRONMENTAL ISSUES IN  
POWER GENERATION**

**IN THIS RESPECT,**

- **THE ENVIRONMENTAL LAW OF TURKEY CAME INTO FORCE IN AUGUST 1983**
- **THE RELATED REGULATION FOR THE CONTROL OF AIR POLLUTION WAS PUT INTO FORCE IN NOVEMBER 1986**

**AND**

- **THE LEGISLATION FOR WATER POLLUTION WAS ISSUED IN SEPTEMBER 1988**

**TO SUPPLY CLEAN ENERGY, AND TO  
MITIGATE THE ENVIRONMENTAL  
IMPACTS OF THE COAL FIRED POWER  
STATIONS THAT UTILIZE LOW QUALITY  
LIGNITE AND THAT HAD BEEN  
CONSTRUCTED BEFORE THE  
ENVIRONMENTAL LEGISLATION CAME  
INTO FORCE, SOME REHABILITATION  
AND REFURBISHING PROGRAMS  
BECAME NECESSARY**

**BECAUSE OF HIGH SULFUR CONTENT AND/OR LOW CALORIFIC VALUE OF DOMESTIC LIGNITE USED IN THERMAL POWER GENERATION, THE SO<sub>x</sub> EMISSIONS ARE MUCH HIGHER THAN THE SPECIFIED LIMITS IN THE “REGULATION FOR THE CONTROL OF AIR POLLUTION”.**

**THEREFORE, INTEGRATION OF FLUE GAS DESULPHURISATION (FGD) PLANTS TO THE THERMAL POWER STATIONS, EXISTING OR UNDER CONSTRUCTION HAS CONSIDERABLE IMPORTANCE AMONG THE ENVIRONMENTAL MEASURES.**

**BECAUSE OF THEIR HIGH INVESTMENT COST, IT IS NOT POSSIBLE TO INTEGRATE FGD PLANTS TO ALL OF THE EXISTING THERMAL POWER PLANTS AT THE SAME TIME.**

**A PRIORITY LIST WAS PREPARED BY CONSIDERING THE LOCATION OF THE PLANTS AND THE CONDITIONS OF THEIR SURROUNDING AND THEIR ENVIRONMENTAL IMPACT ON AGRICULTURE, FOREST, HUMAN HEALTH, TOURISM POTENTIAL.**

- **IMPROVEMENT OF ELECTROFILTERS IN SOME OLDER POWER STATIONS, REHABILITATION PROGRAMS FOR THE MANAGEMENT OF LIQUID AND SOLID WASTES, INSTALLATION OF EMISSION MONITORING AND RECORDING INSTRUMENTS TO THE T.P.P. ARE ALSO INCLUDED IN THE PROGRAMS,**
- **BESIDE THE RETROFIT FGD PLANTS, OTHER REFURBISHING AND REHABILITATION PROGRAMS ARE UNDER INVESTIGATION AND EXECUTION. THE PROGRAM CALLED “COAL POLLUTION ABATEMENT PROJECT” WILL BE CARRIED OUT IN COOPERATION WITH THE WORLD BANK.**

- **1 FGD FACILITY EXISTING, 4 FGD FACILITIES UNDER CONSTRUCTION FOR THE EXISTING SOLID FOSSIL FIRED POWER PLANTS AND ALL SOLID FOSSIL FIRED CANDIDATE GENERATION UNITS WERE CONSIDERED TO BE EQUIPPED WITH FGD PLANTS BASED ON LIMESTONE WET SCRUBBING WITH GYPSUM END PRODUCT.**
- **ALL EXISTING AND CANDIDATE SOLID FOSSIL FIRED P.P. WERE CONSIDERED WITH ELECTROSTATIC PRECIPITATORS FOR CONTROLLING PARTICULATE EMISSIONS WERE TAKEN INTO CONSIDERATION IN THE GENERATION EXPANSION STUDY,**

# **ENVIRONMENTAL INPUT DATA**

- **INVESTMENT AND OPERATION AND MAINTENANCE COSTS OF FGD FACILITIES WERE INCLUDED IN THE INVESTMENT AND OPERATION AND MAINTENANCE COSTS OF GENERATING UNITS.**



- **ENERGY SOURCES INPUT**
  - **FOSSIL FUEL**
    - **SOLID FUEL**
      - **NET CALORIFIC VALUE**
      - **MOISTURE CONTENT**
      - **ASH**
      - **CARBON CONTENT**
      - **SULPHUR CONTENT**
      - **NITROGEN CONTENT**
      - **OXYGEN CONTENT**
      - **HYDROGEN CONTENT**

- **GASEOUS FUEL**

- NET CALORIFIC VALUE

- HYDROCARBONS (CH<sub>4</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>3</sub>H<sub>8</sub>, C<sub>4</sub>H<sub>10</sub>n)

- GASES (CO<sub>2</sub>, N<sub>2</sub>)

- **LIQUID FUEL**

- CALORIFIC VALUE

- SULPHUR CONTENT

- **TECHNOLOGIES INPUTS**
  - **COAL FIRED**
    - **EMISSION FACTORS**
    - **LAND USE**
    - **COAL STOCK**
    - **WASTES AREA**
  - **NATURAL GAS FIRED AND OIL FIRED**
    - **EMISSION FACTORS**

## **– EMISSION FACTORS**

- CO<sub>2</sub>            929 - 2170 gr/kWh**
- NO<sub>x</sub>             1.81 - 4.24 gr/kWh**
- SO<sub>x</sub>             12.5 - 82.1 gr/kWh**
- DUST            239 - 589 gr/kWh**

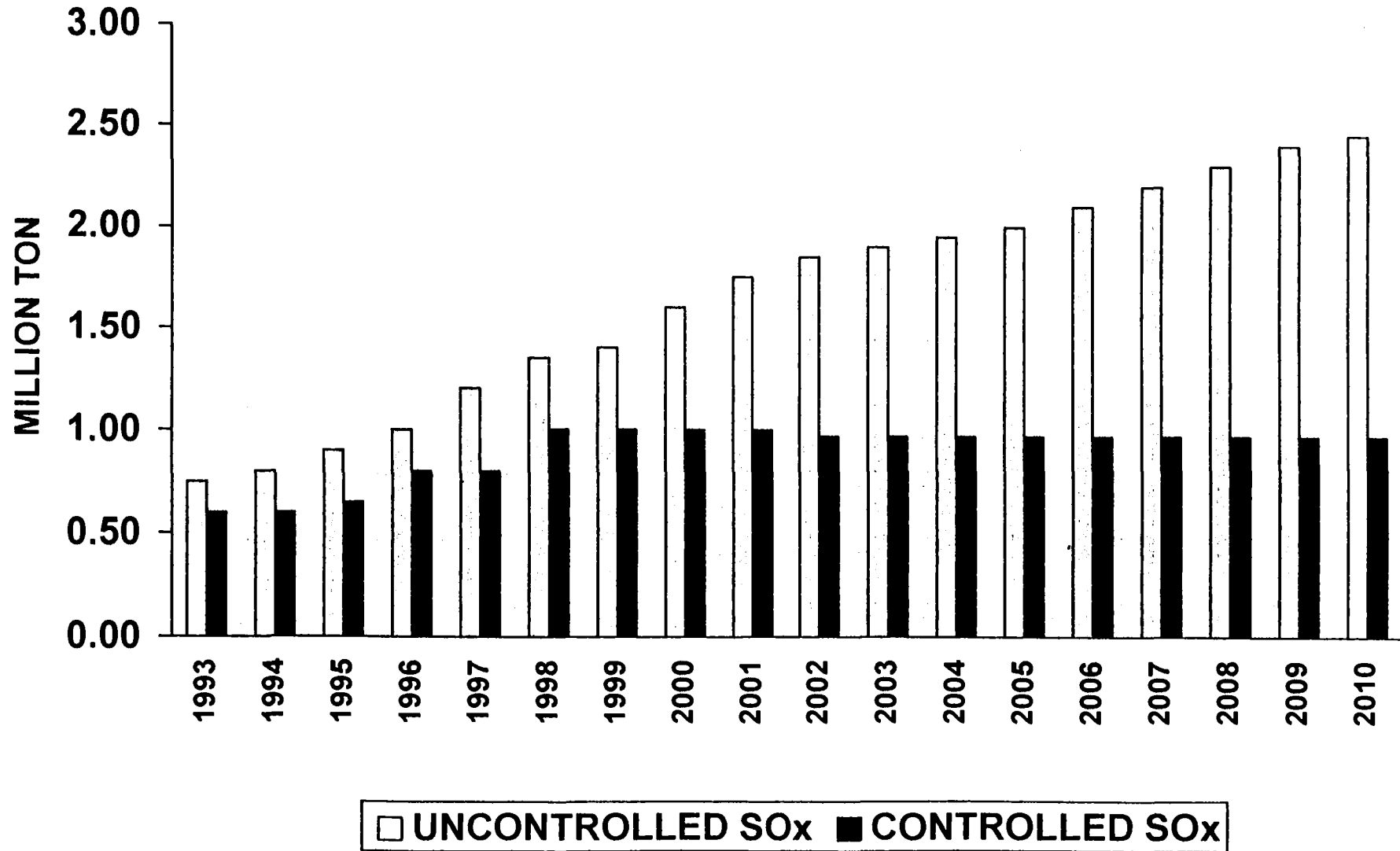
# **ENVIRONMENTAL IMPACT RESULTS**

- **THE OBJECTIVE FUNCTION OF THE CONTROLLED CASE IS 33% HIGHER THAN THE REFERENCE CASE (WHICH IS NO AIR POLLUTION CONTROL DEVICES ARE CONSIDERED)**
- **UNCONTROLLED SO<sub>x</sub> EMISSIONS INCREASES FROM 999,000 TON LEVEL TO 2,660,000 TON LEVEL IN THE PERIOD 1996-2010. DUE TO THE ADDITION OF SOLID FOSSIL FIRED POWER PLANTS TO THE GENERATION SYSTEM.**

- **CONTROLLED SO<sub>x</sub> EMISSIONS ARE 773,000 TONS IN 1996, 1 000 000 TONS IN 1998 BECAUSE OF COMMISSIONING OF TWO LIGNITE FIRED UNITS INSTALLED WITHOUT FGD PLANT, AND BEYOND 1998 REMAINS CONSTANT AROUND 1,000,000 TONS LEVEL UNTIL 2010**

**SINCE A SUBSTANTIAL PORTION OF THE SO<sub>x</sub> EMISSION FROM THE NEWLY INSTALLED UNITS WOULD BE CONTROLLED, THIS EMISSION MAINLY COMES FROM THE EXISTING AND COMMITTED GENERATION UNITS OPERATING WITHOUT A FGD PLANT.**

# CONTROLLED CASE





# AKKUYU NPP PROJECT SCHEDULE

<b>BIDDING ANOUNCEMENT</b>	<b>DECEMBER</b>	<b>1996</b>
<b>BID SUBMISSION</b>	<b>OCTOBER</b>	<b>1997</b>
<b>CONTRACT SIGNING</b>	<b>OCTOBER</b>	<b>1998</b>
<b>COMMISSIONING OF THE FIRST UNIT</b>	<b>DECEMBER</b>	<b>2005</b>
<b>COMMISSIONING OF THE SECOND UNIT</b>	<b>DECEMBER</b>	<b>2006</b>

# **BIDS SHALL BE GIVEN AS TWO ALTERNATIVES**

## **❖ MAIN OFFER:**

NPP Net Output: Min. 800 MWe

Max. 1400 MWe

## **❖ ALTERNATIVE OFFER (OPTIONAL):**

NPP Net Output: Max. 2800 MWe

**Unit Size Above and Equal to 600 MWe**

**❖ THE BIDDING IS**

- ON TURNKEY BASIS,**
- OPEN, IN PRINCIPLE TO PLANT TYPES OF PWR, BWR AND PHWR COMMERCIALY IN OPERATION,**

**❖ THE BIDDERS ARE REQUESTED 100% FULL FINANCIAL LOAN COVERING MAIN OFFER.**

# **RADIOACTIVE WASTE MANAGEMENT SYSTEM**

# GENERAL

- RADWASTE SYSTEM WILL BE DESIGNED IN ACCORDANCE WITH US.NRC-CFR 50.34a DESIGN OBJECTIVES OR EQUIVALENT,
- PROVISION OF SUFFICIENT STORAGE FACILITIES FOR RADIOACTIVE WASTE AT OR IN THE NEIGHBORHOOD OF THE NPP FOR A MINIMUM OF 10 YEARS

# **GASEOUS AND LIQUID RADWASTE**

- BEFORE DISCHARGING TO THE ENVIRONMENT, RADIOACTIVITY SHALL NOT EXCEED THE REQUIRED VALUES GIVEN IN USNRC 10 CFR 20, APP. B OR EQUIVALENT,
- DOSES RESULTING FROM THESE RELEASES SHALL NOT EXCEED THE LIMITS GIVEN IN USNRC 10 CFR 50, APP. I AND RG 8.8 OR EQUIVALENT.

# SPENT FUEL

## SPENT FUEL POOL STORAGE CAPACITY:

*ONE COMPLETE CORE PLUS 20 YEARS*

*OF NORMAL OPERATION*

HOWEVER, ONE COMPLETE CORE PLUS 10 YEARS  
POOL CAPACITY FOR WET STORAGE AND 10  
YEARS OF DRY STORAGE TOGETHER WITH ALL  
NECESSARY EQUIPMENT AND SYSTEMS MAY BE  
PROPOSED.

# **FOR FUTURE,**

CONSIDERING NUCLEAR CAPACITY AND NUMBER OF NPPs, WHEN REACHED TO THE ECONOMICALLY FEASIBLE LEVEL, THE KNOWN PROJECT ON THE WORLD WILL BE APPLIED FOR THE INTERIM STORAGE AND FINAL DISPOSAL.



# FINAL DISPOSAL

- THE PROPOSED METHOD FOR THE MANAGEMENT OF SPENT FUEL IS;

*DIRECT DISPOSAL OF SPENT FUEL WITHOUT REPROCESSING*

- TO INVESTIGATE A SUITABLE SITE FOR FINAL DISPOSAL, A PROJECT HAS ALREADY BEEN LAUNCHED BY TAEK.

