



Energy Efficiency and Renewable Energy Strategies in Turkey

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Athens/GREECE

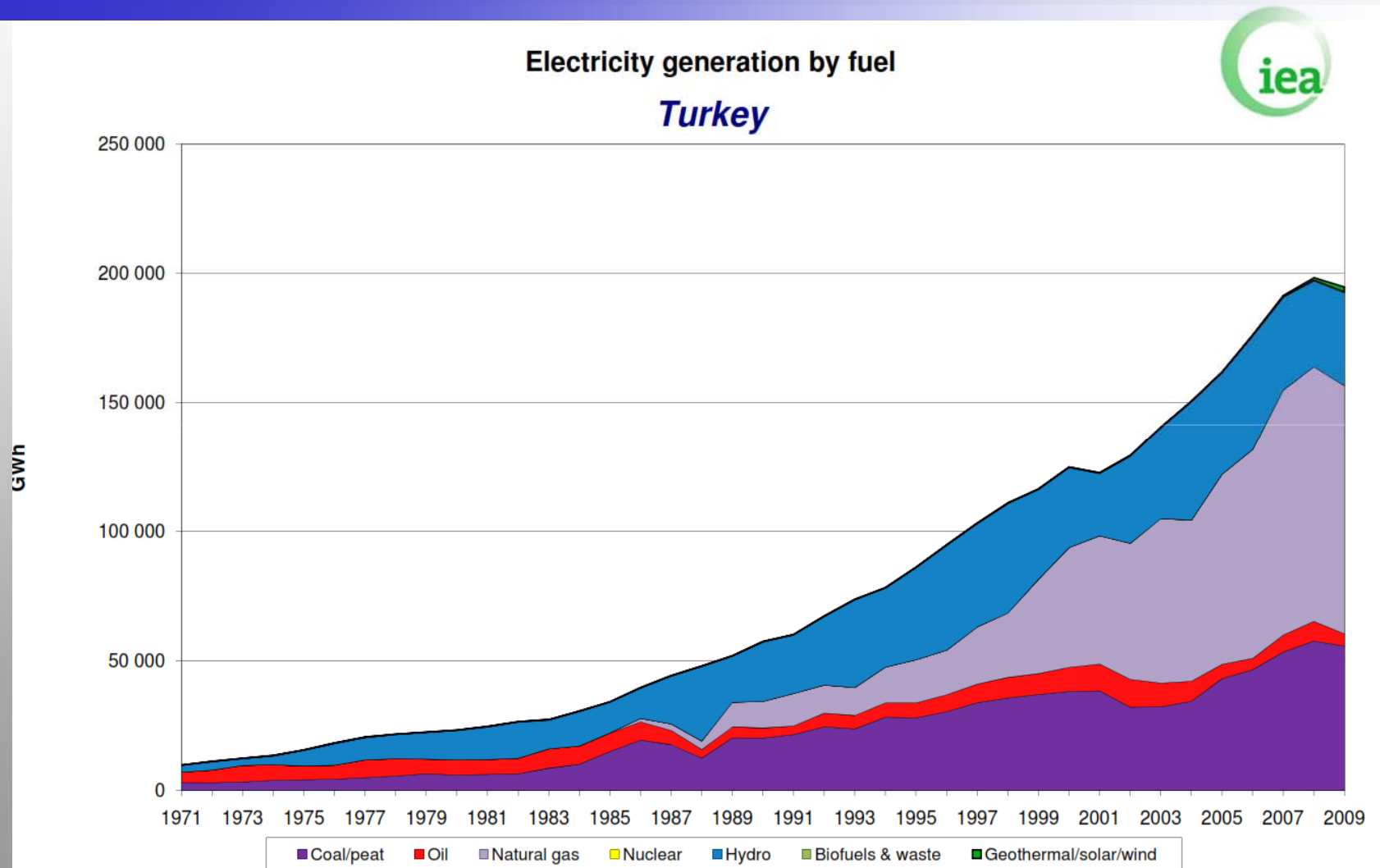
Turkey / Energy

- Energy security-sustainable development
- Energy Bill
 - Imported Natural gas, Oil and Coal 55 Billion \$
 - Import Dependency 71%
- Kyoto has been signed (CO_2)
- 2nd in demand increase
- Domestic resources
 - Coal
 - Lignites (12 Billion Tonnes)* (100 Years)
 - Hard Coal (1.1 Billion Tonnes)
 - Wind
 - Sun
 - Geothermal
 - Hydro
 - Biomass
- Planned Coal PowerPlant Capacity:
7000 MW



Electricity Generation

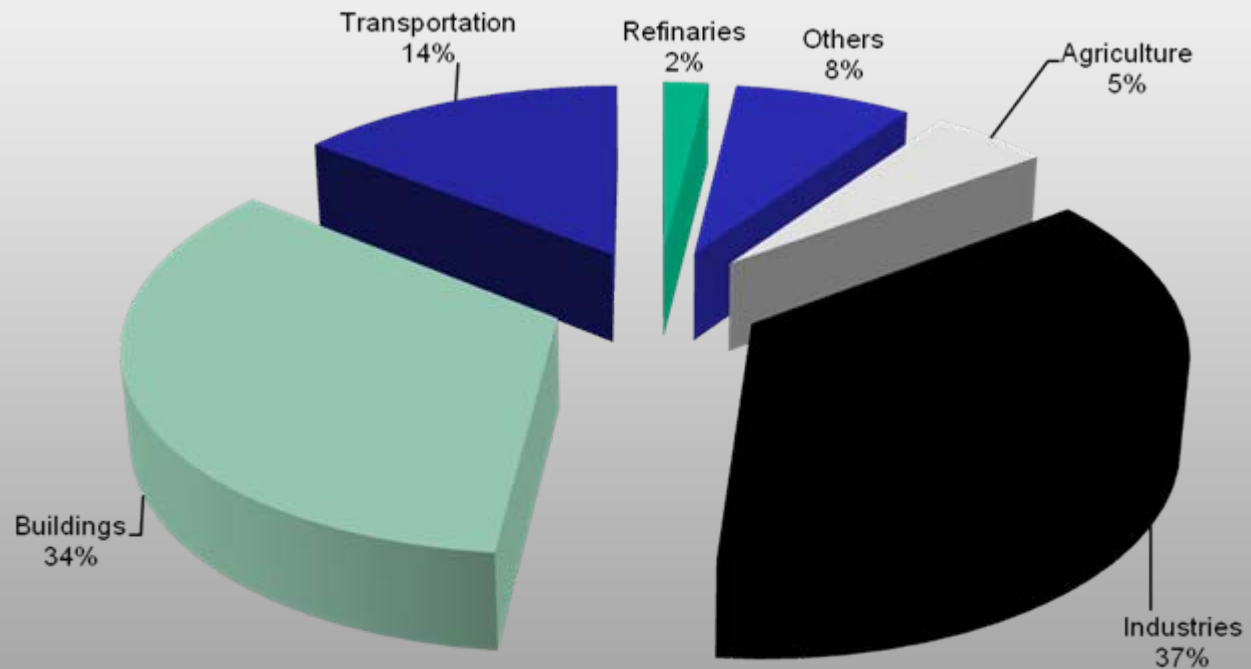
Electricity Generation by Fuel* in Turkey (1971 – 2009)



Source: Energy Balances of OECD Countries 2010 (OECD / IEA Pub.)

Energy Statistics

2010 Energy Supply: 109 Mtoe



Solution for Import Dependancy

Domestic Resources

Coal
Oil and NG

Energy Efficiency

Renewables

Hydro
Wind
Solar
Biomass
Wastes
Geothremal

Nuclear Power

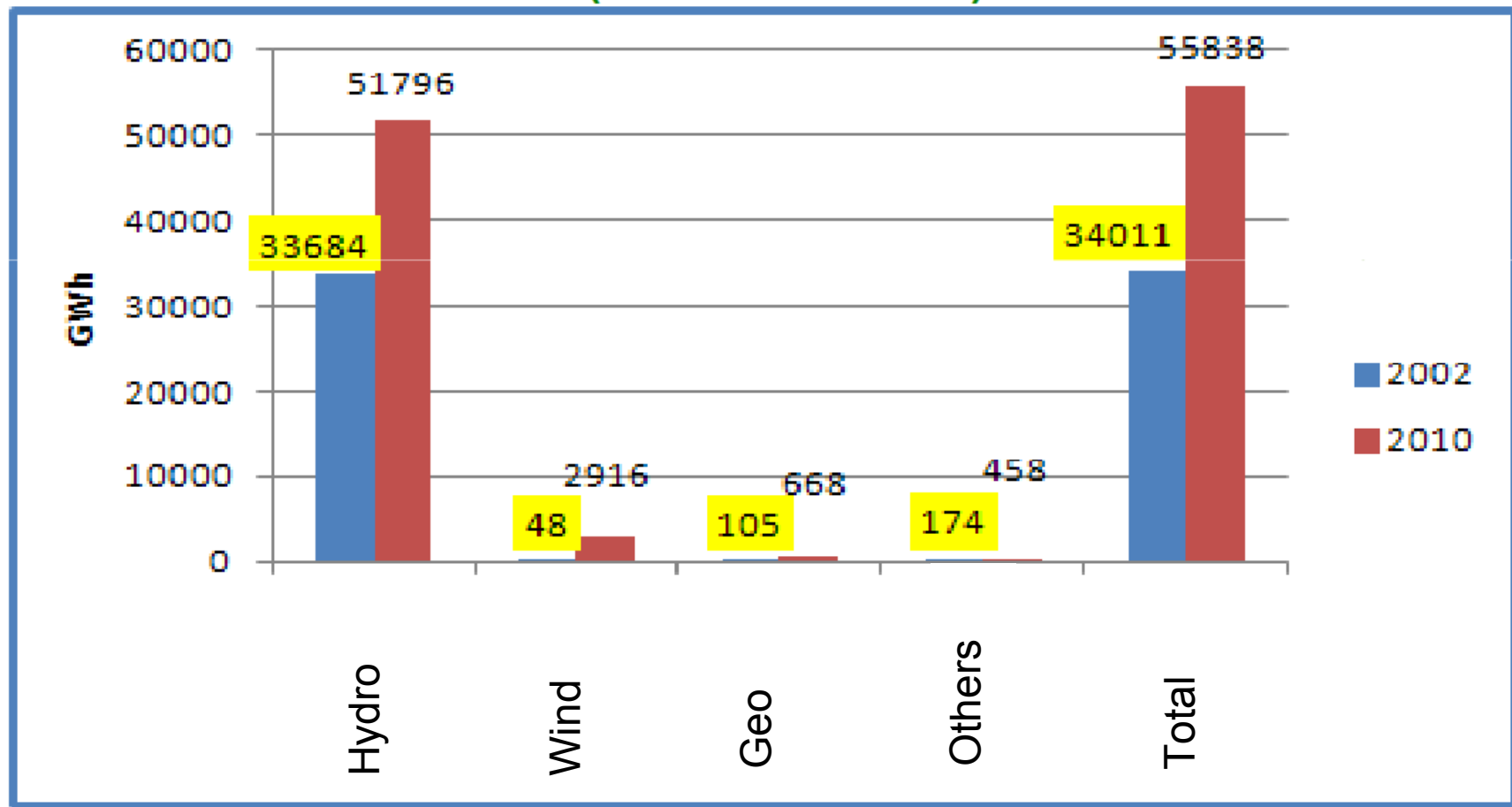
Decreasing Losses



TUBITAK

MAM

Renewable Energy



Legislation

- Energy Efficiency Law 2007
- Regulations
 - Increasing efficiency in energy resources and consumption 2011
 - Energy performance of buildings 2008
 - Cost sharing at central heating systems 2008
 - Energy efficiency in transportation 2008
 - Energy Efficiency supports for SMES 2010
 - Energy managers assignment in public schools 2009
 - Efficiency requirements of gas or liquid fuel boilers 2008
 - Energy Labeling for Air Conditioners 2006
 - Energy efficiency requirements for refrigerators, and freezers 2006
 - Labeling for refrigerators and freezers
 - Energy Efficiency requirements for lighting 2006
- Notifications
 - Labeling for dishwashers, washing machines, drying machines, ovens
- Circulars

Strategy Documents

- Energy Efficiency Strategy Document 2012
 - To reduce energy intensity and energy losses in industry and services sectors
 - To decrease energy demand and carbon emissions of the buildings and to promote sustainable environment friendly buildings using renewable energy sources
 - To provide market transformation of energy efficient products
 - To increase efficiency in production, transmission and distribution of electricity; to decrease energy losses and harmful environment emissions
 - To reduce unit fossil fuel consumption of motorized vehicles, to increase share of public transportation in highway, sea road and railroad and to prevent unnecessary fuel consumption in urban transportation
 - To use energy effectively and efficiently in the public sector
 - To strengthen institutional structures, capacities and collaboration; to increase use of state of the art technology and awareness activities and to develop financial mechanisms except public.

http://www.yegm.gov.tr/duyurular/EV/EV-Strateji_Belgesi/Energy_Efficiency_Strategy_Paper_2012.pdf

Related Strategy Papers

- National Climate Change Strategy Document 2010
- National Climate Change Action Plan
- Industrial Strategy and Action Plan
- TAEK Strategy
- TÜBİTAK Strategy
- SMES Strategy



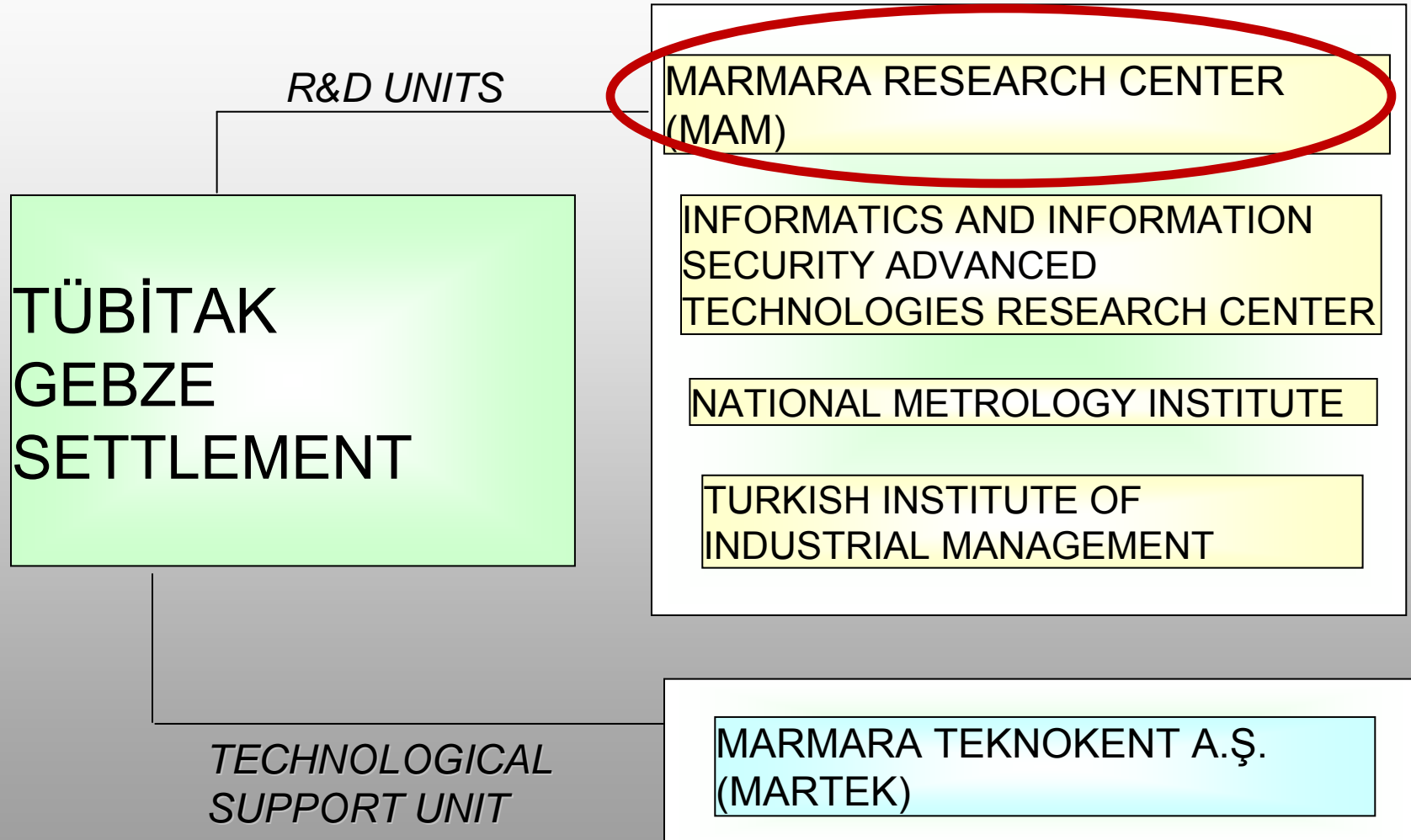
Target of 10 years

- Installed Generation Capacity 100.000 MW
- 5 Billion USD investment each year
- RES Capacity %30
 - Wind 20.000 MW
 - Solar 3000 MW
 - Geothermal 600 MW
- %75 Privatized
- 2 Nuclear Power Plants



Case Study 1-TUBITAK MRC EI

TÜBİTAK Gebze Settlement



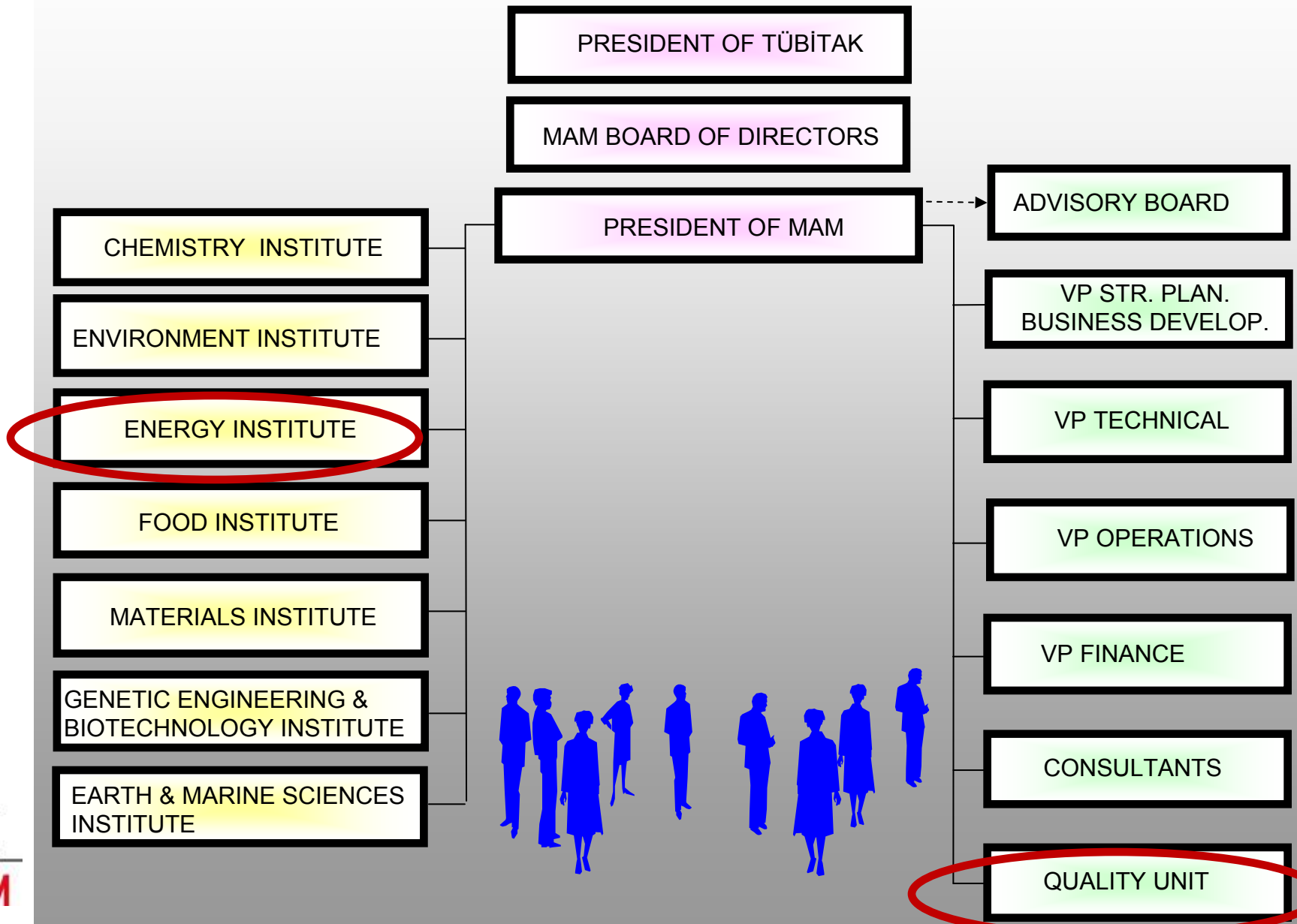
VISION

To excel in Research, Innovation and Commercialization (RIC) and provide prosperity and high quality of life for People of Türkiye.

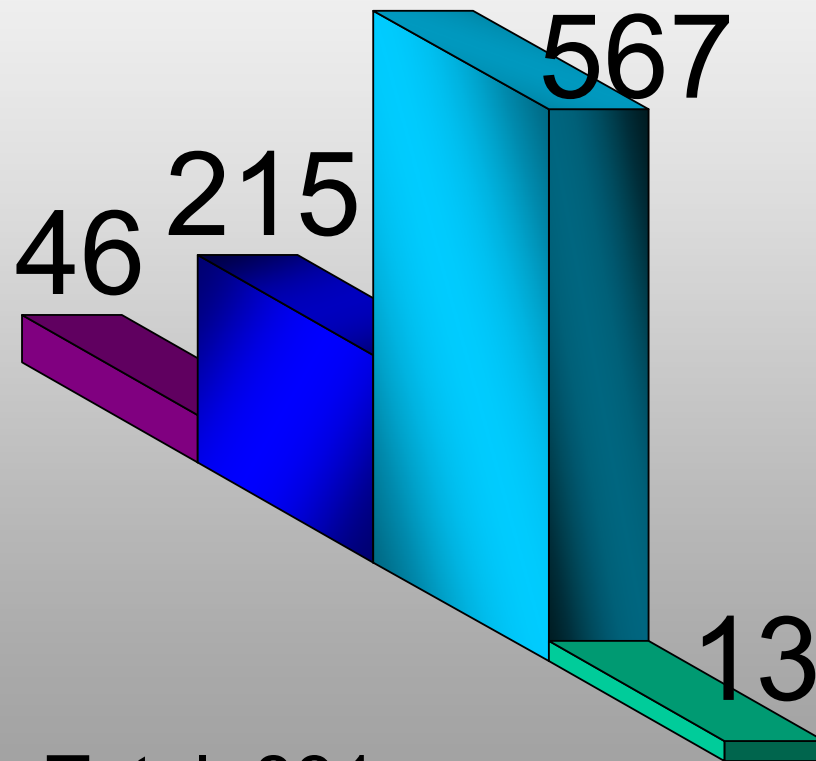
MISSION

To advance science and technology and develop cutting-edge technologies and high-value products to make Türkiye a world leader.

Organization Chart

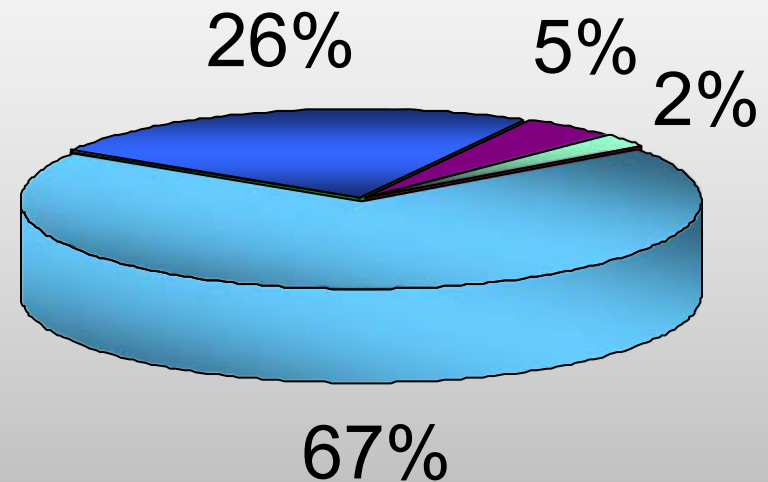


Personnel Profile



Total: 831

*May 2012



- Manager
- Researcher
- Administrative Personnel
- Security

Activities

Projects

- Basic research
- Applied research
- Innovative
- Partnership
- Collaborative
- Technology transfer

Services

- Testing
- Analysis
- Consultancy
- Training



Certificates

- ★ **National Facility Security Certificate**
- ★ **NATO Facility Security Certificate**
- ★ **Manufacturing Authorization Certificate**
- ★ **ISO 9001-2008 The Certificate of Quality Management System for all the Institutes and the Departments of MAM**
- ★ **ISO 14001-2004 The Certificate of Environment Management System for all the Institutes and the Departments of MAM**
- ★ **ISO 17025 The Accreditation Certificate of Service Laboratories (EI,FI,MI,CEI)**



TUBITAK Marmara Research Center

**ISO 14001 Environmental Management System Practices
&
Liabilities Derives from National Legislative Framework**

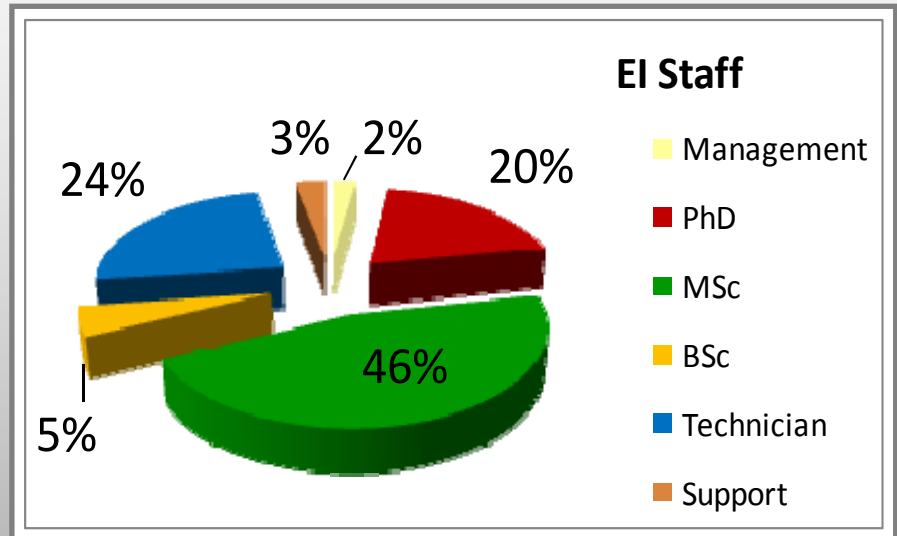
**This study is conducted by TÜBİTAK
MRC Energy Institute**



Energy Institute

Staff Profile

Management	3
Researcher	99
<i>PhD</i>	<i>30</i>
<i>MSc</i>	<i>60</i>
<i>BSc</i>	<i>9</i>
Technician	35
Support	5
Total	142



Interdisciplinary Research

Electrical Engineers
 Electrical&Electronics Engineers
 Machine Engineers
 Chemistry Engineers
 Chemists
 Physists
 ...

Research Teams



**Combustion and Gasification
Technologies**



**Thermal Power Plant
Technologies**



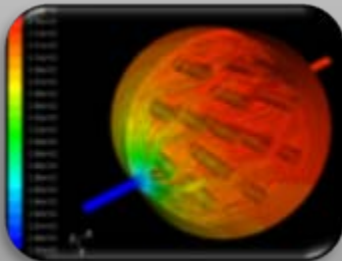
Fuel Analysis



Energy Institute



Power Electronics



Gas Technologies



Fuel Cell Technologies



Vehicle Technologies



Battery Technologies

EU Projects

Ongoing projects

- **MC-WAP** (6th FP) Molten-Carbonate Fuel Cells For Water Borne Applications
- **MCFC-CONTEX** (7th FP) Effects of CONtaminants in biogenous fuels on MCFC catalyst and stack compo-nent degradation and lifetime and EXtraction strategies
- **TYGRE** (7th FP) High Added Value Materials From Waste Tyre Gasification Residues
- **AB-E2PHEST2US** (7th FP) -Enhanced Energy Production Of Heat And Electricity By A Combined Solar Thermionic-Thermoelectric Unit System

Completed projects

- **EU-DEEP** (6th FP) The Birth of A European Distributed Energy Partnership That Will Help The Large-Scale Implementation of Distributed Energy Resources in Europe
- **NATURAL-HY** (6th FP) Preparing for the hydrogen economy by using the existing natural gas system as a catalyst.
- **TERMISOL** (6th FP) New Low Emissivity and Long-lasting Paints for Cost Effective Solar Collectors
- **HYPROSTORE** (6th FP) Improving of the S&T Research Capacity of TUBITAK MRC IE in the Fields of Hydrogen Technologies
- **BIGPOWER** (6th FP) Improving of the S&T Research Capacity of TUBITAK MRC IE in the Fields of Integrated Biomass Gasification with Power Technologies
- **NETBIOCOF** (6th FP) Integrated European Network For Biomass Co-Firing
- **MOCAMI** (5th FP) Development and demonstration of a small-sized hybrid system with the combination of the MCFC technology and a microturbine
- **IRMATECH** (5th FP) Integrated Research on Materials, Clean and efficient energy Technologies and processes to enhance MCFC in a sustainable development
- **BIOCOGEN** (5th FP) Biomass Cogeneration Network
- **CASES** (6th FP) Cost Assessment Sustainable Energy Systems



El Laboratories



Environmental Management System

- ✓ 1- TUBITAK MRC is implementing an environmental management system (EMS) based on ISO 14001 (certified in 2004) as a part of the Total Quality Management System.

The key areas determined are

- reduction in electricity consumption,
- efficient use of natural gas,
- emission and immission management,
- efficient cooling-heating,
- water consumption management and
- waste management.



Environmental Management System

- ✓ 2- TUBITAK MRC, as being a governmental institution, has to harmonize its environment- and energy strategy with Energy Efficiency Strategy Paper for Turkey: 2012- 2023 .

The strategy consists of the goals listed below which are outlined in the “Energy Efficiency Strategy Paper for Turkey: 2012- 2023

- 1- Reduction of energy intensity and energy losses
- 2- Reduction in energy demand and carbon emissions of the buildings; increased use of renewable energy in buildings
- 3- Reduction of fossil fuel consumption per capita
- 4- Effective and efficient energy use: increased energy efficiency in buildings

Implementations

PRACTICES

✓ **Electricity Consumption**

- Photocell lighting
- Solar enlightenment
- Special window design for efficient utilization of daylight in the main building of Energy Institute.
- Replacement of incandescent bulbs with energy-efficient bulbs : Circular No. 2008/19 dated 13/08/2008 obligated all public bodies and institutions



✓ **Natural Gas Consumption**

- Monitoring with SCADA
- Heat control valve system in boilers

✓ **Emission and Immission Measurement**

- Flue Gas Emission Measurement at 5 different points of the Campus (by TUBITAK MRC Environment Institute-Air Quality Measurement Team)



Implementations

- ✓ ***Efficient cooling-heating***
 - Air conditioning/heating system based on ambient heating/cooling
 - Heat-isolation in buildings / new constructions & construction materials
- ✓ ***Water Consumption Management***
 - Use of photocell taps
 - Use of waste water in irrigation of Campus plants
 - Pollution measurement of two Campus Ponds, pond water use in irrigation
- ✓ ***Waste management***
 - Waste separation & recycling
 - Waste incineration (Wastes are delivered to the authorized incineration plant of Kocaeli Municipality)
 - The measurement of amount of dangerous waste
 - Reduced use of paper in daily work
- ✓ **Green campus activities: Periodic Tree Planting Ceremonies**
- ✓ **Zero emission vehicle use in some on-campus transportation**
- ✓ **Voluntary Energy Efficiency Team in Energy Institute**

Institutional framework and policies

DECISION MAKING

- ✓ TUBITAK MRC Presidency with the Directors of 7 Research Institutes of the Center took the initiative to be certified with ISO 14001. But process started before 2004 with ISO 9001 and 17025 certifications in 2002, and has continued with 18001 (in action since 2005).
- ✓ Energy management regulations have been in effect since 2005. The aim of which are:
 - control the consumption of the fuel and electrical energy use at TUBITAK MRC Institutes/Units in an effort to minimize negative effects on environment and human health,
 - implement technical and administrative rules and regulations
 - increase consciousness of the TUBITAK MRC staff about energy efficiency issues.



Institutional framework and policies

ENERGY MANAGER

- ✓ Regarding the energy management, Turkish Energy Efficiency Law (No.5627/2007) makes the appointment of an energy manager obligatory for governmental institutions with an annual consumption rate over 250 TPE.
- ✓ TUBITAK MRC employs an Energy Manager (currently working for another TUBITAK institute: National Metrology Institute (TUBITAK UME).
- ✓ An advisor from TUBITAK MRC Energy Institute to the Energy Manager has also been appointed. His mission is to provide support for the Energy Manager where needed.

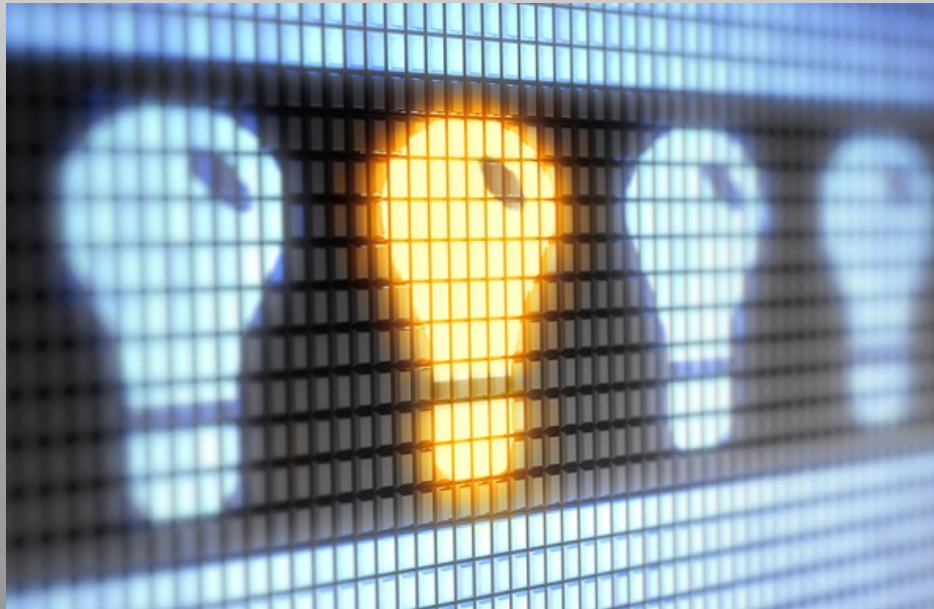
Energy assessment

- ✓ Analysis regarding energy use was conducted in the sectors of:
 - heating and cooling,
 - hot water,
 - lighting,
 - ventilation,
 - construction design and materials.
- ✓ **Use of solar and wind energy for production of hydrogen that is needed for some of the conducted R&D projects** (especially fuel cell projects). This was done under the project of Hydrogen Demonstration Park-HyDePark - to show how renewable energy can be used for the production of another clean energy source, i.e. **hydrogen**



Energy assessment

- ✓ On-campus electricity consumption data are periodically collected by Building, Maintenance and Operations Unit.
- ✓ The electricity invoices received from SEDAŞ (the local distribution company) are forwarded to the related institutes.
- ✓ Total active and reactive electrical energy consumption data and invoice costs are reported to the Electrical Energy Consumption Table.
- ✓ Every month, Building Maintenance and Operations Unit revises the electrical and fuel consumption costs and prepares a statistical report comparing the current cost with the cost in the previous month



TÜBİTAK MAM 2011 YILI ELEKTRİK ENERJİSİ TÜKETİMİ VE BEDELİ ÇİZELGESİ					
Çizelge Kodu: Ç.K.01.61.01		Yürürlük Tarihi: 01.03.2004		Güncelleştirme: 01.03.2004	
Fatura Dönemi (2009)		Aktif Tüketim (kWh)	Reaktif Tüketim(End) (kVarh)	Reaktif Tüketim(Kap) (kVarh)	Birim fiyat (TL) KDV DAHİL
OCAK		651.484,20	31422,60	7734,90	146.507,40
ŞUBAT		691.110,90	30035,70	10570,80	155.418,80
MART		804.857,40	34886,40	12206,10	180998,40
NİSAN		677455,80	33485,70	12633,90	151779,30
MAYIS		678325,20	35597,10	10080,9	151976,10
HAZİRAN		733145,70	50797,80	3443,10	164258,30
TEMMUZ		648393	57828,9	1297,20	145267,10
AĞUSTOS		702.475,20	79.902	2297,70	157.383,40
EYLÜL		670.072,80	49.003,8	17.049,90	150.124,00
EKİM		621869,40	21.548,70	31.746,90	151.360,40
KASIM		748187,70	21866,10	44373,90	183.178,40
ARALIK		803.256,60	28.200,30	21.024,30	196.244,70
TOPLAM		8.430.633,90			1.934.496,30

YİB Elektrik Mühendisi:
Adı-Soyadı: Bülent AYVAZ

YİB Yöneticisi:
Adı-Soyadı: Metin KAPLAN

İmzası:

İmzası:

Trainings

- ✓ **Trainings for the personnel:**
 - Quality Management System and Environment Management System Information Training
 - Risk Analysis Assessment
- ✓ **Trainings for Service Providers (Suppliers):**

Training of Waste Management Company on Classification, Collection, Transport, Storage and Incineration of Solid and Dangerous Waste.
- ✓ Training of the recently appointed energy manager including ISO Standard 50001 Energy Management System.



Conclusion

Although it proves to be difficult to implement standardized rules regarding energy efficiency /RE in such a big R&D Center like TUBITAK MRC, which includes 7 institutes conducting several projects at once with varying scale, characteristics and timing, it should be perceived as a bold step by the Center to adopt ISO 14001 standard, and stimulate practices of energy efficiency /RE.



Case Study 2-Ege University Solar Energy Institute

- Ege University - Solar Energy Institute (GEE) was established in 1978 for graduate education and research on solar energy and its applications.
- Along with the solar energy, other renewable energy resources like wind, biomass and geothermal are being studied for energy saving and efficiency aspects.
- GEE (24 academic, 16 administrative staff, 50 MSc & 53 PhD students) has concluded 190 projects on renewables (<http://eusolar.ege.edu.tr>).

MILESTONES Infrastructure Projects

- 03 DPT 006 – Development and Applications of Alternative Energy Technologies (Solar-Wind-Biogas-Heat Pumps)
- 07 DPT 002 – Photo-electronic Technology Productions; Organic LEDs; Organic FETs
- 11-DPT-001 Organic Optoelectronic and Photovoltaic Technologies in Energy Efficiency

Grid Connected PV Power Systems



Off-Grid PV Power Systems

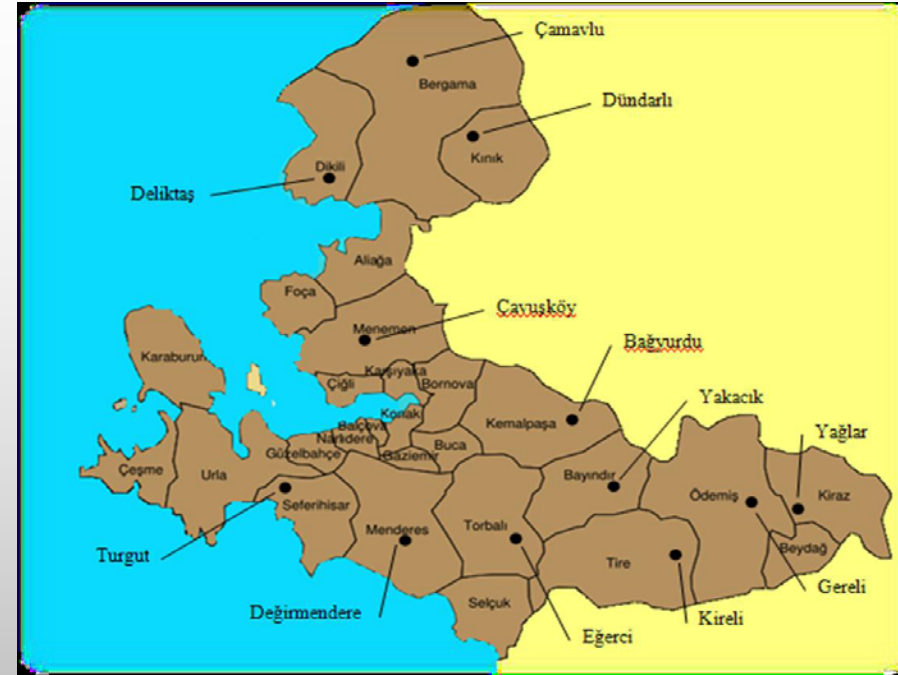
Biogas Projects

✓Development and Widespread of Biogas System for Rural Area

PROJECT NO: 07/DPT/003

✓The Production of Biogas from Agricultural and Animal Wastes and Utilization of Obtained Gases in Integrated Energy Conversion Technologies

TÜBİTAK - 1007 107 G 024 – TÜBİTAK KAMAG 1007



LOCATIONS OF BIOGAS PLANTS

County	Town/Village	Contact	Animal Numbers	System capacity (m3)
BAYINDIR	Yakacık	Yılmaz ENVİL	35	25
BERGAMA	Çamavlu	Ertan KUŞTAŞI	42	25
DİKİLİ	Deliktaş	Ahmet SEVER	8	5
KEMALPAŞA	Başıbüyük	Hüseyin ÖZDEN	40	25
KINIK	Dündarlı	Ahmet ÇİLİNGİR	25	25
KIRAZ	Yağlar	Pervin ÜZÜM	25	25
MENDERES	Değirmendere	Selami YÜCE	35	25
MENEMEN	Çavuşköy	Abdurrahman ÜRKÜ	12	5
ÖDEMİŞ	Gereli	Şenol EKER	22	25
SEFERİHİSAR	Turgut	Mustafa K. BOZYEL	15	5
TİRE	Kireli	Mahmut ÇÖP	30	25
TORBALI	Egeci	İbrahim DAYAR	20	25



Turkish Photovoltaic Technology Platform (UFTP)

- Managed by EU.
- Supported by TÜBİTAK (The Scientific & Technological Research Council of Turkey).
- Represents Turkey on International Energy Agency-Photovoltaic Power Systems (IEA-PVPS) activities on behalf of Turkish Government.
- Covers 60 members (public bodies, universities, local authorities, trade and professional chambers and industrial companies).
- Aims to define effective PV technology policies and develops the PV roadmap for Turkey.

YETMER BUILDING CONSTRUCTION CONTRACTS for a Net Zero Energy Building

- NEDO (The New Energy and Industrial Technology Development Organization of Japan) and ETKB (The Ministry of Energy and Natural Resources of Turkey) have signed a protocol regarding the YETMER commitments.



YETMER PROJECTED BUILDING PLAN



Projected Activities

- Test & Analysis Labs of *Photovoltaic, solar thermal, biomass, geothermal and wind energy technologies,*
- *Certified trainings for qualified labor,*
- *In situ test & analysis services,*
- *Science center.*
- ***ZERO EMISSION BUILDING***

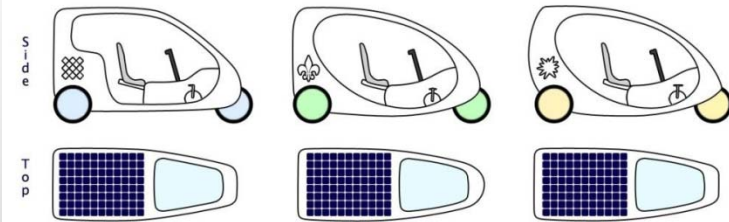
Aim and Vision of the Society

- To increase the **consciousness for renewable energy and related technology**
- To strengthen the connection between **university, industry and the society**
- Stimulation of **Innovation with creative ideas and applications**
- To gain a role to shape the future **for green and sustainable life**

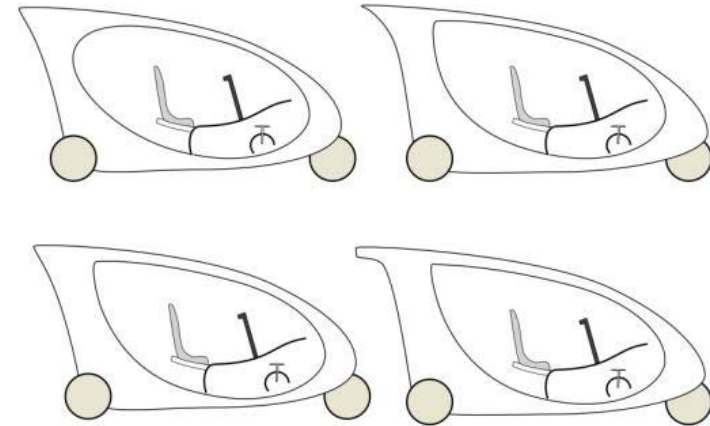
Ege Solar Team



Starlight - Ecotour



EGE YET Solar Taxi sketch design / by **KOD**





Conclusion

For energy security and sustainable development energy efficiency and renewable energy are the key factors that have to be put in act.



Thank You

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