

# Enerjide Ne Yapmalı, Nasıl Yapmalı? SBF, Ankara, 12-13 Mayıs 2016

## ***SOME THOUGHTS ON ENERGY R&D, H2020 and TURKEY***

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## ***SOME THOUGHTS ON ENERGY R&D, H2020 and TURKEY***

### **Outline**

***Specificities of R&D in Energy areas***

***Importance of well equipped research centers***

***Evolution of Energy R&D in EU programs***

***Some recommendations***

# ENERGY R&D (1)

## *Energy is a*

- \* **prime mover of all activities of the society**
- \* **primary element of economic wealth**
- \* **primary element of the independence of a country or region**
- \* **primary element of international connections**

## ENERGY R&D (2)

*Energy has a*

**major role in the relationship between economic activity and environment to promote the transition to a globally sustainable ecosystem including the circular economy ambition**

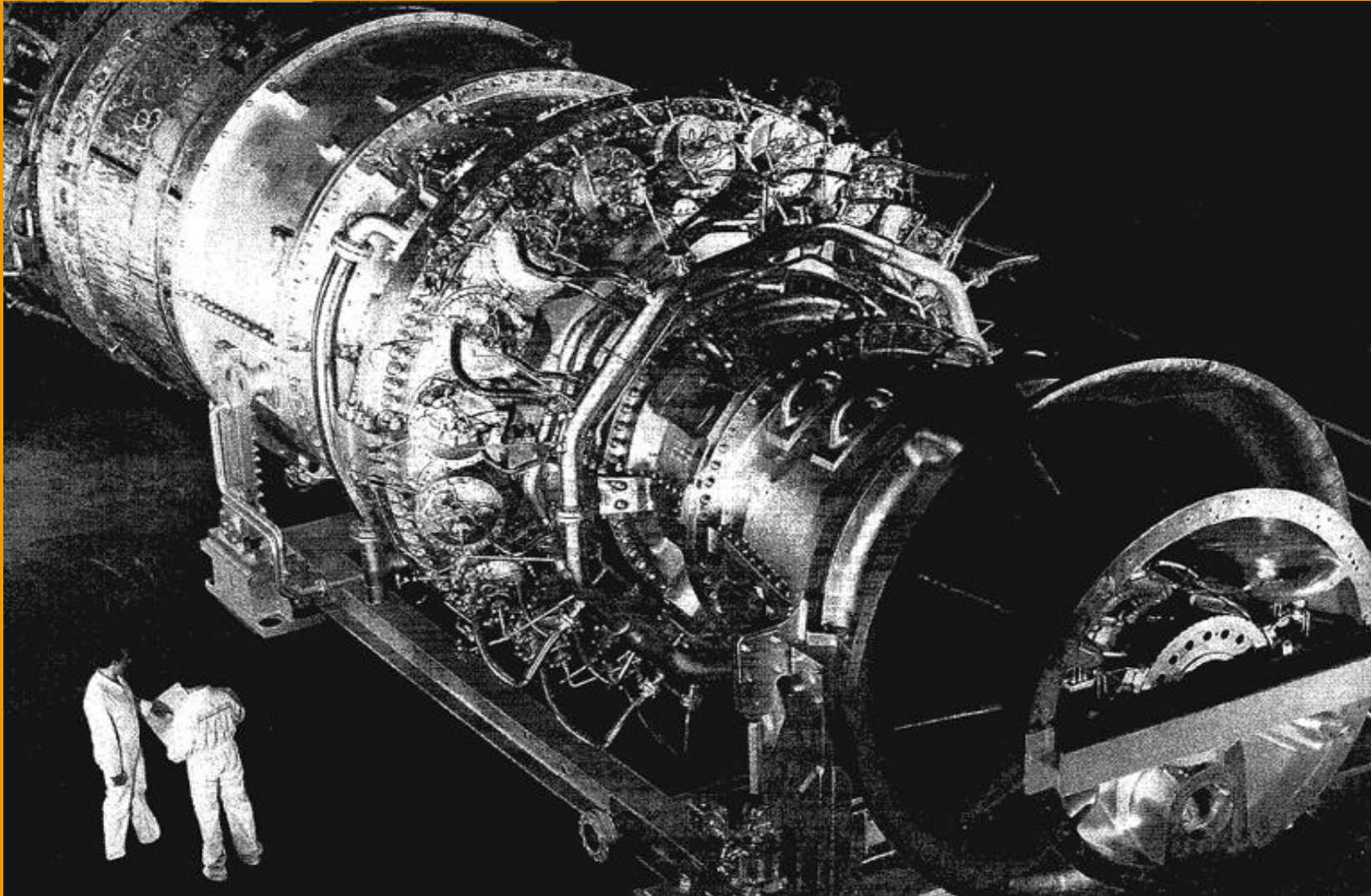


## ENERGY R&D (3)

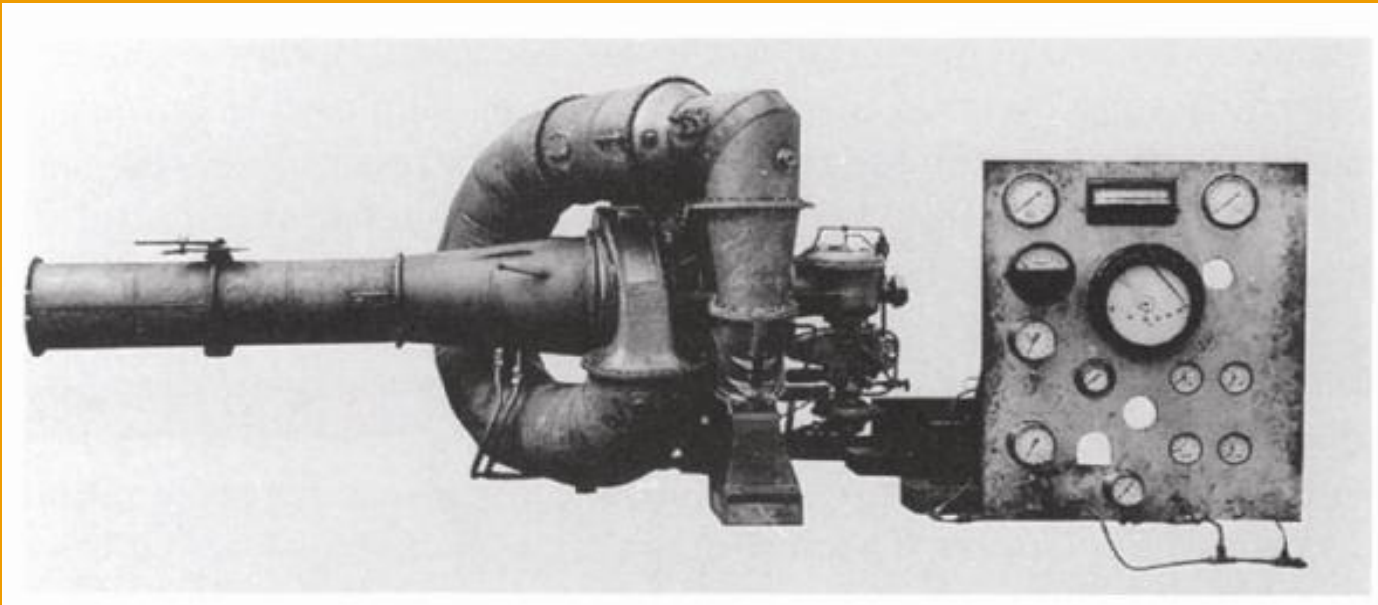
### *Energy R&D needs*

- \* **very long term and continuous efforts**
- \* **steady investment (financial and on HR)**
- \* **strong relationship between research centers/universities, industry and public bodies**
- \* **large infrastructures and complex research tools**
- \* **strong interdisciplinary approaches (including Social sciences & Humanities)**

# Energy R&D needs long term and continuous efforts (1)



## Energy R&D needs long term and continuous efforts (2)

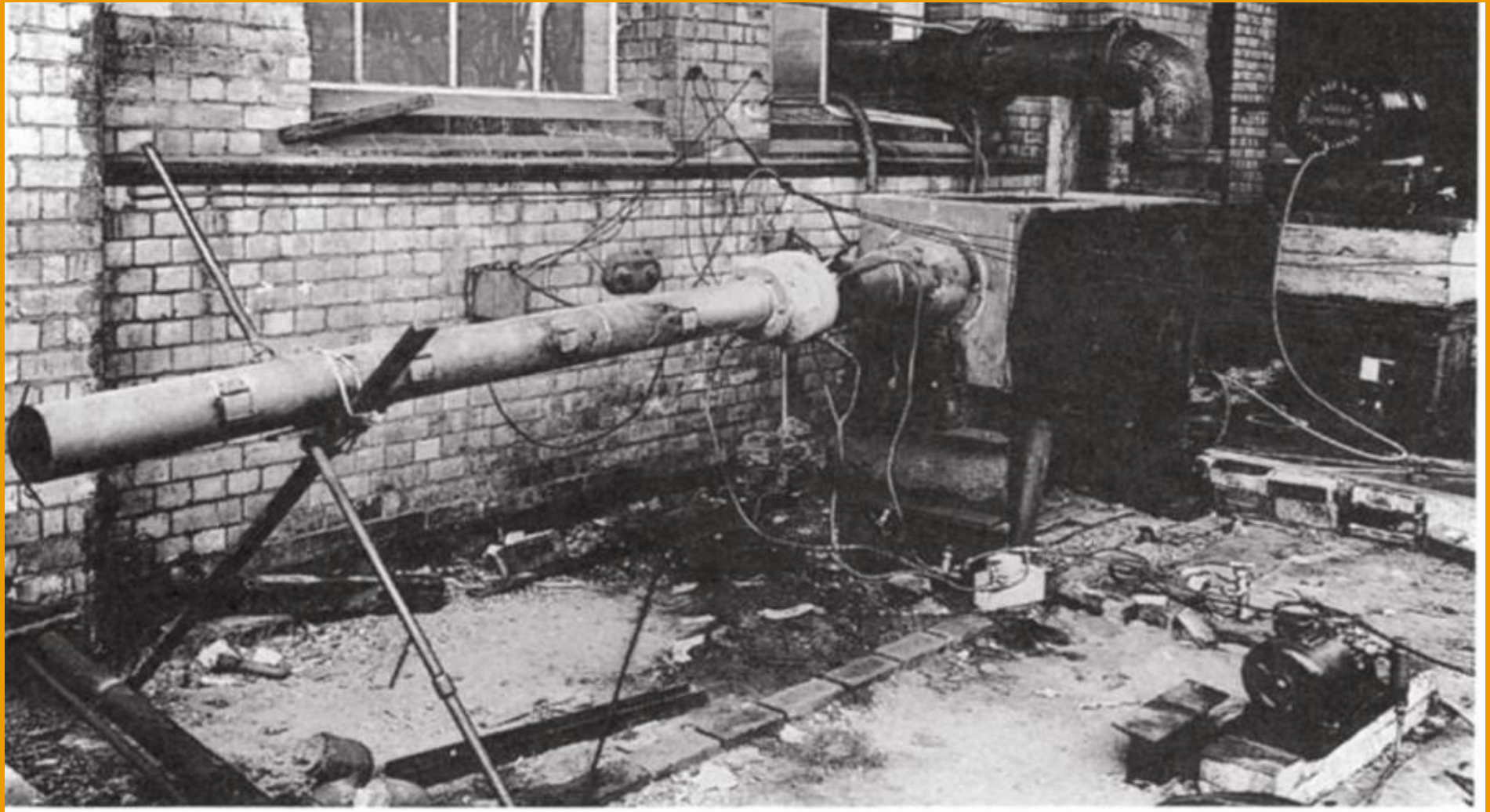


Assembly of the first model of Whittle's experimental engine which run for the first time on 12 April 1937.

The W1 engine had its first run on 12 April 1941 and was first flight tested with The Glouster E28 aircraft on 15 May 1941



## Energy R&D needs long term and continuous efforts (3)

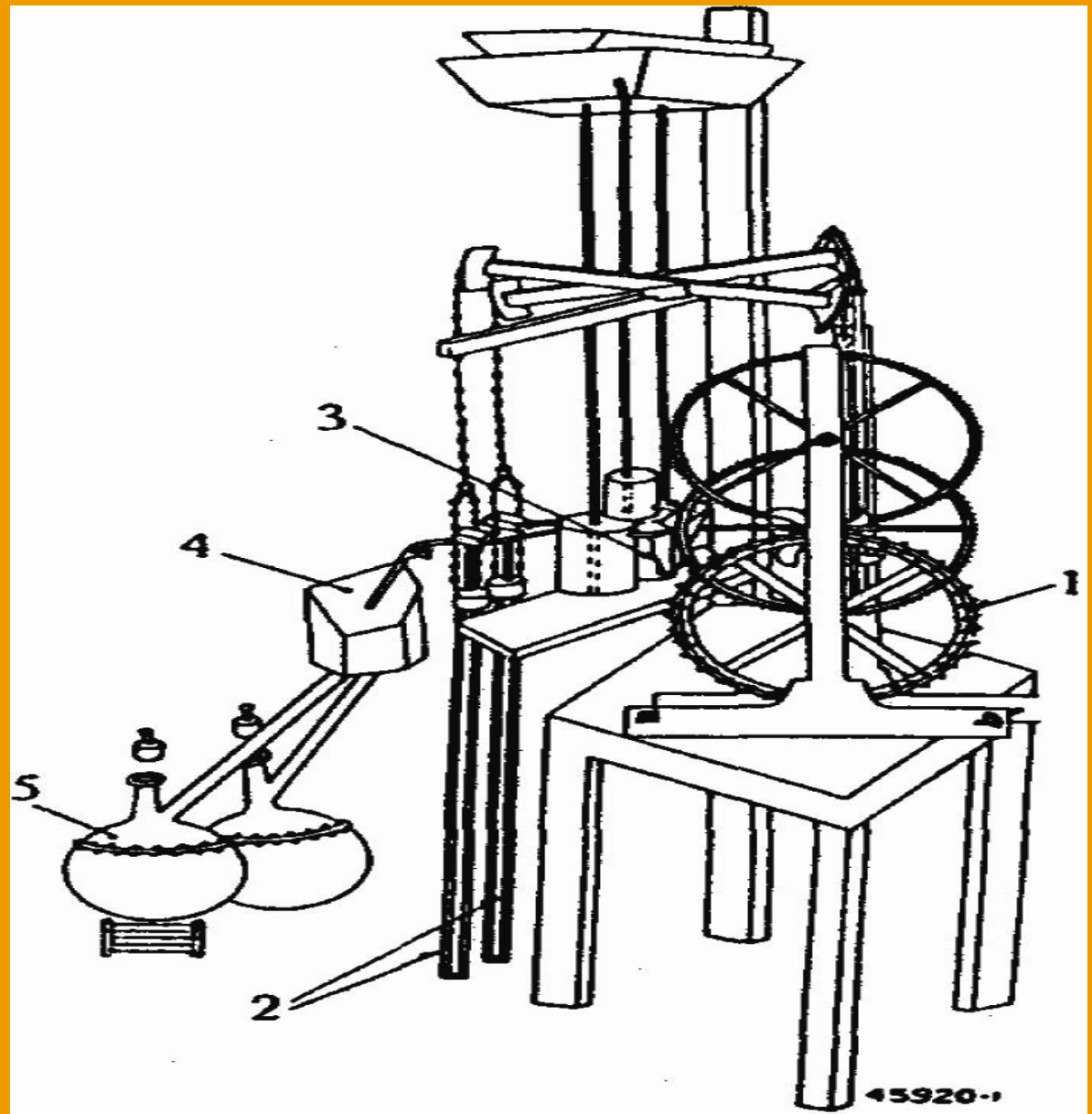


Whittle's combustion chamber test rig





The prehistory of the gas turbine technology starts with the patent issued to **John Barber in England (1791)**, but no working model of it was ever built.



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## Half a century history

1958 : Creation of the Aerothermal Sciences Institute in Meudon, near Paris

1969 : Creation of the Research Center on the Chemistry of Combustion and High Temperatures (CRCCHT) in Orléans

1975 : I Gökalp arrives to the Aerothermal Sciences Institute for his PhD

1983 : IG moves to the CRCCHT as CNRS researcher

1991 : CRCCHT becomes the Institute for Combustion and Reactive Systems (LCSR)

1991: IG is missionned by the CNRS to develop engineering sciences in Orléans

1995 : Transfer of the Aerothermal Sciences Institute to Orleans

2001 : Construction of a new building to host the two Institutes

2003 : IG becomes the Director of the LCSR

2007 : IG creates ICARE by merging LCSR and the Aerothermal Sciences Institute and becomes the Director of the new Institute

2012: ICARE is recognised as the French Excellency Center by the French Ministry of Higher Education and Research (under the acronym CAPRYSSSES)



**ICARE UPR 3021 CNRS**  
**INSTITUT DE COMBUSTION AEROTHERMIQUE**  
**REACTIVITE ET ENVIRONNEMENT**  
*Directeur: Dr. Iskender GÖKALP*

## **2 Research areas**

Energy & Environment  
Propulsion & Space

## **3 Research domains**

Chemical kinetics & dynamics of combustion & reactive systems  
Atmospheric chemistry  
Space propulsion & high speed flows

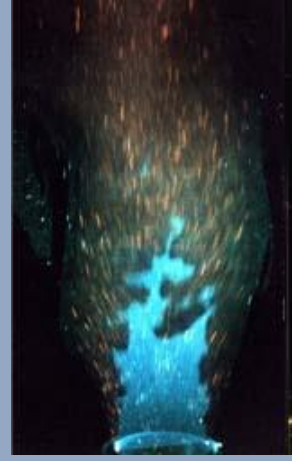
**Personnel:** 11 CNRS researchers, 17 University of Orleans academicians, 16 Engineers & administrative staff, 23 PhD students, 22 contractual staff (total : 89 with 44 permanent staff)

**Important facts since 2012:** **CAPRYSES** Excellency center (2012-2019); **ERC Senior Grant** 2G-Csafe (2012-2016); **HELIOS** Natural irradiation atmospheric simulation chamber; **Chair Fondation AIRBUS** Propulsion & Environnement (2013-2016); **FP 7 OPTIMASH** (2012-2016); **MITHYGENE ANR Project on Hydrogène Risks** ICARE, IRSN, CEA, EDF, AREVA; AIR LIQUIDE (2013-2016)

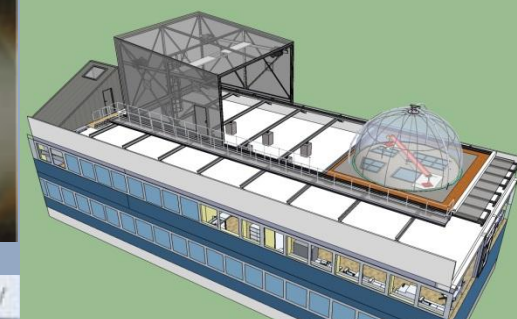
# Expertise areas & Applications



- *Combustion*
- *Chemical kinetics*
- *Plasma physics*
- *Fluid mechanics, turbulence*
- *Multiphase flows*
- *Supersonic, hypersonic, rarefied, ionised flows*



- *Aerospace Propulsion*
- *Plasma Propulsion*
- *Liquid and Solid Propulsion*
- *Atmospheric reentry*
- *Atmospheric chemistry*
- *Energy Production*
- *Alternative fuels, biofuels, H2*
- *Reduction of pollutant emissions*
- *Mitigation of industrial risks*





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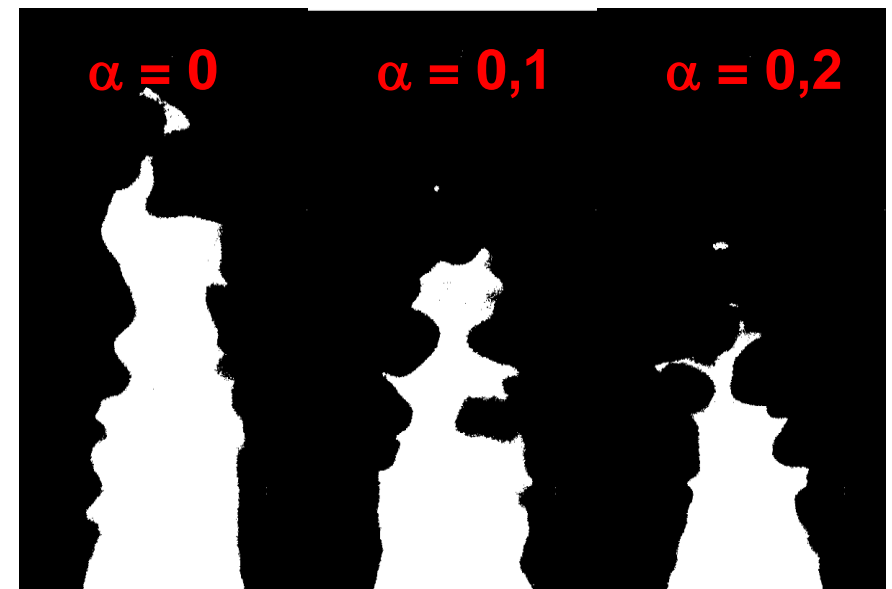
**FP1**

## **TURBULENT COMBUSTION AND DIAGNOSTICS**

**Coordinated by HARWELL, UK**

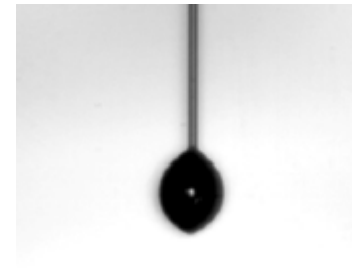
**Funded under: FP1-ENNONUC 3C**

**From 1986-04-01 to 1989-09-30**



**FP2**

**IDEA**  
**Integrated Diesel European Action**  
**Coordinated by VW**  
**Funded under: [FP2-JOULE 1](#)**  
**From 1990-01-01 to 1993-06-30**



## FP3

### **IDEA EFFECT**

**Integrated development on engine  
assessment on environment friendly  
fuel efficient combustion technology**

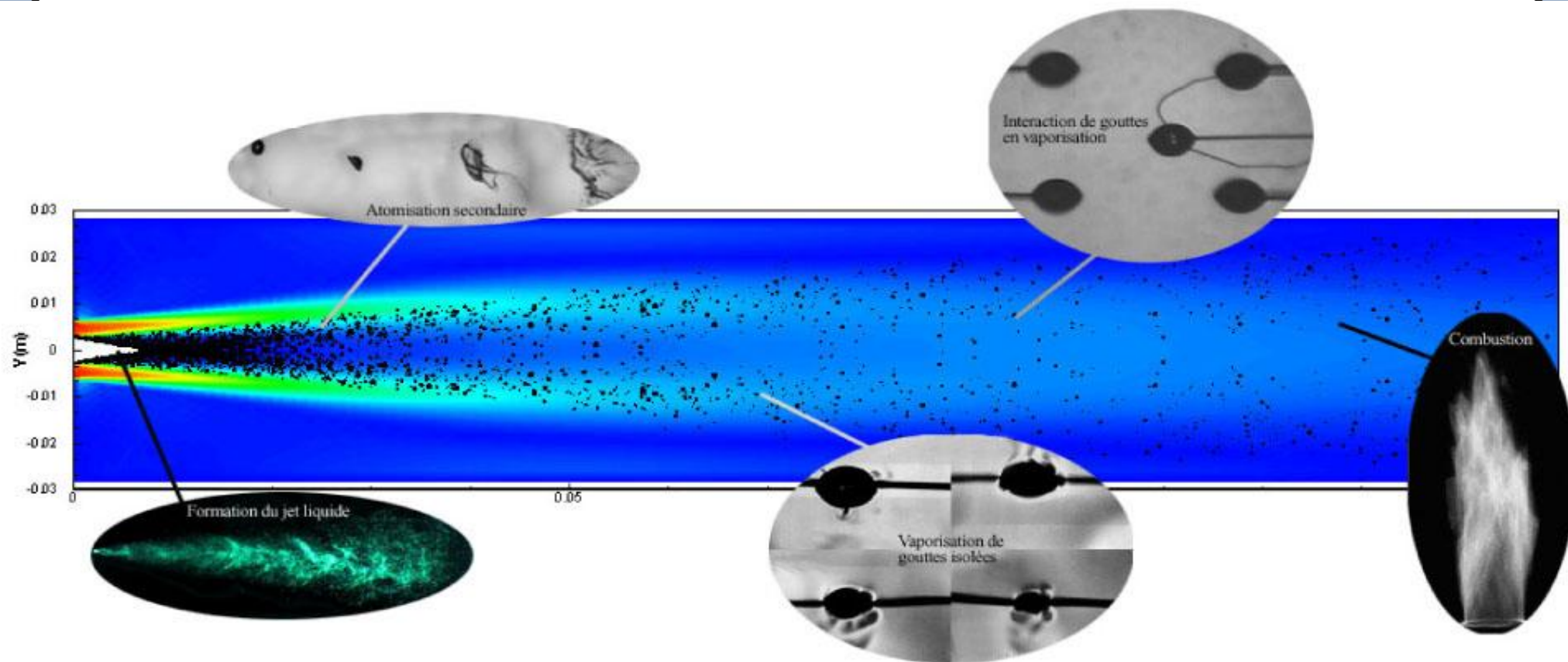
**Coordinated by VW**

**Funded under: [FP3-JOULE 2](#)**

**From 1993-01-01 to 1996-12-31**



# Liquid fuel atomization and combustion

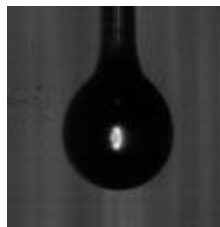


[**ACREVO** - ADVANCED COMBUSTION  
RESEARCH FOR ENERGY FROM  
VEGETABLE OILS

**Programme:** FP4-FAIR

From 1996-01-01 to 1997-12-31

Coordinated by I Gökalp

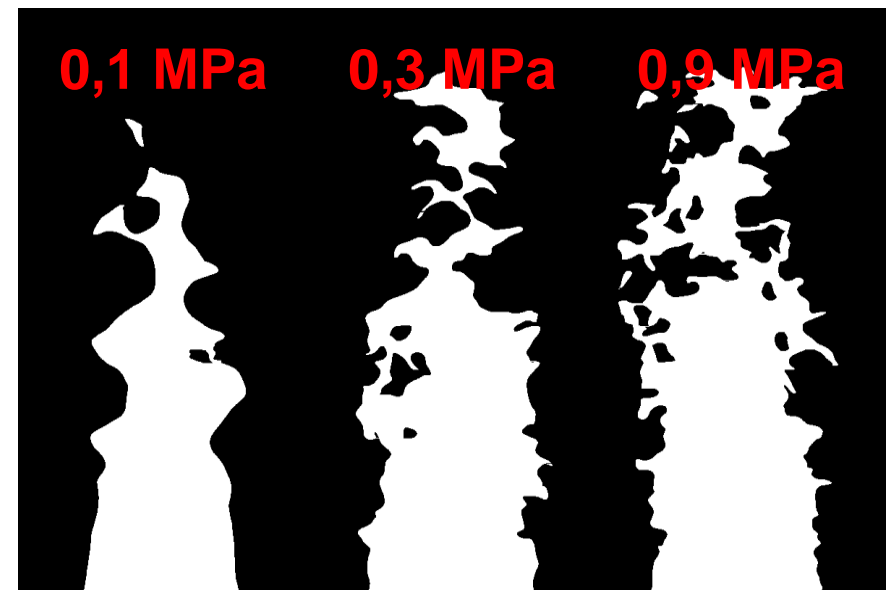


Vaporisation sequences of an RME droplet  
at 773 K and atmospheric pressure

FP5

**AFTUR**  
Alternative fuels for industrial gas  
turbines - (AFTUR)  
Funded under: [FP5-EESD](#)  
From 2003-01-01 to 2006-06-30  
Coordinated by I. Gökalp

### Pressure effect



***High pressure effects on  
natural gas – air turbulent  
premixed flames***



**FP7**

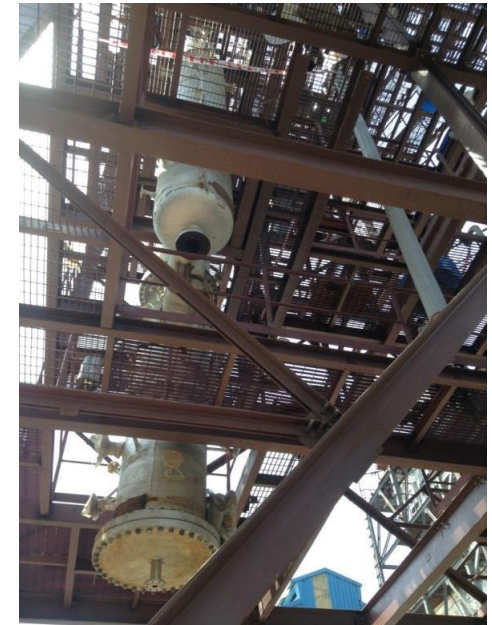
## **OPTIMASH** **Optimizing gasification of high-ash content coals for electricity generation**

**Funded under: FP7-ENERGY**

**From 2011-11-01 to 2015-10-31,**

**Ongoing project**

**Coordinated by I. Gökalp**



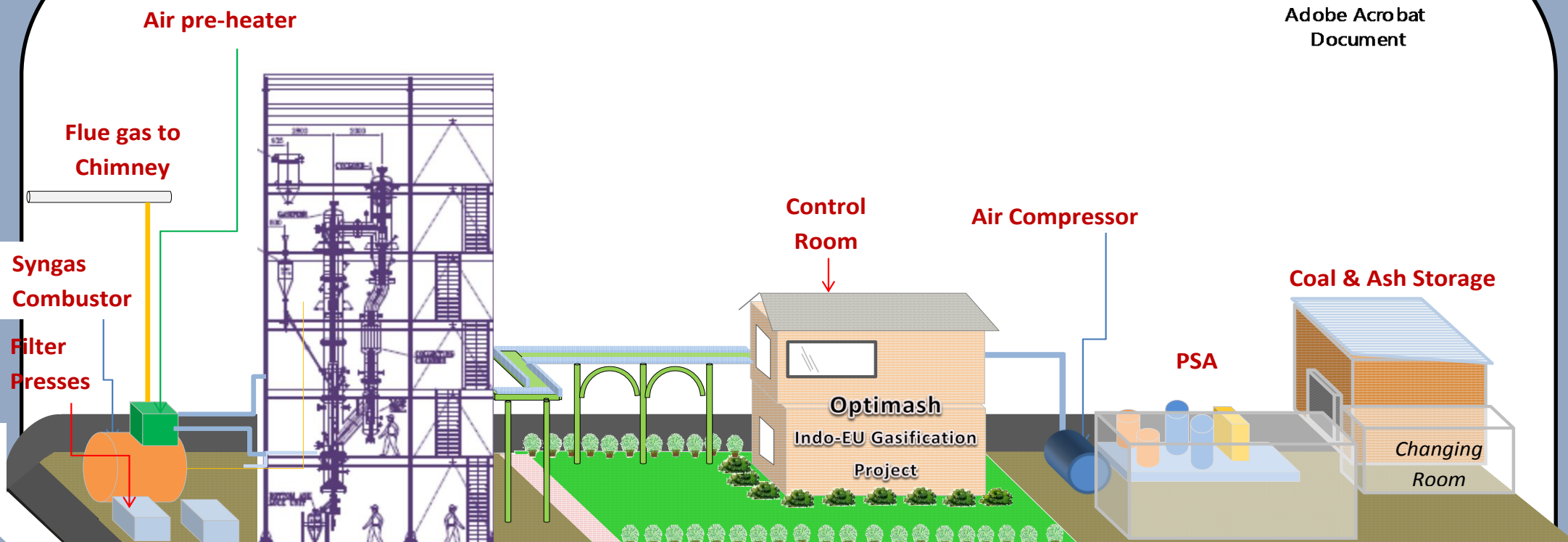


# Optimash Plant Layout

## Optimash Plant General Arrangement



Adobe Acrobat  
Document



**H2020**



**“Optimization of low carbon technologies for cement industry by integrating carbon capture & utilisation with alternative fuel use”**

**In Enabling decarbonisation of the fossil fuel-based power sector and energy intensive industry through CCS LCE-15-2015**



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# SOME RECOMMENDATIONS

## ***Recommendations for Turkey (mostly in the LCE topics)***

- \* Build rapidly the necessary infrastructures for energy studies (they are really lacking)
- \* Develop in the universities the basic curricula for energy sciences (reacting flows, turbulence, multiphase flows, numerical simulation of complex flows, optical and laser diagnostics); develop excellency centers in those areas with a division of work strategy
- \* develop strong university / industry collaborations
- \* focus first on priority areas both for Turkey and H2020 WP (LCE topics essentially)
- \* target niche areas where in a relatively short time excellency can be acquired (energy from biomass and organic waste, hydrogen generation, fuel cells, hybrid solar thermal – fossil/biomass systems, utilisation of CO<sub>2</sub>...
- \* develop international collaboration in those areas (use joint PhD programs and bilateral programs in parallel or prior to EU projects)