



**2014 INTERNATIONAL WORKSHOP ON  
ENVIRONMENT AND ALTERNATIVE ENERGY  
"Increasing Space Mission Resiliency through Sustainability"**

***HYPHEN***

*(OR THE HALF-WAY REPORT ON ESA'S OWN ENVIRONMENT & ENERGY)*

**Laurent Jauniaux**

NGC 6302, captured by  
the NASA/ESA Hubble  
Space Telescope

**21/10/2014 NASA – Cap Canaveral**

- ESA aims to become an environmentally, socially and ethically responsible organisation, committed both as a space agency and as a corporate entity
  - Commitments and goals of the Agency Framework Policy on Sustainable Development [ESA/C(2010)29];
    - **Program Activities**
    - **Environment and Energy** : Introduction of the 20-20-20 objectives (based on the European Union policy:
      - 20% reduction of CO<sub>2</sub>e emissions (T1)
      - 20% improvement in energy efficiency (T2)
      - 20% increase in use of renewable energy (T3)
  - **Governance and Ethics**
- ... **by the year 2020** (referring to 2007 baseline)
- For it's on-sites operations, definition of practical objectives and integration of best standards and generic types of actions [ESA/C(2011)13] :
    - Deployment of **Environmental Management Systems** (EMS)
    - For building operation **Reduction of Energy use** and **promotion of alternatives** (optimising efficiency of energy use, development of a building code for construction, refurbishment and maintenance),
    - Promote business travel & commuting alternative (**Video Conference**, Public transportation),
    - Reduce use of water, paper and waste production,
    - Introduce responsible **procurement**.



... nice challenges but...

- No financial means were associated for the implementation of the SD policy.
- Furthermore :
  - Budgetary constraints (running costs reductions and investment limitations) were almost simultaneously introduced,
  - Ageing building Infrastructure,
  - Increasing Legal framework in particular in the field of building construction, refurbishment and operation.

=> all improvements have to come from better use of available resources and self finance.

# ESA at a glance



## headquarters

Located in Paris, home to the main programme directorates that steer and formulate ESA policy.



## estec

The European Space Research and Technology Centre, Noordwijk, the Netherlands, is the largest site and the technical heart of ESA.



## esoc

The European Space Operations Centre, Darmstadt, Germany, tracks and controls European spacecraft.



## esrin

ESA's centre for Earth observation activities, near Rome, Italy, also develops information systems and hosts the Vega launcher project.



## eac

The European Astronaut Centre, Cologne, Germany, trains astronauts for missions to the International Space Station and beyond.



## esac

The European Space Astronomy Centre, near Madrid, Spain, hosts the science operation centres and archives for ESA's astronomy and planetary missions.



## redu

Redu Centre in Belgium is part of ESA's ground station network and is also home to ESA's Space Weather Data Centre.



## harwell

Harwell Centre in Oxfordshire, UK, is focusing on commercialisation and partnerships in space activities.



## guilana space centre

ESA's launchers lift off from Europe's Spaceport in Kourou, French Guiana. It is jointly operated by the French space agency (CNES) and ArianeSpace with the support of European Industry.



## More premises:

- **Liaison offices** : Brussels, Washington, Moscow
- **Ground stations** : Kiruna (Sweden), Cebreros (Spain), Kourou (French Guiana), Perth (Australia)...
- **Integrated teams** : Baltimore (NASA), Pasadena, (NASA), Toulouse (CNES)

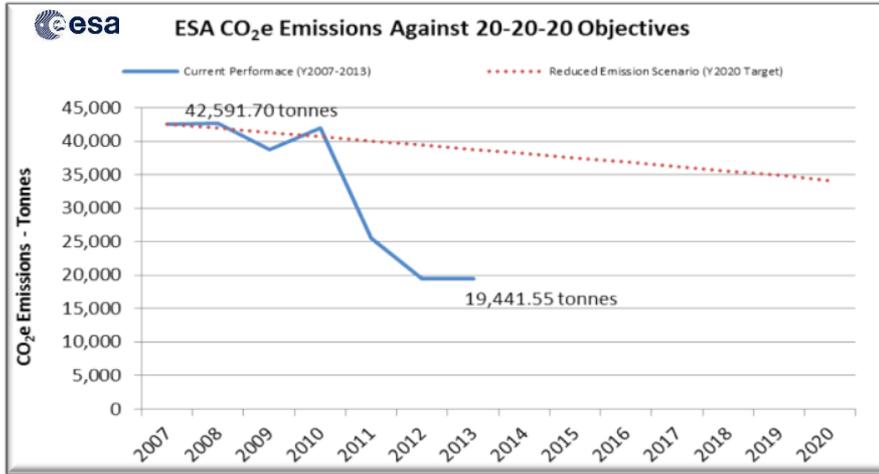
More than 250,000 building surface

5000 on site employee

# E&E report : ESA's own Facilities performance against the 20-20-20 Targets

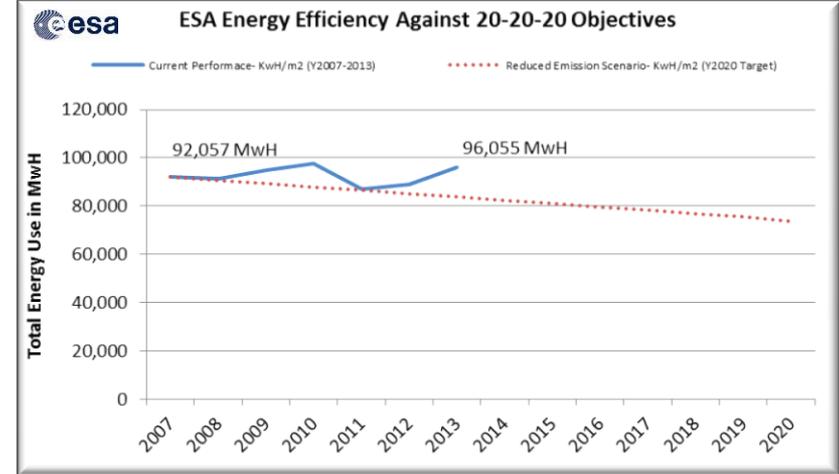


## Global CO2e Emissions Target (T1)



Global CO2e Emissions were in Y2013 down by 45% from the baseline year. (Y2020 target: 20% from Y2007)

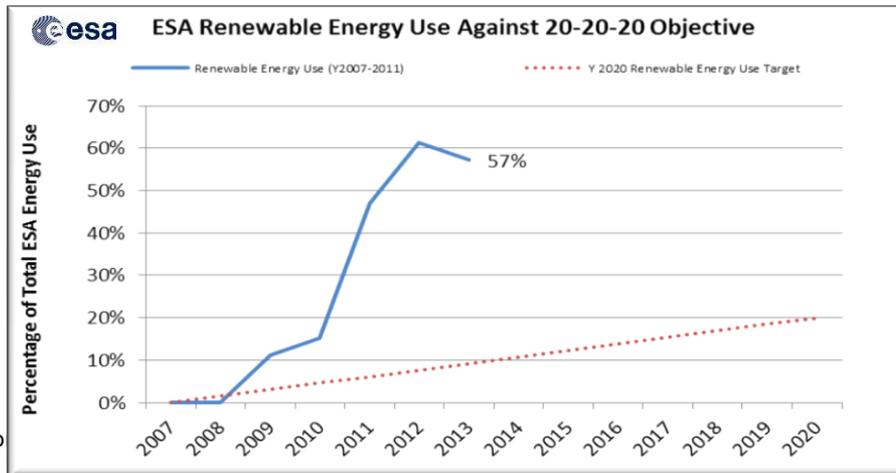
## Energy Efficiency Target (T2)



Global energy efficiency (in Kwh/m2) raised in Y 2013 of 4% from the baseline year.

(Y2020 target: improve efficiency by 20% from Y2007)

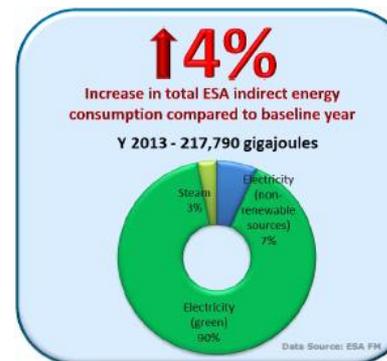
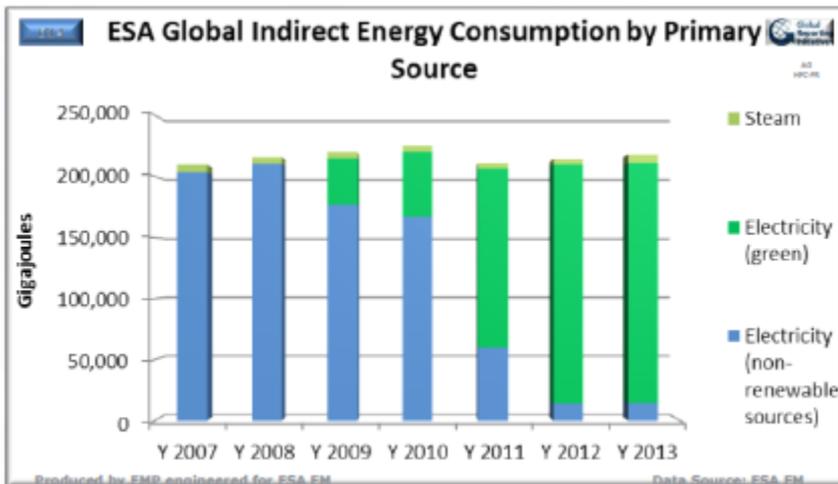
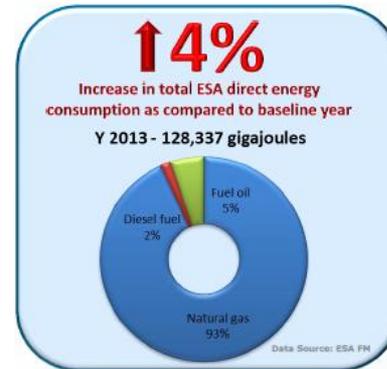
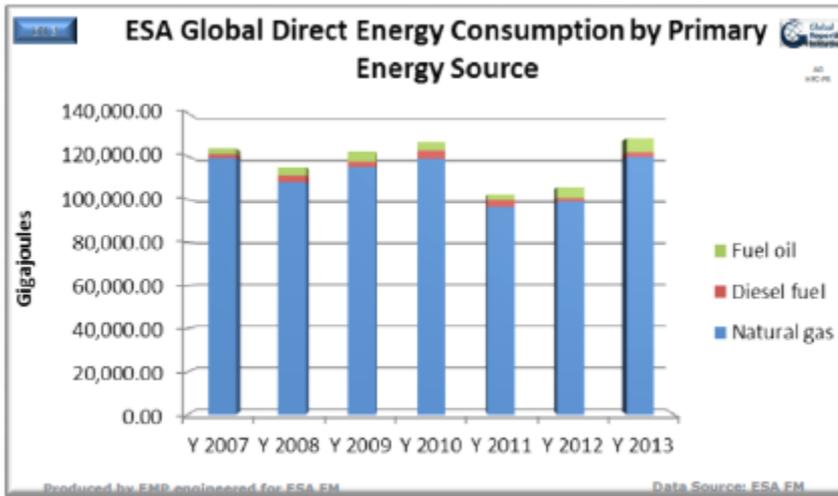
## Renewable Energy Use Target (T3)

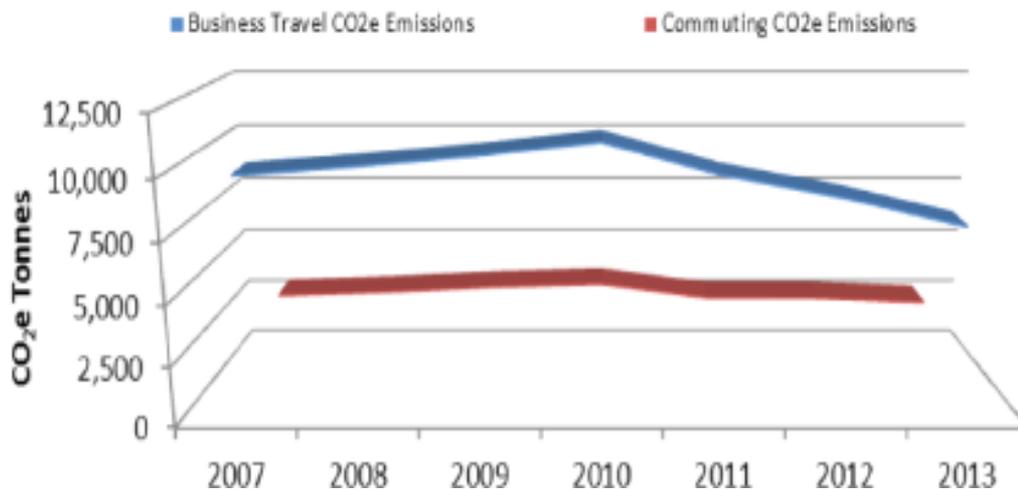


ESA global renewable energy use in Y 2013 was up 57% .  
(Y2020 target- increase 20% from Y2007)

Data to be weighted by a number of intensity factors:

- Number of sqm evolution (+12%)
- Number of on site employee (+10%)
- Climatic conditions (Degree Days)
- Sites activities (ESTEC test center)





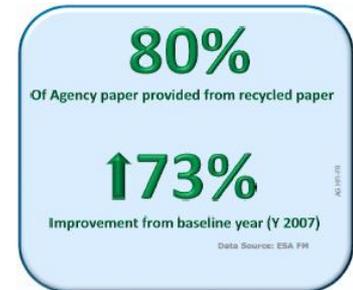
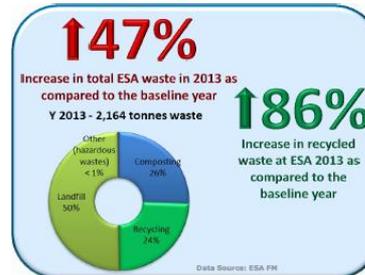
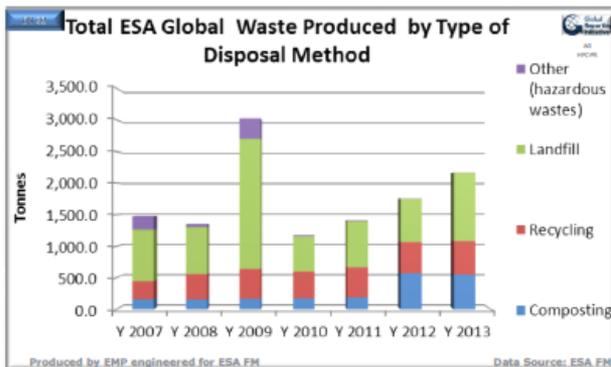
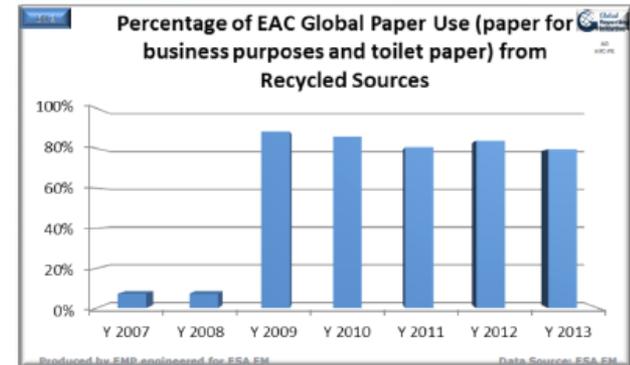
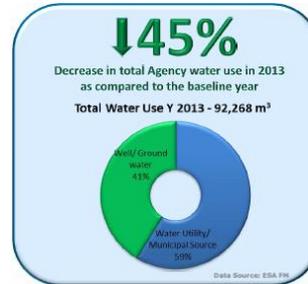
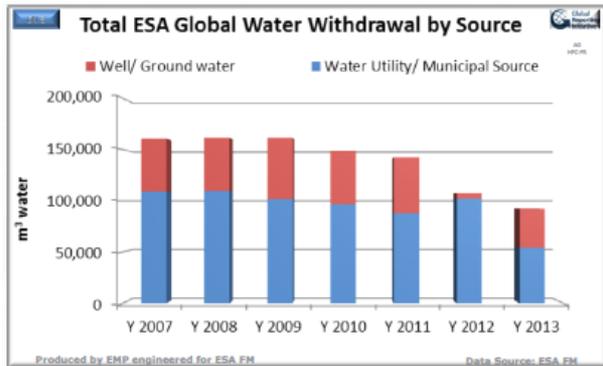
**↓21%**  
Increase in CO<sub>2</sub>e emissions from Agency business travel in 2013 as compared to the baseline year

**↓10%**  
Decrease in CO<sub>2</sub>e emissions from Agency employee commuting in 2013 as compared to the baseline year

Data Source: ESA FM

ESA Facilities Environmental report (2001-2013):

<http://esamultimedia.esa.int/multimedia/fm/esa-facilities-environmental-report-year-2007-2013/>



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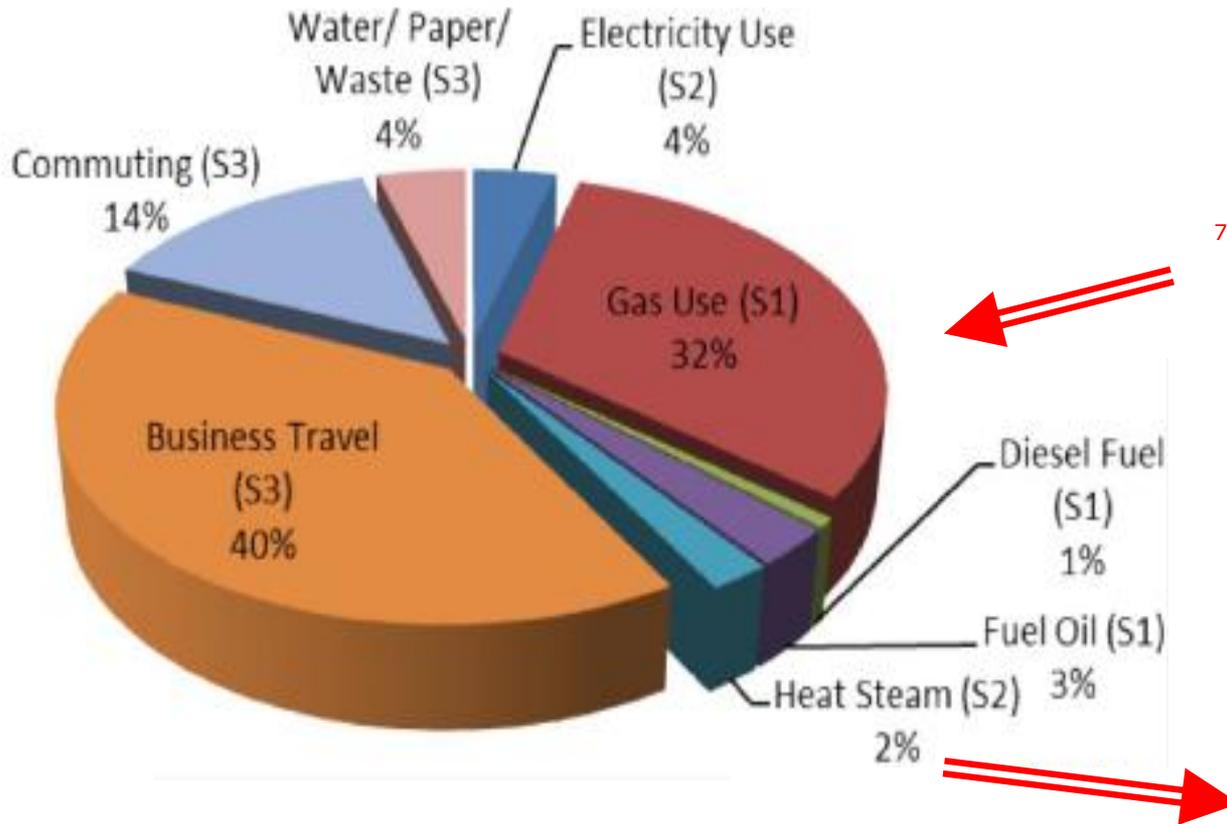
<http://esamultimedia.esa.int/multimedia/fm/esa-facilities-environmental-report-year-2007-2013/>

# E&E report : “Half way” Conclusions on the 20/20/20 objectives

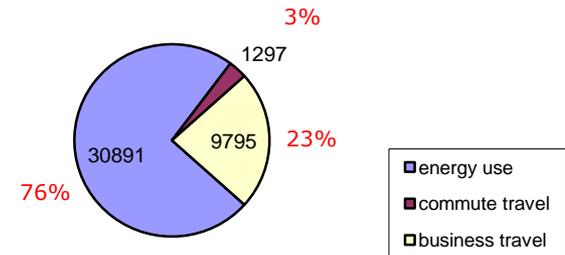


- ⇒ T1 (Co2e) and T3 (renewable energy) are met easily by the **procurement of green electricity** and a **new Travel policy** (**Trains** instead of short hauls flight (<500km) and extensive use of **Video Conference** facilities).
  
- ⇒ T2 (efficiency) achievement **is a challenge** (13% efficiencies are to be found, within 7 years time frame), it will require essentially:
  - ⇒ Buildings energy efficiencies increase (buildings envelope performance, Lighting replacement, .....)
  - ⇒ Building Operations (operating mode, tuning, ...)
  - ⇒ Users awareness and involvement
  
- ⇒ Significant improvements in Water and Paper use.

## ESA CO<sub>2</sub>e Emissions Y 2013 (19,442 tonnes)



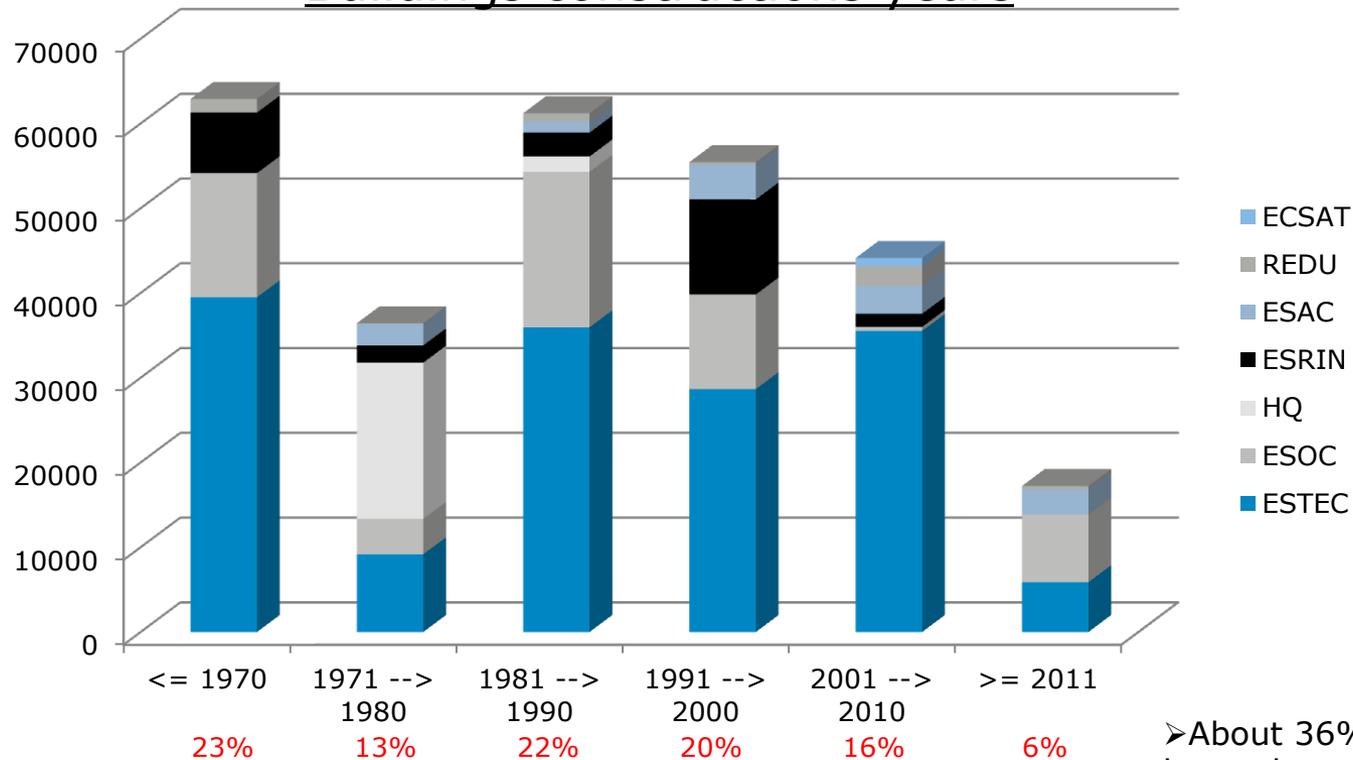
## Source of CO<sub>2</sub> emissions in 2007 (total 41,983 tonnes CO<sub>2</sub>/year)



### **Priorities:**

- Business travel
- Commuting
- Heat/cooling efficiency

## Buildings constructions years



➤ About 36% of ESA's infrastructure is beyond normal life cycle (more than 30 years of utilisation)

➤ Major investments should be soon considered for another 22% (more than 20 years)

To respond further to the various challenges :

- the ageing infrastructure, the budgetary constrains, the increased legal framework
- the (Agency Space) programs requirements/needs

The needs to strike a balance between cost and environmental performance while setting of targets for sustainable construction and awareness.

- Deploy **Environmental Management System** across the Agency.
- **Encourage projects** which bring sustainable environmental benefits
- Maintain and deploy **awareness** (& communication)
- Implement **guiding principles** for the sustainable construction, rehabilitation and maintenance (and operation) of ESA's building.
- Support management & key users decisions to **invest** in building infrastructure refurbishment (or rebuild) by:
  - Offering long term vision on **Estate Management** (prioritisation)
  - Detail performance **measurement**
  - **Consolidate Reporting**

- The advantages of official certification to standards such as ISO 14001 (Environment) *and OHSAS 18001 (Health and Safety)* are many.
  - Enhancing compliance;
  - Reducing/mitigating risks;
  - Increasing efficiency/reduce costs;
  - Enhance image with stakeholders and the public;
  - Achieve/improve employee awareness of health, safety and environmental issues and responsibilities.
- But EMS implementation has a cost (accreditation process itself, training, improvement initiatives, maintaining the system).

**Out 5 of the 7 ESA sites managed by the Facility Management department are in 2014, already ISO 14001 certified.**

The set of guiding principles (tool) for all sites to support Sustainable Estate :

- Construction of new building
- Renovation of existing building
- Building operation / Maintenance

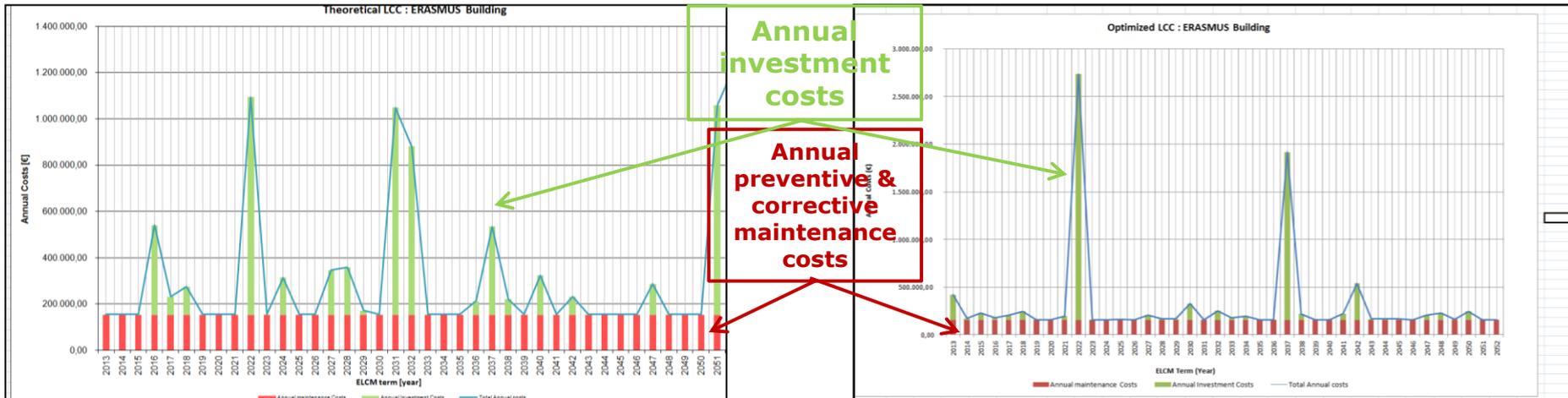
Organised in 9 Categories with specific targets/recommendations.

Targets are based on BREEAM European system

- new construction "excellent"
- Refurbishment "very good"
- maintenance & operation "BREEAM-in-use"



=> ESOC, ESAC, ECSAT, (2016) REDU (2017)



Methodology based on :

- 15 years cycle for major investments and 60 years life time.
- Regular building/equipment condition assessment audits.
- Compliance with IPSAS 17.

Allowing ESA to prioritize investment proposal for infrastructure renewal.



# E&E report : The Smart Metering Project Initiative



To increase energy efficiencies an advanced metering system project has been initiated to measure, read and analyse utility consumption remotely, providing a robust energy measurement, monitoring, targeting and reporting infrastructure.

- Monitor electricity, fossil fuels and water consumption, across the main ESA sites (key buildings, installations, data centres, ....)
- Underscoring accountability of key Energy manager,
- Ease the environmental reporting against objectives (as set by the E policy (20/20/20) and the ESA sites Heads),
- Support ISO14001 and ISO 50001 PDCA process,
- Enhance internal & external communication,
- Identify future improvements and priorities definition,
- Last but not least, contribute on the overall reduction of Energy consumption.



- In 2012 the ESA FM Department has set-up a Compliance Management team to look Agency-wide:
  - to harmonise the approach to health, safety and environmental compliance at all sites, whether certified or not.
  - to share best practices, mitigate costs, report, map risks, and ensure follow-through of continuous improvement activities.
  - to share in the benefits and success
- Further framework are being prepared in the fields of:
  - Energy management ISO 50001 (ESRIN project)
  - Operation management Breeam-in-use (HQ project)



## **Energy :**

- ESRIN and ESAC solar production plant (electrical, thermal)
- ESOC geothermal heat pumps for a 8000m<sup>2</sup> office buildings (409 MWh/year of heating and 77 MWh/year of cooling).
- HQ electrical energy saving campaign (lighting replacement conducted to a 18% efficiency gained on the overall electrical consumption).
- REDU Smart antenna heating management system (project 2015)

## **Mobility and awareness**

- ESTEC shuttle to airport and hotel pickup (instead of individual transportation (taxis and rented cars))
- ESTEC, ESAC plugs for electrical vehicle
- EAC bicycle use for internal mobility within DLR campus
- Health Safety and Environment awareness campaigns

## **Waste**

- ESRIN advanced recycling program (2015)

## **Water**

- ESTEC Water replacement of meeting rooms fountains (suppression of bottle)

## **Procurement**

- FM services contracts, in particular chemical products (cleaning, maintenance) and food served at the canteen.
- IT equipment and configuration

1. Two out of the three 20/20/20 objectives are met. Further initiatives will have to take place in particular in the field of efficiency improvement. Projects like smart metering and lighting replacement are promising but still more effort will have to be accomplished within available resources level. Sites initiatives need to be further encouraged.
2. Building code has not been yet implemented and translated in policy, as the lack of available resources do not permit but in practical we have succeed until now to include building certification for new build and are now starting the operational part. ELCM, SMP are supporting managerial decision to invest in sustainable infrastructure.
3. EMS bring significant management structure & commitment & guidance
4. Initiatives should be further encouraged.
5. Communication & Awareness are key for further improvement as user involvement is key to drive further progress.



## Y 2013 Global CO<sub>2</sub>e Emissions by Site

