Department of *Engineering, ICT and Technologies for Energy and Transport (DIITET)*

A department for a smart, sustainable and inclusive growth in the cyber-physical world

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Department of Engineering, ICT and Technologies for Energy and Transportation (DIITET)

- **21 Institutes**
- **1400 FTE (850 Researchers)**
- **Research areas:**
  - Energy, transport, new materials, sensor technologies, aero-space;
  - ICT, manufacturing systems, constructions;
- **2012 budget from projects: 60 Meuro**
DIITET investigates and provides solutions for a cyber-physical world

New products and services are increasingly based on the use of "cyber-physical systems", i.e., physical systems integrated and controlled through ICT systems (sensors and actuators, computing systems, storage and communication, etc.) to increase their efficiency, reliability, adaptability and security, and to enable its use in multiple application scenarios.

DIITET adopts a multidisciplinary and holistic research approach joining “physical” engineering disciplines with “virtual” ICT to address main societal challenges:

- Secure, clean and efficient energy;
- Smart, green and integrated transport;
- Inclusive, innovative and secure societies;
- Health and wellbeing;
- Sustainable agriculture, marine and maritime research
- Climate action, resource efficiency
Physical-world research areas

- **Energy**
  - Generation and micro-cogeneration of clean and efficient energy;
  - Energy storage systems;
  - Exploitation and efficient use of renewable energy sources;
  - Controlled thermonuclear fusion;
  - Energy harvesting.

- **Transport**
  - Intelligent and multimodal transport;
  - Sustainable mobility;
  - Maritime technologies;
  - Internal combustion engines, electric and hybrid engines

- **New materials**
  - Advanced materials for energy, transport and construction;
  - Multi-functional or nano-mesa structured materials, oriented to the industrial needs, from biomedical to advanced sensors.
Physical-world research areas II

✓ **Sensor technology**
  • High-performance monitoring systems;
  • Remote sensors and methods for remote sensing data processing;
  • Monitoring, control and security for complex systems;
  • Sensor and Actuators for applications in mechanical engineering, automation, biomedical diagnostics and manufacturing systems.

✓ **Advanced manufacturing systems**
  • Factory of the future;
  • Technologies and automation systems for production lines;
  • Methodologies, tools and technologies for (de)manufacturing;
  • Smart textile.

✓ **Construction**
  • Technologies for secure and high-performance buildings;
  • Sustainable buildings;
  • Pollution control in buildings.
Cyber-world research areas

- Internet of the future;
- 5G networking
- Wireless networking;
- Social networking;
- Pervasive embedded systems;
- Big Data;
- Knowledge, content and data management;
- Cloud computing;
- Multimedia and visualization;
- Human Computer Interaction;
- Software engineering;
- Cyber-security;
- e-energy, e-health, e-mobility;
- Smart cities;
- Digital Agenda;
- Modeling and analysis of complex systems;
- Bioinformatics; .........
Smart cities are CPS

Smart Mobility

Smart Energy

RENEWABLE ENERGY PRODUCTION

Smart and sustainable Buildings

MONITORING

TOWN AND BUILDINGS CONTROL THROUGH ACTURATORS

Smart Hospital
A smart city operates simultaneously in the digital/virtual and physical domains.

“Sustainability, livability, and social equity through technological and design innovation thanks to digital nervous systems, intelligent responsiveness, and optimization at every level of system integration”

The Smart Cities Group @ MIT
Big Data as “proxies” of the human behavior

Shopping patterns & lifestyle

Relationships & social ties

Desires, opinions, sentiments

Mobility
Mining Big Data from human digital footprints in the physical and virtual world
ICT and renewable sources for energy efficiency: the CNR smart city project

We have selected, together with Associazione Nazionale Comuni Italiani (National Association of Italian Municipalities) three cities -- a small city, a touristic city and historical city --- to test CNR smart cities solutions.

Demonstrators for
- sustainable building
- sustainable city
- sustainable historical site
DIITET and PON SUD - phase 1

**PRISMA** *(cloud computing technologies per smart government)*

**DICET INMOTO** *(smart culture and smart tourism)*
- DiCeT –LivingLab Di Cultura e Tecnologia
- INMOTO: INformation and MObility for Tourism

**RES NOVAE** *(renewable energy, smart grid)*

**I-NEXT** *(smart energy and smart transportation)*

**SMART HEALTH** *(e-health)*
DIITET participates in five out of the eight National Technology Clusters, approved by the Ministry of Education and Research, in December 2012:

- Intelligent factory
- Ground and marine transport means and systems,
- Aerospace,
- Technologies for smart communities,
- Technologies for ambient assisted living

In particular, DIITET is directly involved in the three projects of the Technologies for smart communities cluster:

- **Educating city**: it focuses on the social challenges related to renewal of the educational and training system through the implementation of new models of learning / teaching for both individual and groups and new systems of evaluation

- **Social Museum and Smart Tourism**: To address the social challenges related to the innovation and development of services related to tourism and cultural heritage

- **Intelligent and Sustainable Mobility**: To address the social challenges related to transportation systems to: i) reduce the environmental impact; ii) improve the energy efficiency; and iii) to strength the security of urban mobility (including goods and passengers)
The Agency for digital Italy promotes the adoption of ICT from public administration according to six strategic axes: Infrastructure and security; eCommerce, eGovernment, Digital Skills, Research and Innovation, Smart Cities and Communities.

The main actions are planned in the areas of: digital identity, digital PA / Open data, digital education, digital health, digital divide, electronic payments and digital justice.
DIITET: A department for innovation of the country

• For advanced economies, the economic growth relays on technological progress. Europe requires the development of products and processes with high knowledge content.

• DIITET joins science and engineering for creating new knowledge for the innovation of the country through the integration of legacy engineering disciplines, anchored to the physical world (e.g., mechanical, construction, energy, new materials and production systems), with "virtual" ICT technologies.

• Interdisciplinary approach that includes the whole chain of research and technological development with the aim of supporting the socio-economic growth of the country: from basic research (including modeling support provided by institutions of applied mathematics) to the development of products and processes, up to the stage of prototyping and development.

• The DIITET contains the expertise to address many of the emerging challenges identified in the Horizon 2020. DIITET, despite its complexity, is the natural place to develop new knowledge for innovation of the country.