TÜBİTAK

ACTIVITIES OF MARMARA RESEARCH CENTER

Semih ERGİNTAV, PhD
Fehmi AKGÜN, PhD

16th Meeting of COMSATS Coordinating Council
2-3 May 2013, Accra, Ghana

OUTLINES

- **BRIEF INTRODUCTION OF**
  - **MRC INSTITUTES**
  - **EARTH AND MARINE SCIENCES INSTITUTE (EMSI)**
    - **Working Areas**
    - **Selected Projects for Proposed Areas**
  - **ENERGY INSTITUTE (EI)**
    - **Working Areas**
    - **Some Selected projects on Combustion and Gasification**
- **POTENTIAL COOPERATION AREAS UNDER ITRG**
- **PROPOSAL OF A METODOLOGY FOR PROJECT DEVELOPMENT**

TÜBİTAK MARMARA RESEARCH CENTER

TUBITAK MRC has a governmental R&D organization consisting of 7 institutes as;

- CHEMISTRY INSTITUTE
- **EARTH AND MARINE SCIENCES INSTITUTE (EMSI)**
- **ENERGY INSTITUTE (EI)**
- ENVIRONMENT INSTITUTE
- FOOD INSTITUTE
- GENETIC ENGINEERING&BIOTECHNOLOGY INSTITUTE
- MATERIALS INSTITUTE

Earth & Marine Sciences Institute (EMSI)

MISION

To become “A Center of Excellence” in the areas of *active tectonics and the underground resources* in Turkey and in the Region.

VISION

To conduct applied researches by multidisciplinary approaches based on measurement, monitoring and modeling in the *areas of active tectonics and the underground resources* and to disseminate knowledge.

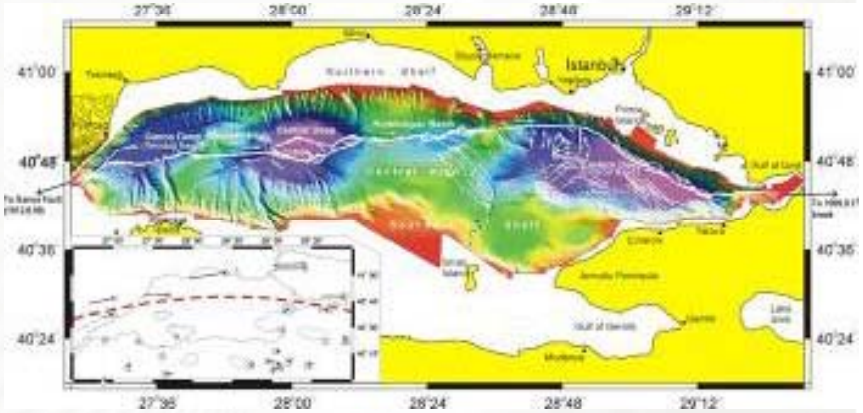
Profile	
Management	**2**
Researcher	**35**
PhD	14
MSc	11
BSc	10
Technician	**4**
Support	**2**
TOTAL	**43**

Earth & Marine Sciences Institute (EMSI)

WORKING AREAS

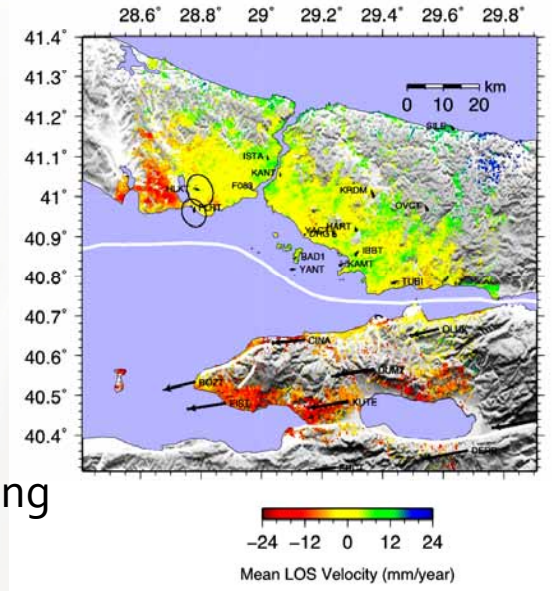
Earthquake Processes

- Earthquake Seismology
- Seismic Micro-zonation
- Crustal Deformation and Structure
- Earthquake Risk Studies
- Active Tectonics



Geophysical Processes

- Seismic Data Acquisition, Processing, Monitoring and Modeling
- Marine Geophysics
- Landslide Researches
- Geodetical Applications



Geological and Geochemical Processes

- Petroleum, Earth Gas, Coal Gas Research
- Burial and Thermal History of Sedimentary Basins
- Quantitative Sedimentary Basin Analysis and Modeling
- Hydro-geochemical Studies
- Medical Geology

SELECTED PROJECTS FOR THE PROPOSED AREA:

NATURAL HAZARD

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ACTIVE KEY PROJECTS ON NATURAL HAZARD

1. Development of Earth Sciences based Solutions to Receive a Site License for a Nuclear Power Station *(Contact point: Dr. Onur Tan, onur.tan@tubitak.gov.tr)*

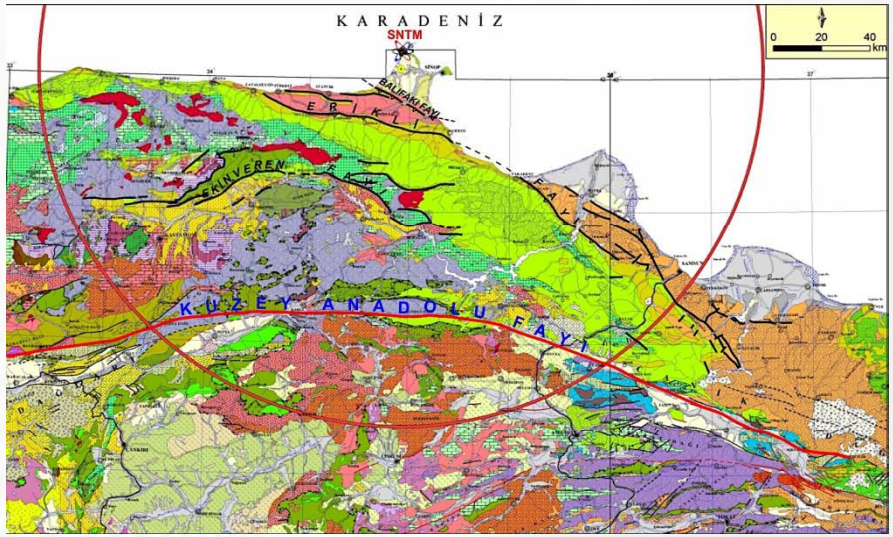
2. Creating Solutions for Urban Settlement Planning through Determination of Landslide and Earthquake Risks *(Contact point: Dr. Vedat Ediger, vedat.ediger@tubitak.gov.tr)*

3. Development of Methods for Purposes of Risk Mitigation and Seismic Hazard Assessment for Major Provinces *(Contact point: Dr. Ekrem Zor, Ekrem.zor@tubitak.gov.tr)*

1) DEVELOPMENT OF EARTH SCIENCES BASED SOLUTIONS TO RECEIVE A SITE LICENSE FOR A NUCLEAR POWER STATION

Project Description

To develop and implement methods for realization of earth sciences based studies required for the site license of Sinop Nuclear Power Plant in an internationally recognizable fashion



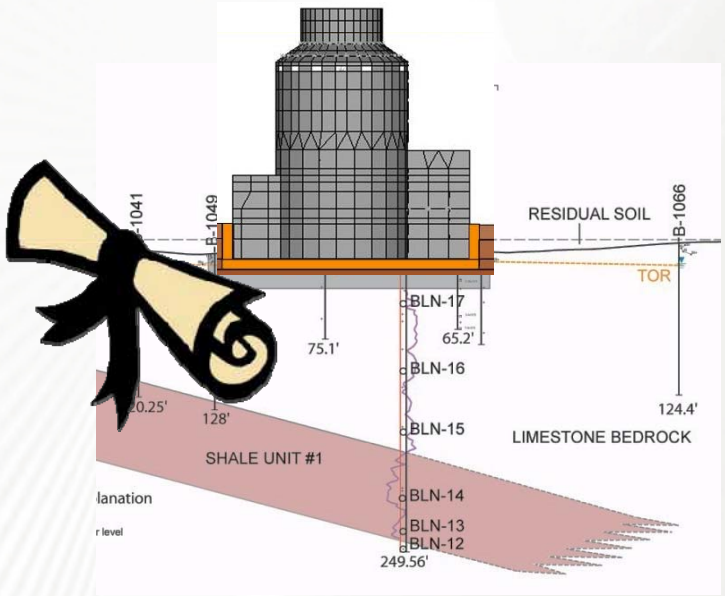
Objectives of the Project

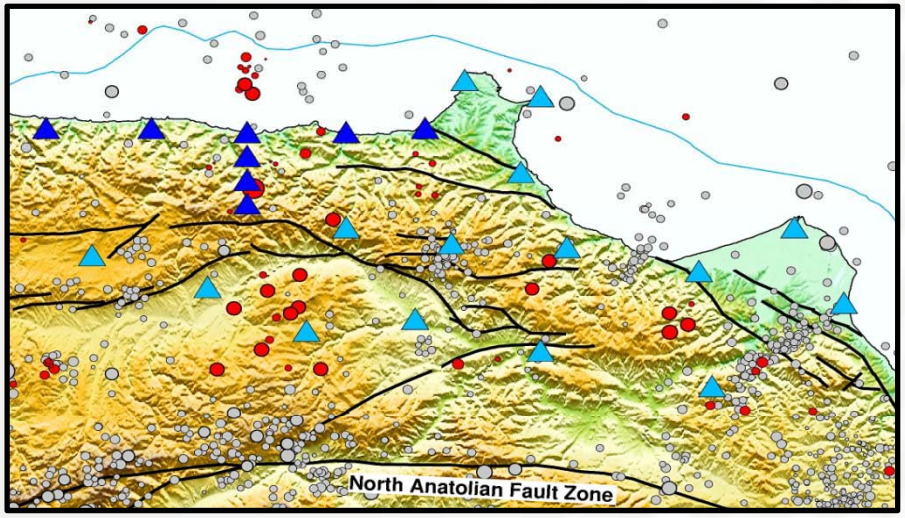
- ✓ To develop methods in order to determine site assessment parameters required for the site license of Sinop Nuclear Power Plant
- ✓ To implement a quality assurance program

1) DEVELOPMENT OF EARTH SCIENCES BASED SOLUTIONS TO RECEIVE A SITE LICENSE FOR A NUCLEAR POWER STATION

Rational Outputs of the Project

- ✓ Establishment of a real time Seismicity Monitoring Infrastructure for the Nuclear Power Plant during its life.
- ✓ Determination of basic design parameters for construction of Nuclear Power Plant
- ✓ Provision of receipt of site license and starting construction





Distribution of earthquakes in the region and locations of planned monitoring stations

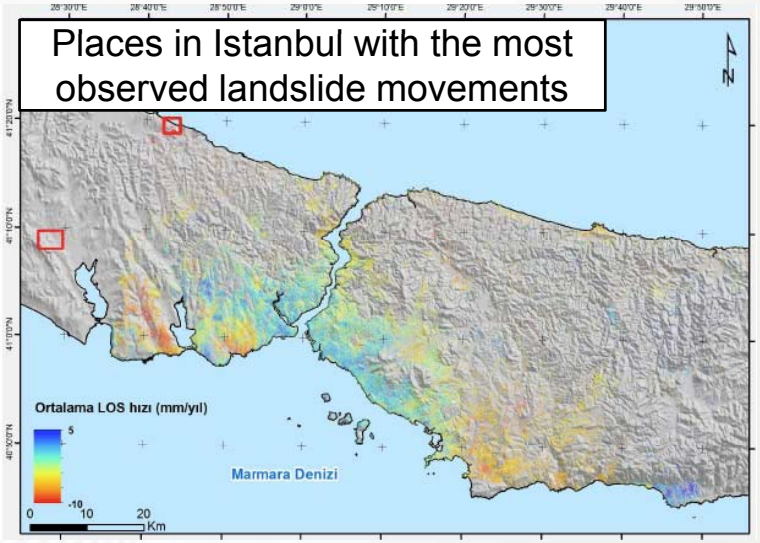
Potential Markets

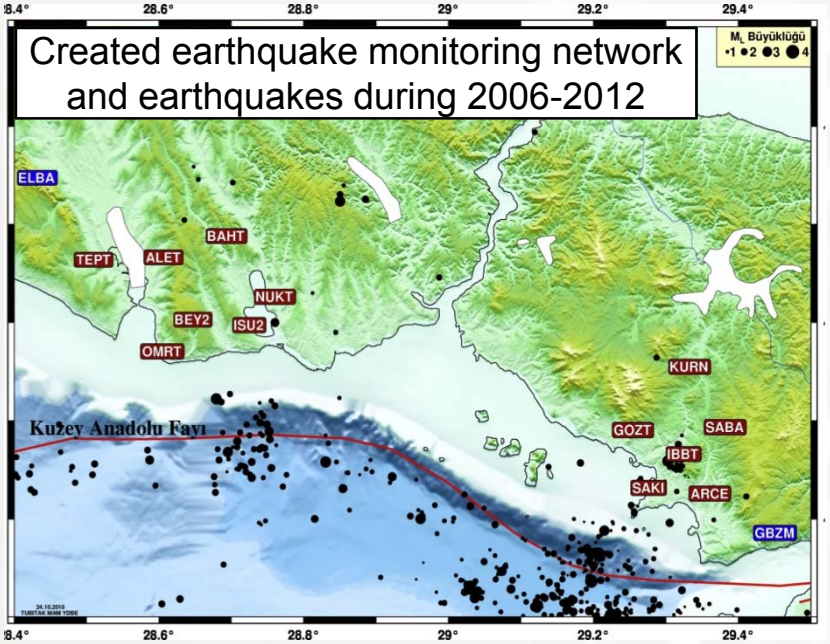
- ✓ T.R. Ministry of Energy and Natural Resources

2) CREATING SOLUTIONS FOR URBAN SETTLEMENT PLANNING THROUGH DETERMINATION OF LANDSLIDE AND EARTHQUAKE

Project Description

Creating solutions to determine regions in western part of Istanbul under risk of landslide and earthquake hazard by contemporary technologies





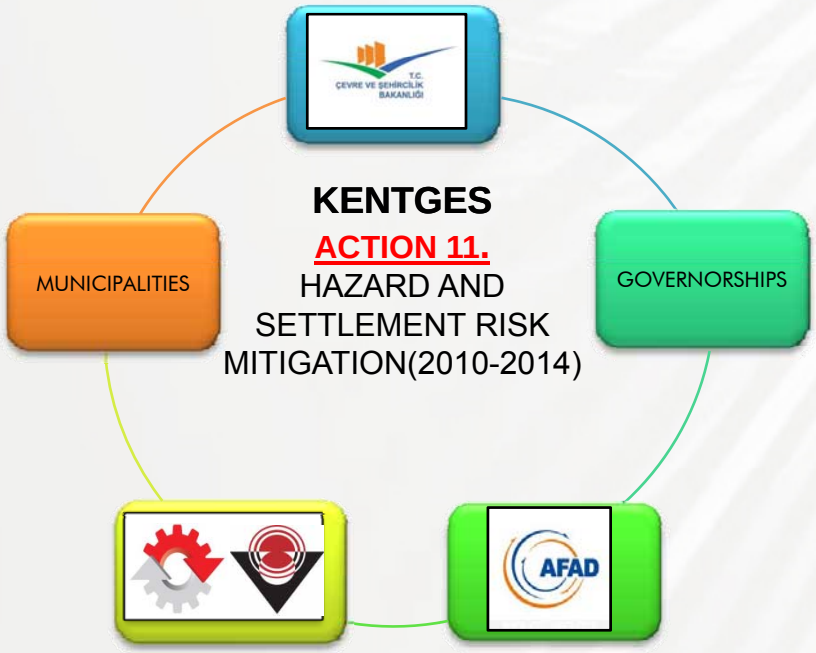
Project Objectives

- ✓ Generation of reference base information belonging to western part of İstanbul
- ✓ Identification of urban transformation and new settlement areas
- ✓ Creation of new methods and reference studies shortly to produce information
- ✓ Real time monitoring of earthquake and landslide risk and investigation of possible precursor signals

2) CREATING SOLUTIONS FOR URBAN SETTLEMENT PLANNING THROUGH DETERMINATION OF LANDSLIDE AND EARTHQUAKE

Rational Outputs of the Project

- ✓ Proper orientation of investments and urbanization through contribution to urban planning
- ✓ Realization of urban transformation studies in short time and the least cost
- ✓ Creation of basic information for geologic models of effective public works planning for earthquake and landslide based hazards
- ✓ To develop knowhow for new techniques such as LIDAR and land based-SAR



Urban Development Strategy Action Plan

(**KENTGES-2023**)

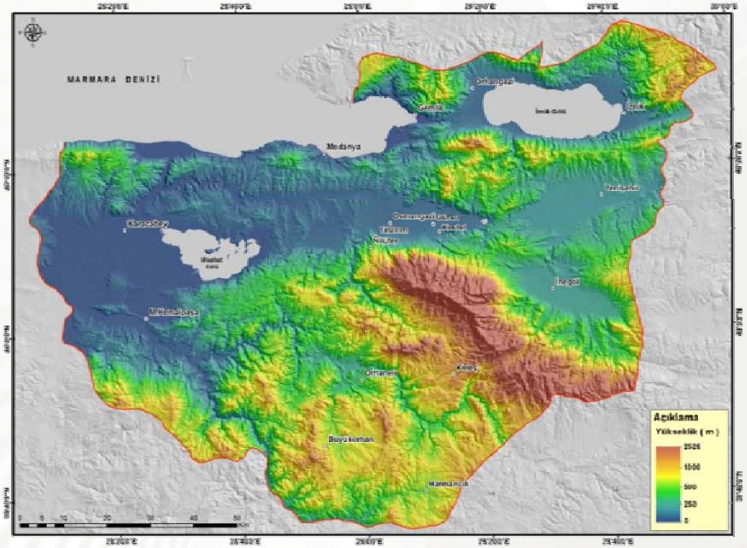
Potential Markets

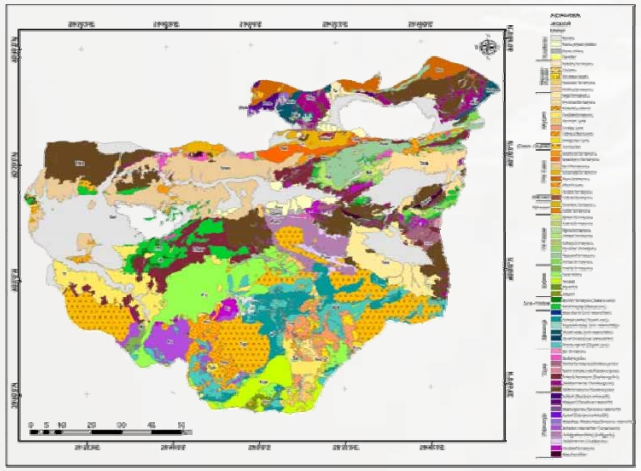
- ✓ T.R. Ministry of Environment and Urbanism
- ✓ Metropolitan Municipalities
- ✓ Disaster Affairs General Directorate

3) DEVELOPMENT OF METHODS FOR PURPOSES OF RISK MITIGATION AND SEISMIC HAZARD ASSESSMENT FOR MAJOR PROVINCES

Project Description

Methods will be developed to assess seismic risk in order to mitigate earthquake damages by carrying out earth sciences studies within boundaries of Bursa Province





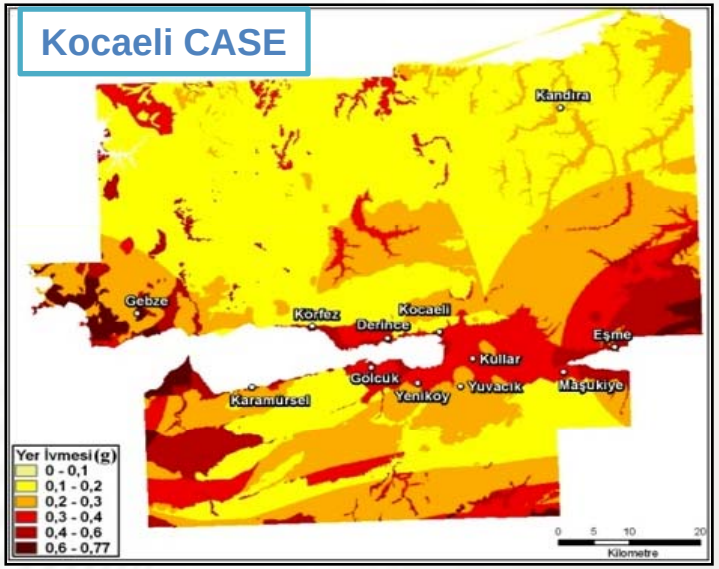
Project Objectives

- ✓ Development of methods to become a reference for Sesimic Hazard Studies done in Bursa Province in province basis
- ✓ Surveying for establishment of Earthquake Master Plan
- ✓ Transfer of techniques developed related to the subject to the end users and establishment of a GIS

3) DEVELOPMENT OF METHODS FOR PURPOSES OF RISK MITIGATION AND SEISMIC HAZARD ASSESSMENT FOR MAJOR PROVINCES

Project Rational Outputs

- ✓ To develop cost and time effective methods for seismic hazard assessment
- ✓ To develop methods for earthquake risk mitigation
- ✓ To contribute correct routing of investments thanks to preparation of bases for urban transformation and space planning



Potential Markets

- ✓ Municipalities
- ✓ Governorships
- ✓ T.R. Ministry of Environment and Urbanism

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SELECTED PROJECTS FOR THE PROPOSED AREA:

MINERAL RESOURCES

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ACTIVE KEY PROJECT ON MINERAL RESOURCES

Developing Integrated Seismic Methods for Determination of Underground Coal

(Contact point: Dr. Aynur Dikbas, aynur.dikbas@tubitak.gov.tr)

DEVELOPING INTEGRATED SEISMIC METHODS FOR DETERMINATION OF UNDERGROUND COAL

Project Description

Developing an “integrated seismic method” for relatively fast, cheap, economical exploration of lignite and investigation of coal bed gas potential.

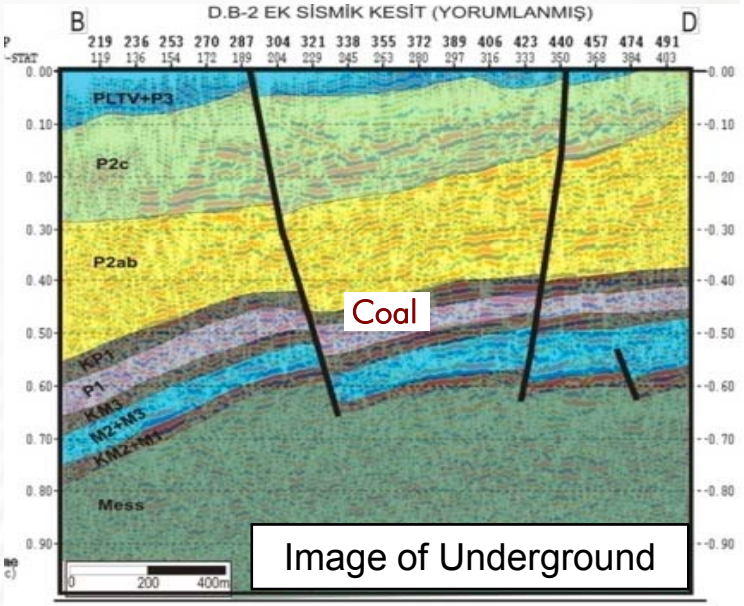


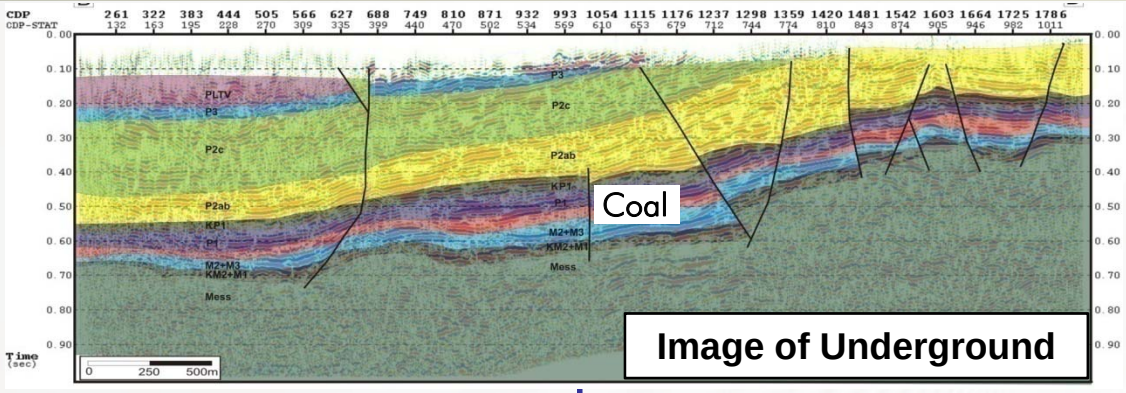
Image of Underground


Evidence of Gas Presence

Project Objectives:

- ✓ To develop integrated seismic methods for rapid and low cost determination of underground coal.
- ✓ To implement the methods at the Tertiary Soma Basin pilot study area.
- ✓ To investigate coal and coal bed gas potential in the pilot study area.

DEVELOPING INTEGRATED SEISMIC METHODS FOR DETERMINATION OF UNDERGROUND COAL

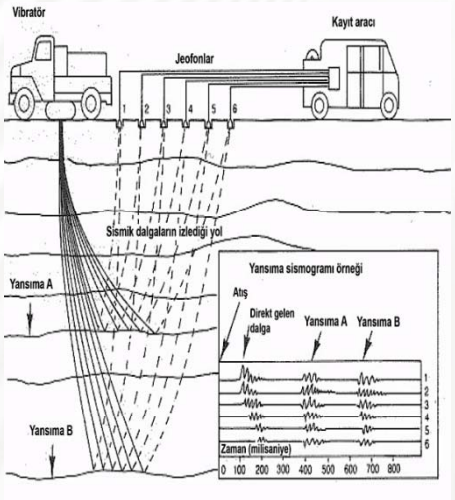


Conventional Method

10-15 drillings within 1 km^2

Solution Provided by Our Group

SurfaceSeismics **Bore Hole Seismics (VSP)**



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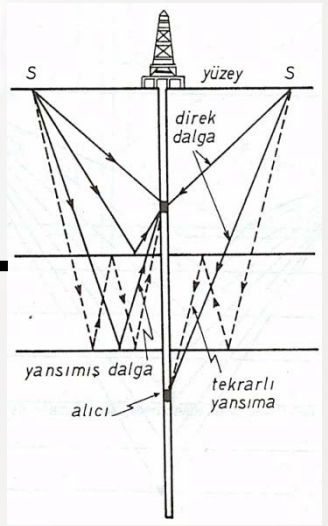

1-2 drillings for calibration purposes and performing integrated seismic operations

DEVELOPING INTEGRATED SEISMIC METHODS FOR DETERMINATION OF UNDERGROUND COAL

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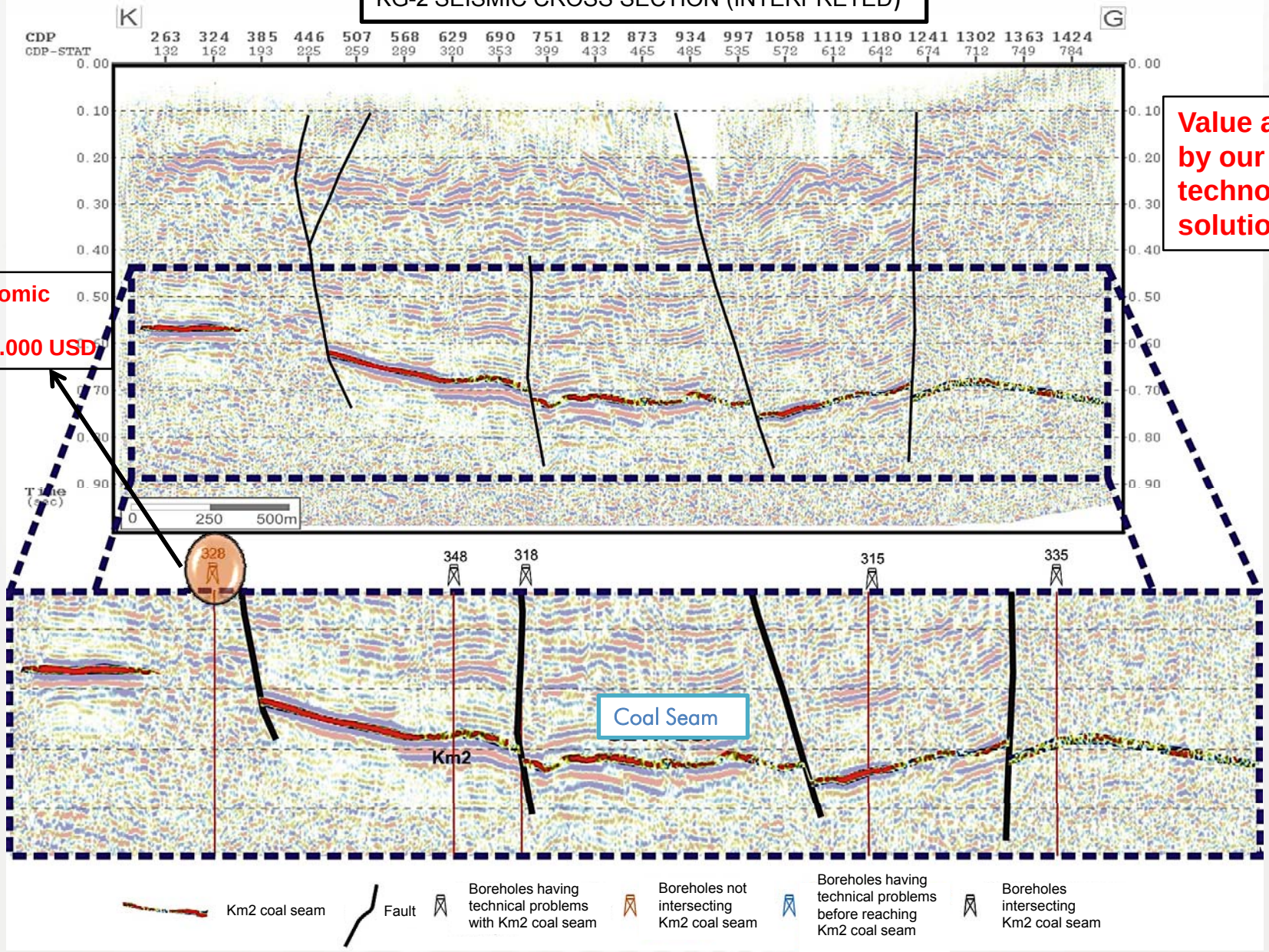
KG-2 SEISMIC CROSS SECTION (INTERPRETED)



Economic Loss > 400.000 USD

Value added by our technological solution

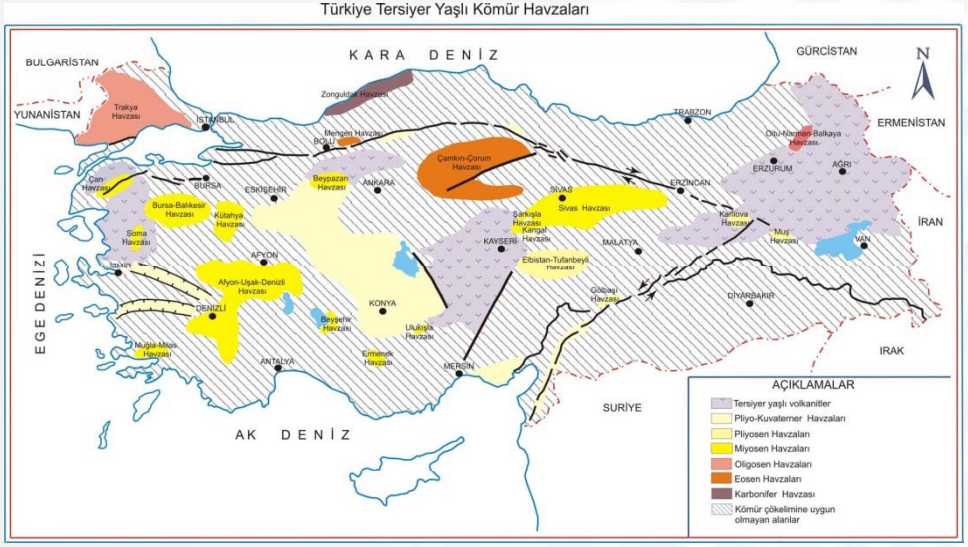
DEVELOPING INTEGRATED SEISMIC METHODS FOR DETERMINATION OF UNDERGROUND COAL

Rational Outputs of the Projects

✓An integrated seismic method that will minimize the number of time consuming and expensive drilling operations for coal exploration has been developed.

✓Coal bed gas potential of lignite has been determined

Contribution to Economy



Distribution of Turkey's Lignite Basins (MTA). There are approx. 60 coal mining sites at these basins. (TKİ)

Potential Markets

- ✓ Determining lignite potential Through collaboration with TKİ providing savings of ~10 years and 60 million TL in budget and 65% in duration.
- ✓ For being export and the national contact point, possibilities of collaborations with all public authorities and private sector companies who have coal exploration and mining licences.
- ✓ By the help of experiences gained, opportunity to take a leading role in the research of geothermal sites

ENERGY INSTITUTE (EI) PROFILE

Staff Profile	
Management	**4**
Researcher	**144**
PhD	32
MSc	74
BSc	38
Technician	**54**
Support	**10**
Total	**212**

Mechanical, electrical, chemical engr.
Physicists, chemists
Technicians, interns

STRATEGIC BUSINESS UNITS OF EI

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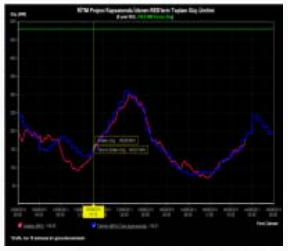
1. Advanced Energy Technologies
   - Combustion and gasification
   - Thermal power plant technologies
   - Fuel cell technologies
   - Gas technologies
   - Fuel technologies

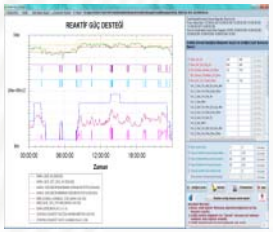
2. Power Electronics and Control Technologies
   - Vehicle technologies
   - Power electronics technologies
   - Battery technologies

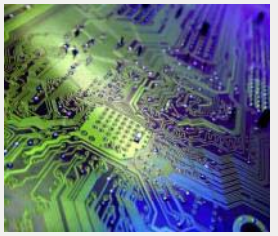
3. Electric Power Research Technologies
   - Power systems information technologies
   - Power systems analyzing and planning
   - Power electronics technologies
   - Automation technologies












Research Fields on Combustion&Gasification

- **Combustion**
  - Bubbling fluidization combustion
  - Circulating fluidization combustion
- **Gasification**
  - Fixed bed downdraft gasification
  - Bubbling Fluidized Bed Gasification
  - Circulating Fluidized Bed Gasification
- **Gas cleaning & conditioning technologies**
  - Syngas conditioning – hydrogen rich gas production
  - Hot gas cleaning
  - Cold gas cleaning
  - CO_2 capturing
- **Liquid Fuel Production technologies**
  - FT Catalysis
  - Fixed and Slury FT Reactors
- **Solid fuel analysis and characterization**
- **Process modelling and simulation**

Projects on Combustion&Gasification

1. Integrated Biomass Gasification with Power Technologies, BIGPOWER, EU FP 6 Project, 2005-2008.
2. Improvement of the S&T Research Capacity of TUBITAK-MRC IE in the Fields of Hydrogen Technologies, HY-PROSTORE, (EU FP6 Project) (2005-2008)
3. The Integrated European Network for Biomass Co firing, NETBIOCOF, EU FP CA 6 Project, 2005-2008.
4. Designing and Manufacturing of 400 kWth Fixed bed Biomass Gasifier, Industrial Project, 2009-2010.
5. Coal and Biomass Gasification, Gas Cleaning and Integrated Energy Production, National Project (SPO), 2005-2009.
6. Combustion of Biomass and Lignite in Circulating Fluidized Bed, National Project (TARAL 1007, EIE,OGM), METU, MAM, GAMA, 2007-2010.

Projects on Combustion&Gasification

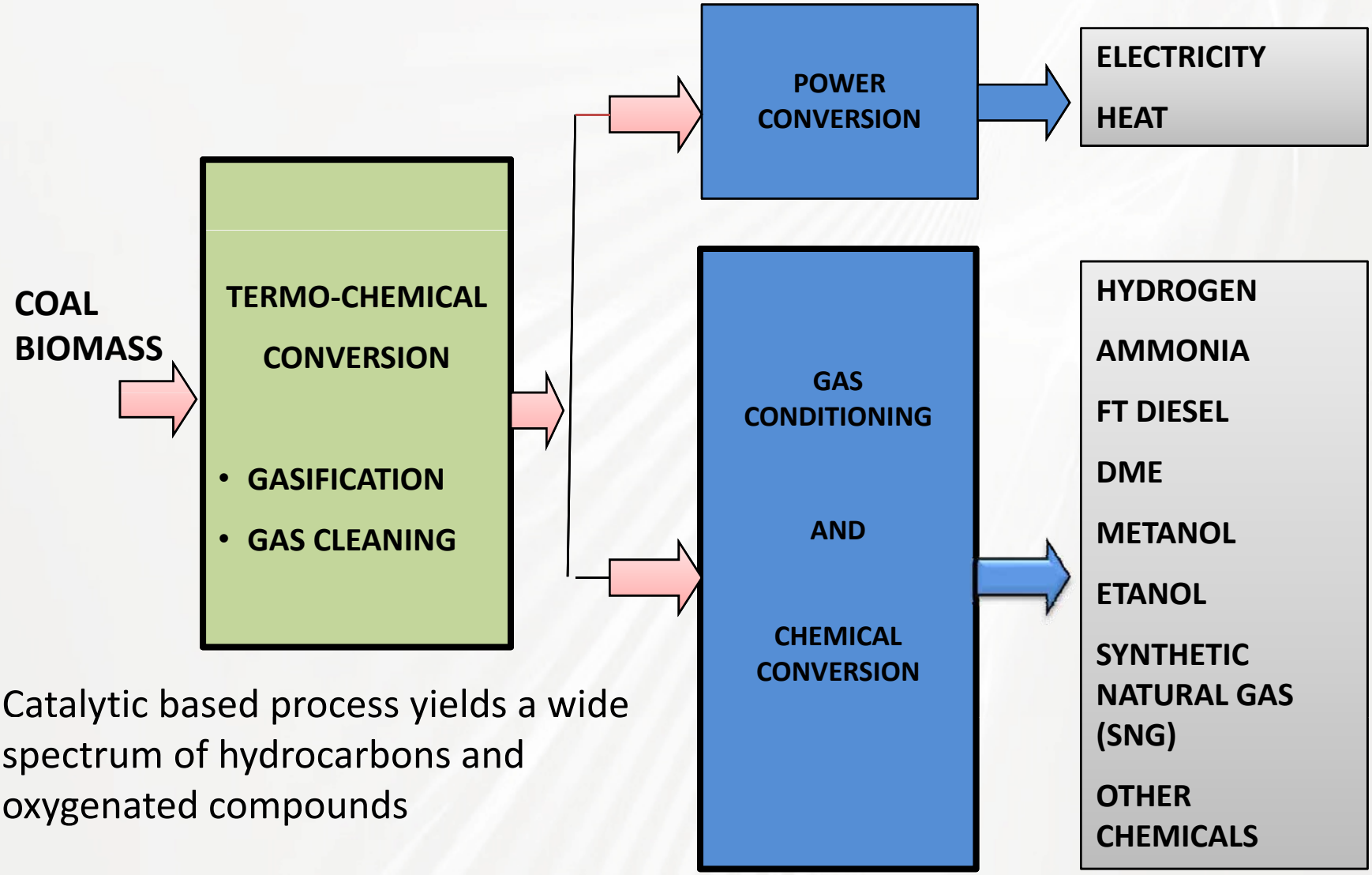
7. Biogas Production and Utilization from Animal and Industrial waste, National Project (TARAL 1007), 2007-2010.
8. Designing and Manufacturing of 250 kWe Fixed bed Biomass Gasifier, Industrial Project, 2009-2010.
9. Designing and Manufacturing of 2 MWe Fluidized Bed Gasifier, Industrial Project, 2009-2011.
10. Fuel Cell Based Micro Cogeneration Systems (MICRO COGEN) , National Project ,2006-2010.

Some of on-going projects

1. Liquid Fuel Production from Biomass and Coal Mixtures (TARAL National Project), 2009 – 2014.
2. Tuncbilek Entrained Flow Gasification Project, TKI, 2011-2013
3. Investigation of Slugging on Boiler Tubes and Improving Availability of Kemerkoy Thermal Power Plant, 2011–2013.
4. Power Plant Performance Monitoring and Evaluating System Design And Application (PERIDSIS), 2011–2013.
5. High Added Value Materials from Waste Tyre Gasification Residues (TYGRE), (EU FP7 Project), 2009-2013.
6. The European Research Infrastructure for Thermo-Chemical Biomass Conversion (BRISK), (EU FP7 Project), 2012-2016

Coal and Biomass Based Polygeneration Concept

Polygeneration is the main application area of **Clean Coal Technologies**



Catalytic based process yields a wide spectrum of hydrocarbons and oxygenated compounds

Liquid Fuel Production from Biomass and Coal Blends

Status: Ongoing (15/06/2009 – 15/06/2014)

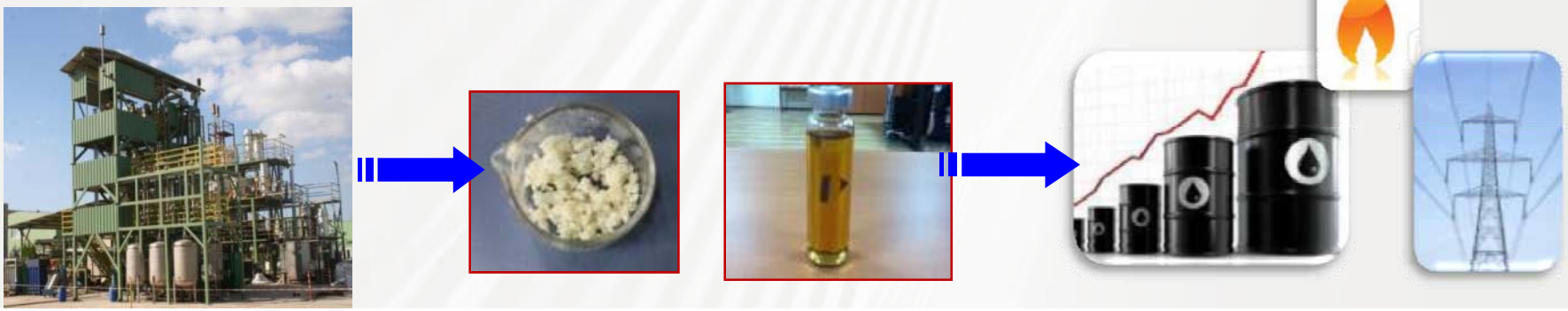
Aim:

- ✓ To produce more economic, efficient and clean liquid fuels from coal and biomass,
- ✓ To develop technologies to be used in industry,
- ✓ To demonstrate the outcomes in a pilot scale.

Scope:

- Development of fuel feeding, gasification, gas cleaning, gas conditioning/separation, liquid fuel production systems.
- Demonstration of all systems as a pilot scale.

Capacity: 250 kg/h feed capacity



Liquid Fuel Production from Biomass and Coal Blends

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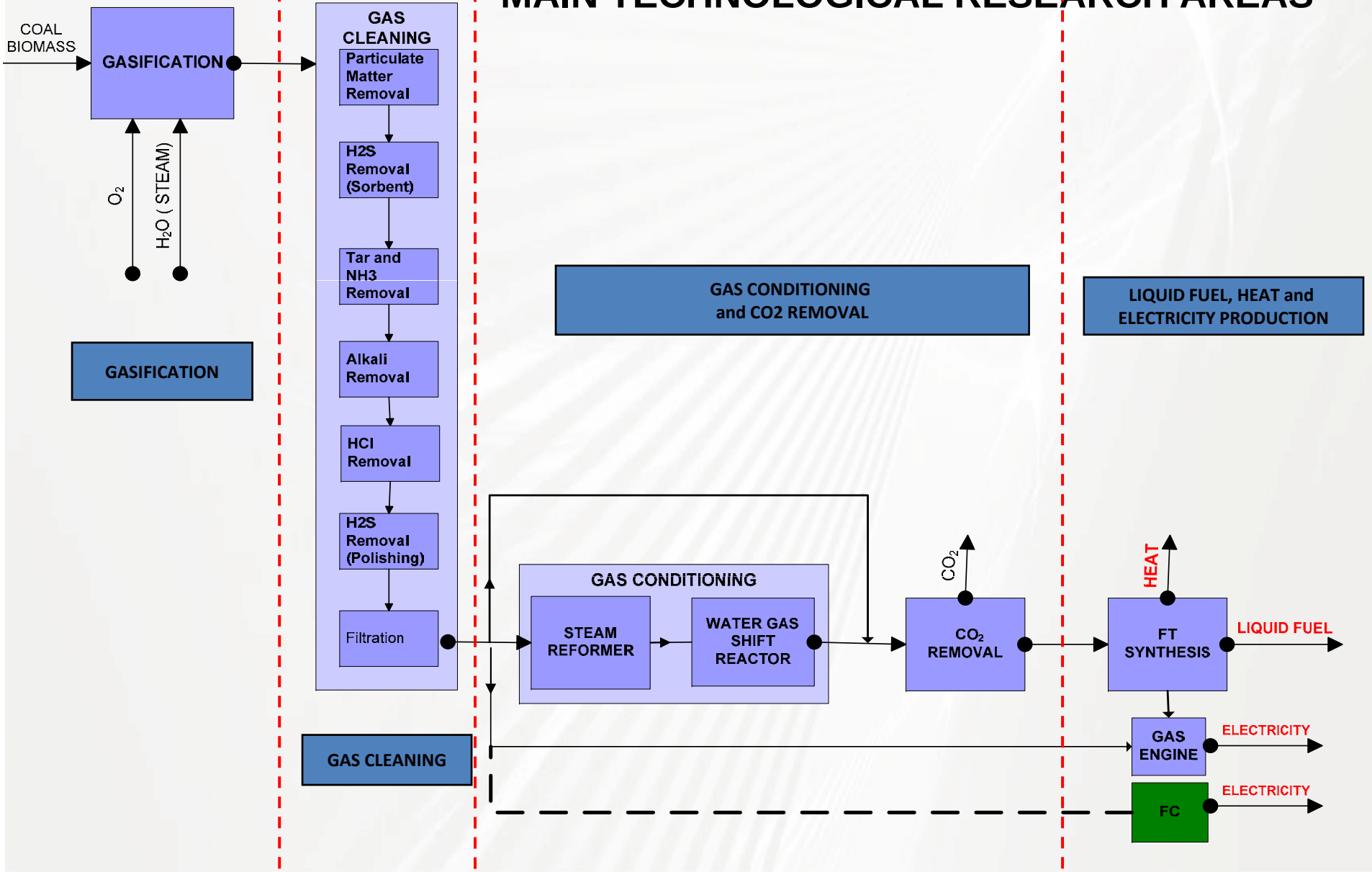
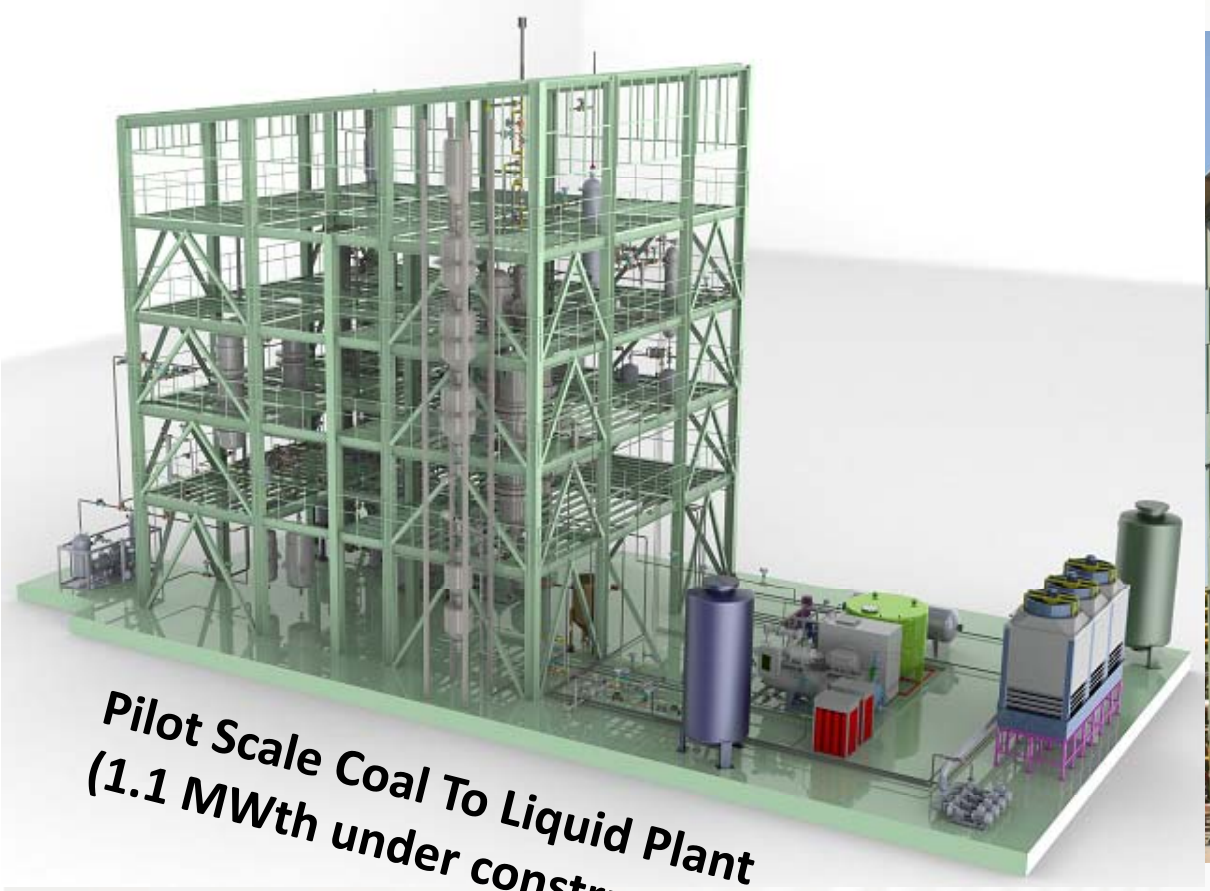
MAIN TECHNOLOGICAL RESEARCH AREAS



Liquid Fuel Production from Biomass and Coal Blends



Pilot Scale Coal To Liquid Plant
(1.1 MWth under construction)

Lab Scale FB Gasifier
(150 kWth in operation)

Entrained Flow Gasification Project

Project partner and Customer: Turkish Coal Enterprise

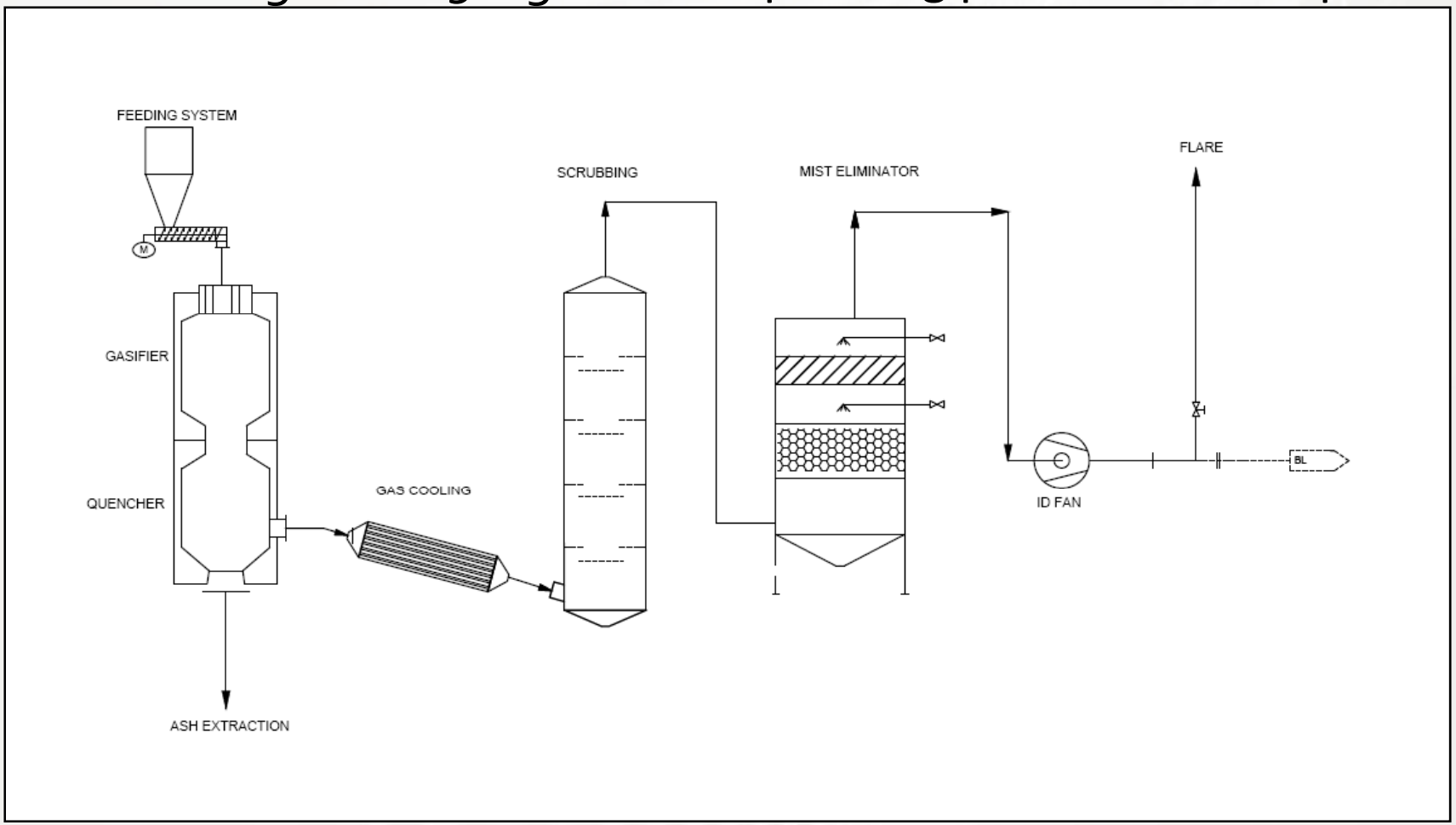
Duration: 04/08/2011-04/08/2013

Aim: To evaluate low quality Turkish lignite in efficient way via entrained flow gasification process for

- IGCC application
- Methanol production
- Liquid fuel production.

Entrained Flow Gasification Project

- Capacity:1,7MWth
- Fuel: Lignite
- Fuel feeding rate: 250kg/h
- Fuel feeding type: Dry feeding
- Gasification agent: Oxygen
- Operating pressure: Atmospheric



Entrained Flow Gasification Project

CURRENT STATUS: System is in operation and experiments are performed with different type of Turkish Lignites.

BFB Gasifier Project

- 250 kWth Capacity
- Parallel Combustor for Allothermal Gasification
- Modular for Parametric Studies

Pilot Scale CFB Combustor Project

- Capacity: 750 kWth
- 24 bar pressure and 800 kg/h steam generation
- Seperate Coal and Biomass Feeding Ports
- Allows Co-Firing Studies

30 kWth Lab Scale CFB Combustor

- 30 kWth Capacity
- Modular for Parametric Studies
- Advanced Control System
- Fast Adaptibility for new studies
- Separate Coal and Biomass Feeding Ports
- Allows Co-Firing Studies
- Allows OxyCombustion Studies

Investigation Of Slugging On Boiler Tubes and Improving Availability of Kemerköy Thermal Power Plant

Status: Ongoing *(07/03/2011 – 07/03/2013)*

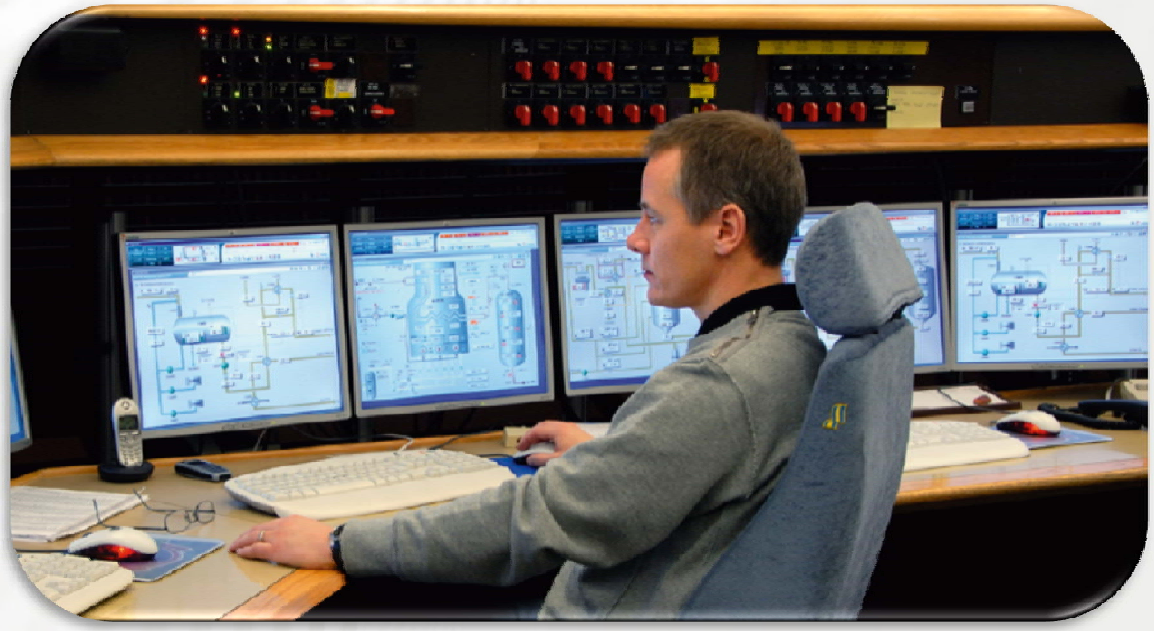
Scope: Determining the methods in order to reduce slugging on boiler tubes and tube failures that cause unexpected trips and production losses in Kemerköy Thermal Power Plant.

Power Plant Performance Monitoring and Evaluating System Design And Application (PERIDSIS)

Status: Ongoing (01/03/2011 – 01/03/2013)

Scope:

- ✓ Measure and monitor thermodynamic and hydraulic parameters effecting power plant performance in order to increase power plant performance and income
- ✓ Designing of power plant monitoring and evaluating system in order to compare expected and measured performance of a power plant.



POTENTIAL COOPERATION AREAS

Potential collaboration areas on coal gasification for IGCC, Coal To Liquid and CHP applications are;

- coal gasification and combustion,
- syngas cleaning,
- FT synthesis and
- FT reactors

Within this scope:

- W/o presuriesed gasification system design and operation
  - Fludized bed gasifier/combustor
  - Feeding systems,
- Syngas cleaning
  - Tar removal
  - Desulfurisation (H_2S and COS)
  - NH_3 removal
  - Particle removal
- Catalyst developments, FT reactor design, cooling systems, Wax-catalyst separation in slury bed reactors

Metodology of the Project Development

1 Multilateral Meetings

2 Visiting between Research Teams

3 Sharing of Potential Project List

Potential Project List

1……

2……

……

N……

Metodology of the Project Development

4 Establishment of Project Teams in Each Center

List no	Titile	The Target	Contatc Point	Project Team
1.	Deveoping of	Producing of	xxxxxx yyyyy	Xxxxx Yyyy Zzzz
2				
3				

Potential Project List

1.....

.....

Metodology of the Project Development

5 Create Links between the Project Teams for each Center

CENTERS / MRC	Project Team-1 in Center A	Project Team-1 in Center B			Proejct Team-n in Center N
MRC Team-1				X	
MRC Team-2		X			
				X	
					X
MRC Team-n	X	X			

Metodology of the Project Development

6 Spesific Project Meetings

CENTERS MRC	Project Team-1 in Center A	Project Team-1 in Center B	Project Team-n in Center N
MRC Team-1			X
MRC Team-2	X	X	

Team Structure	Required Infrastructure	Methodology	Milestones	Budget	Source of the Budget	.....	.....

Metodology of the Project Development

7 Reports of each Project Team

Team Structure	Required Infrastructure	Methodology	Milestones	Budget	Source of the Budget	.....	……
1	……..						
2	……..						
3	……..						
4	……..						
..							

SELECTION COMMITTE
(establisment by COMSATS Members)

Metodology of the Project Development

8 Check the Possibilities of the Budgets and Create a Short List

SELECTION COMMITTE
establisment
by COMSATS Members

A SHORT LIST

1	……
2	……
3	……

START THE PROJECTS <u>UNDER THE CONTROL OF</u>

1) **COMSATS**
2) **THE SOURCE OF THE BUDGETS**

(e.g. COMSATS, CENTERS, FP7, …….)

Thank You For Your Attentions