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Satellites for Energy

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www.esoa.net

www.earsc.org

www.euroteleserv.eu

Regions need:

- To find appropriate alternative energy sources
- To find appropriate energy efficiency measures fitting their regional characteristics
- To devise methods to use alternative energy sources:
 - ➔ To reach their regional targets & demonstrate progress, &
 - ➔ To support implementation & evaluation of their strategies

Can Satellite Technology Help ? yes



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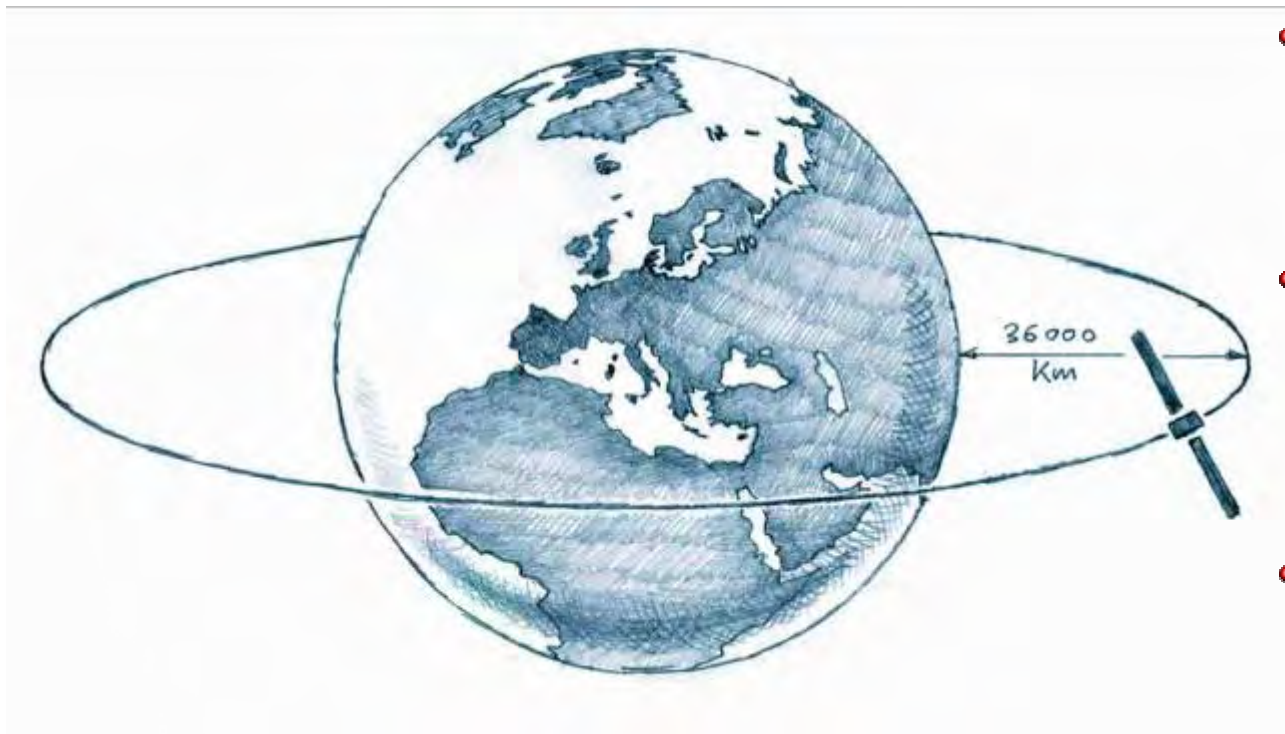


Getting More4NRG

- Space Technology is acknowledged as a major tool to address environmental issues (from diagnosis to real-time monitoring)
 - EC's GMES programme
- Space is acknowledged as essential in improving transport management
 - GPS
 - EC's Galileo programme

Space can also help improve the production of renewable energy sources, monitor secure distribution of energies & increase energy efficiency - all while reducing CHG emissions by fossil energy sources

Satellites use Renewable Energy



- Satellites are solar-powered systems operating for up to 15 years each
- All broadcast satellites in orbit today use less energy than 1 terrestrial TV mast
- Latest rocket technology uses “clean” O_2 & H_2 from ethanol or from sea water using hydro-electric power

EARSC

European Association
of Remote Sensing
Companies

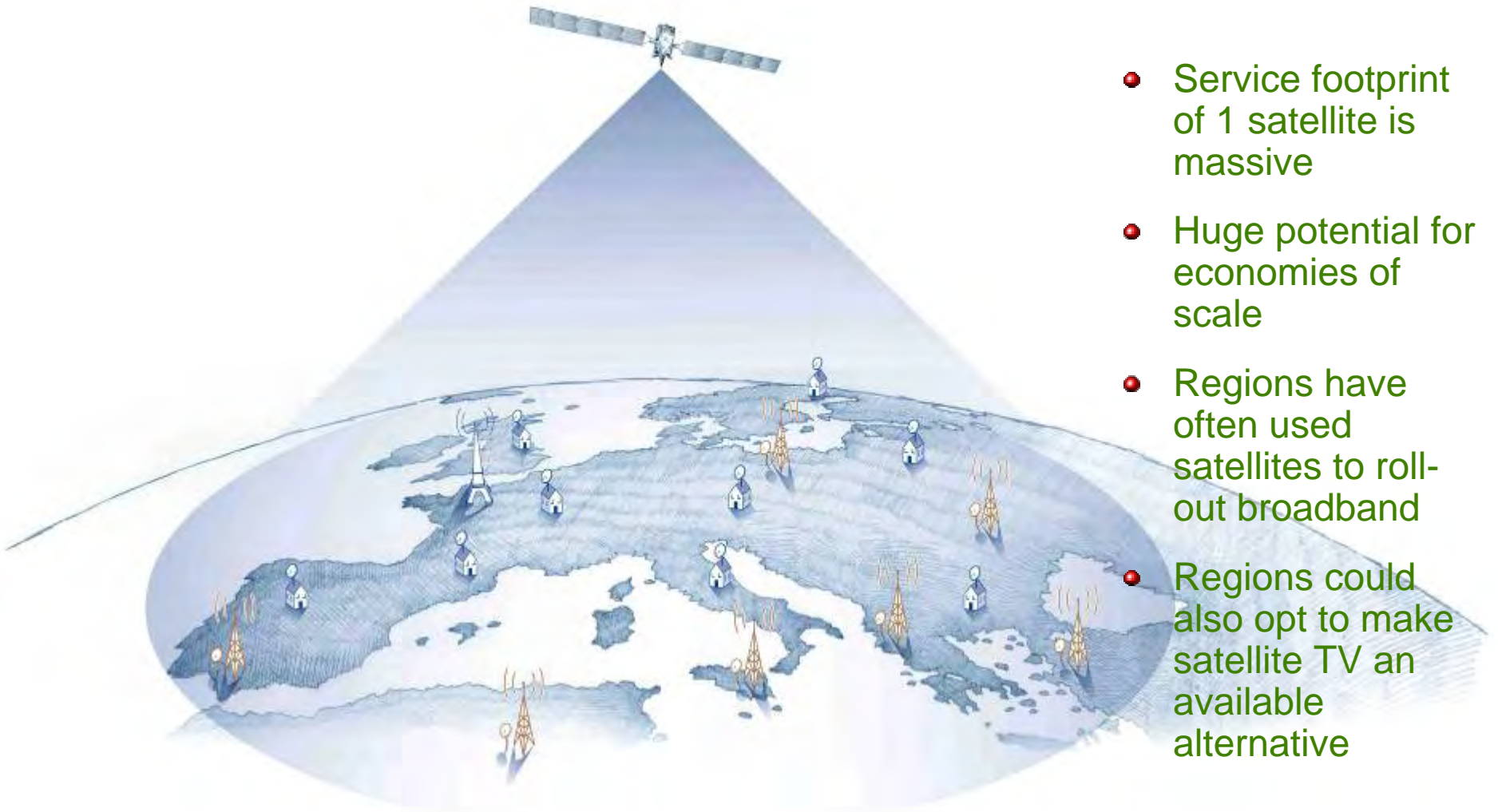


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ESOA
European Satellite Operators Association

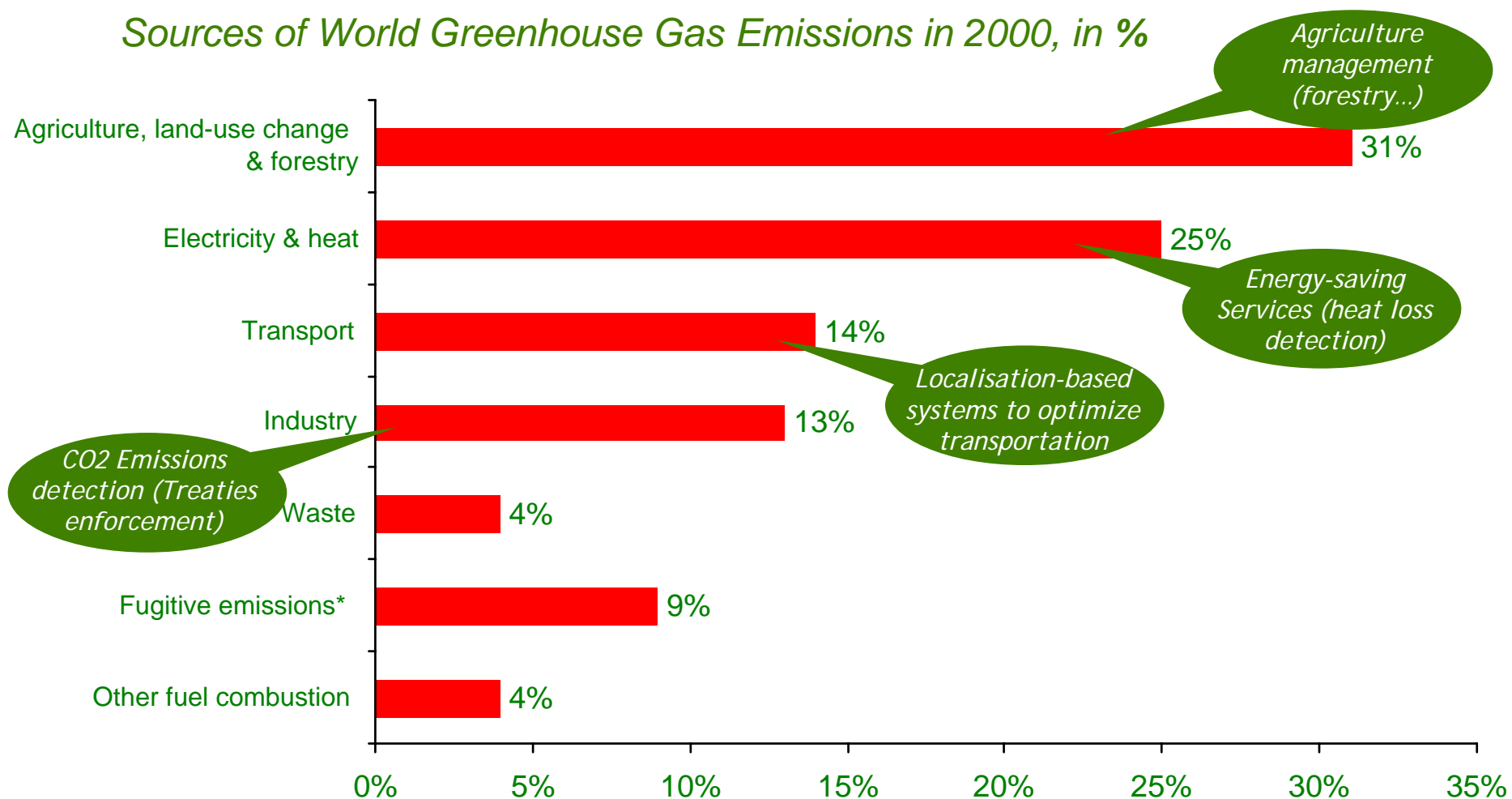
...and they do it efficiently



- Service footprint of 1 satellite is massive
- Huge potential for economies of scale
- Regions have often used satellites to roll-out broadband
- Regions could also opt to make satellite TV an available alternative

World Greenhouse Gas Emissions

Sources of World Greenhouse Gas Emissions in 2000, in %



Source: the Atlas of Climate Change



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Energy Generation Renewable Energy (I)

Areas with water reserves/ large open areas/ coastal areas lend themselves to renewable energy production & management:

Satellites contribute to clean energy production by observing & transmitting data on:

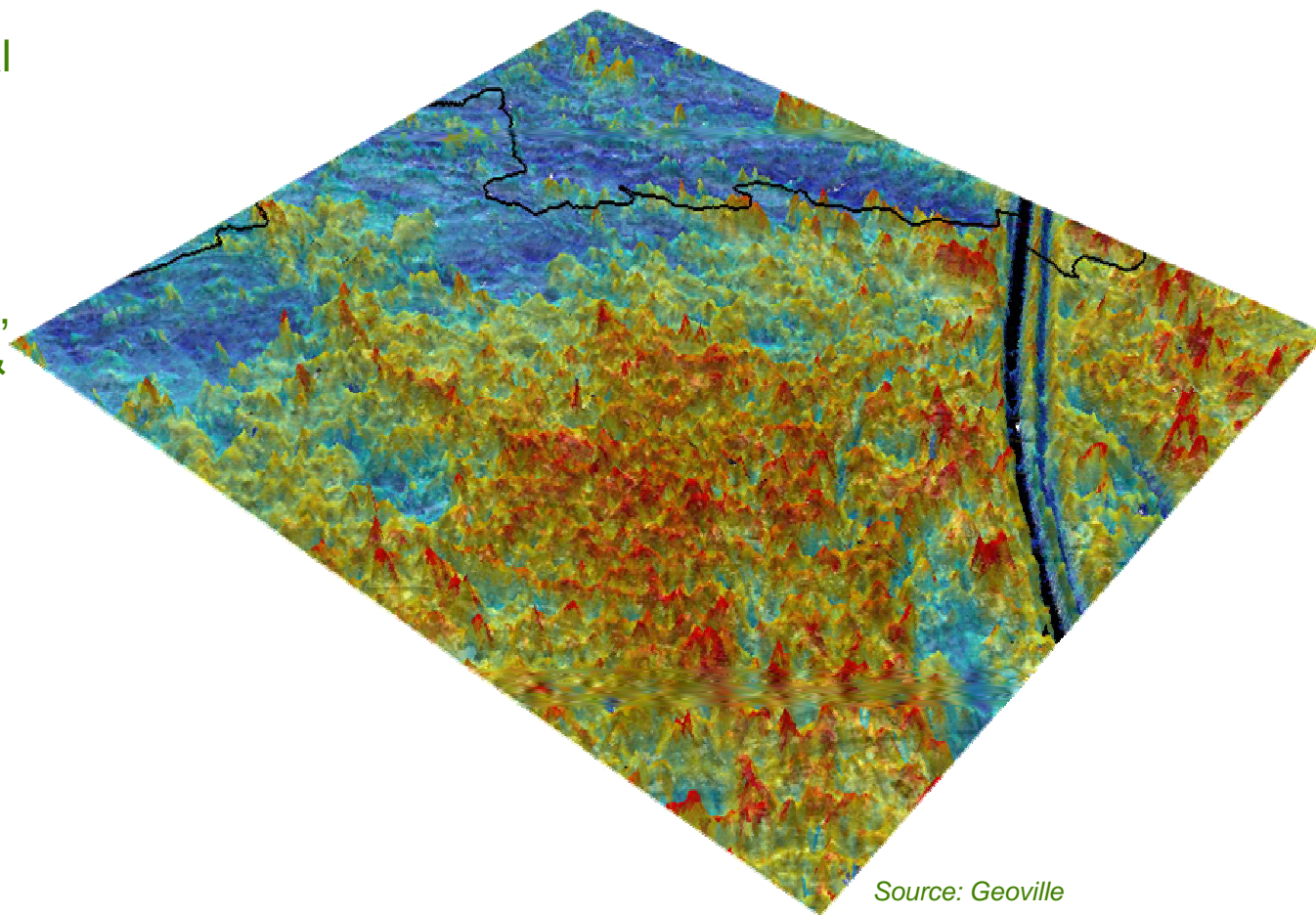
- WIND: Speed, direction, frequency ...
- WATER: Availability, temperature, Snow reserves ...
- SOLAR: Radiation, cloud obstruction ...
- BIOENERGY: Biomass, crop yield ...
- GEOTHERMAL: Temperature, location ...

Energy Generation Renewable Energy (II) Example 1: Vienna

Vienna, Austria: 3D Map for Potential Solar Panels

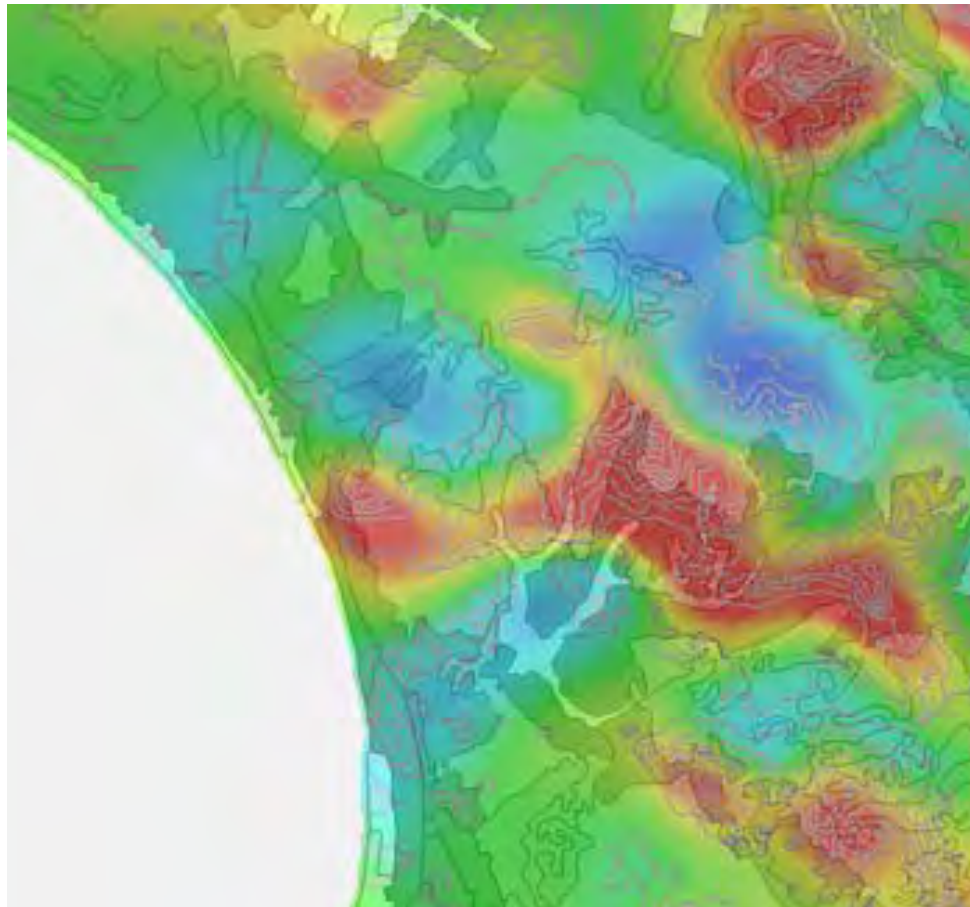
An “Energy Potential Map” to identify potential hot spots locations for alternative energy sources: wind farms, solar power plants & panels

In combination with land cover and property data this information can be used for ideal site identification & selection



Source: Geoville

Energy Generation Renewable Energy (II) Example 2: Albania

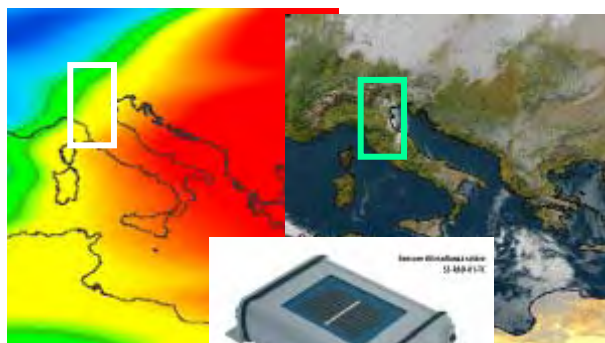


*Dures, Albania
Potential Map for Solar &
wind Power provided by
Earth Observation Satellites*

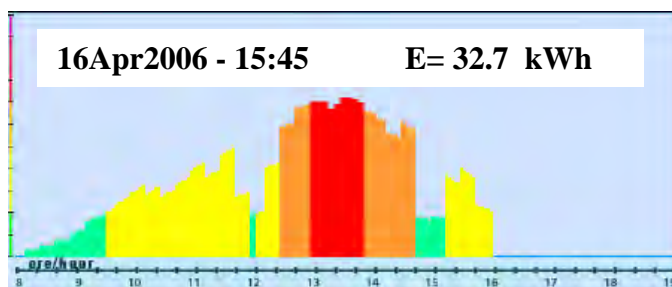
Source: Geoville

Expected energy yield assessment exploiting EO satellites

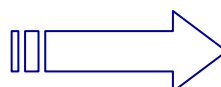
(1) Atmospheric optical properties retrieval from satellite data and radiative transfer model for solar radiation assessment



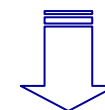
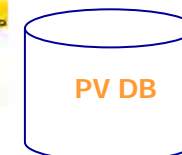
(2) Energy product and possible in-situ solar radiation measurement are logged



(5) The expected energy production is evaluated during the day and then compared with the real energy production



(3) Solar radiation and PV modules temperature are evaluated at the PV plant location



PV plant optoelectronic modeling

(4) Energy yield model simulates the PV plant energy production



Source: FlyBy

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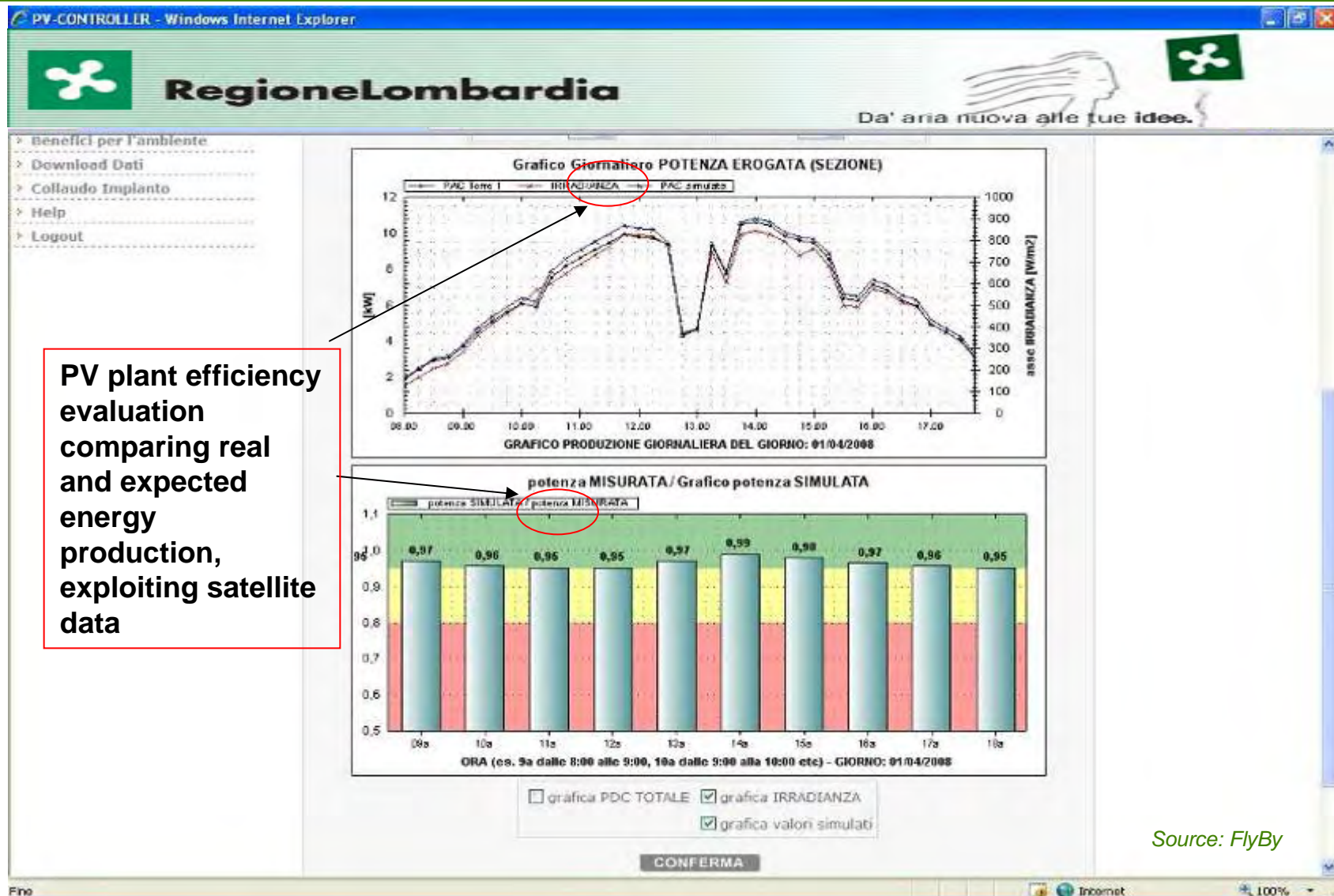
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Energy Generation Renewable Energy (IV) Example 3: Lombardia





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Sustaining Consumption of Renewable Resources: Forest Management

Forests:

- Help reduce atmospheric CO₂
- Are susceptible to fires, increasingly within Europe
- Provide global watershed benefits & provide fuel wood

Satellites monitor forests: over-harvesting, fire damage, assessment of greenhouse gas release

Space based information can reduce the rate of global deforestation by 15-20% via regulation & verification measures



Credit: Sertit

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Energy Generation & Distribution Wind & Water (I)

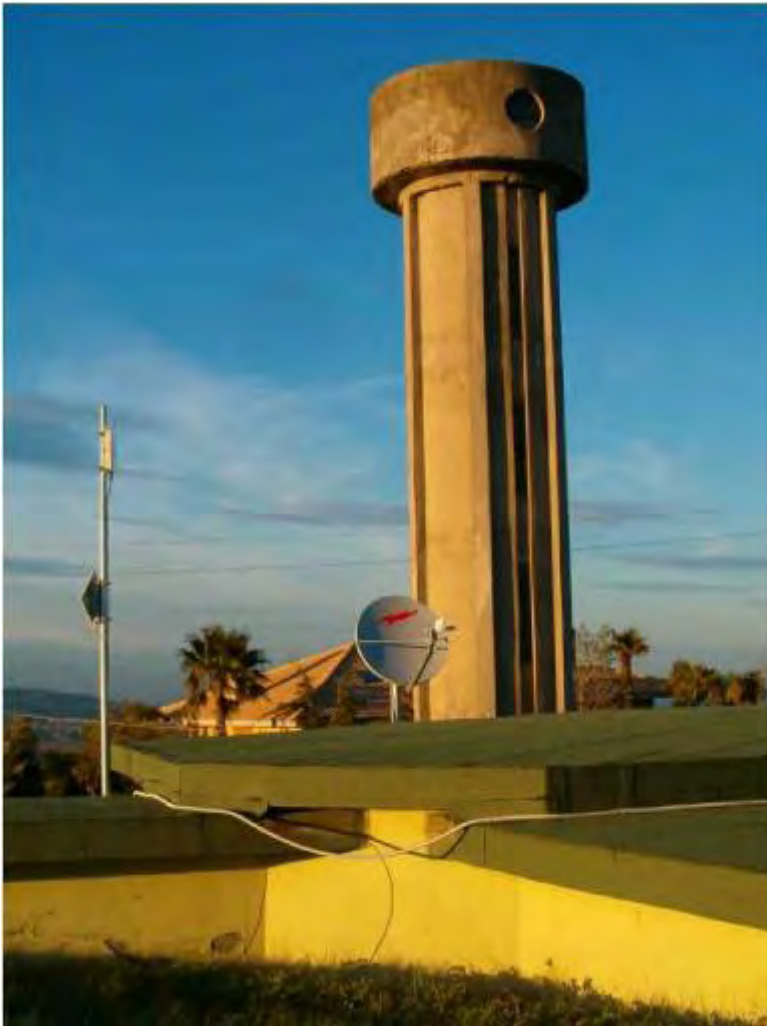


Case Study: Enel, Italy

Required remote control of high voltage systems, real-time monitoring, transmission of real-time data monitoring

Solution: Supervisory Control and Data Acquisition (SCADA) system, private satellite network, network integration, automatic traffic re-routing in case of failure, broadcast of alert messages

A similar project is implemented in Crete



Hydropower Generation

Case Study: Hydrowatt

Required real-time monitoring & remote control of hydropower plants; remote access for operation & maintenance

Solution: 2-way private satellite network, VPN & mobile network (GSM, GPRS) integration



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Reducing the Carbon Footprint Traffic (congestion) Management (I)

Generating more jobs, providing good housing & a healthy green environment

Anna Nagurney, Director of the Virtual Center for Supernetworks at the Isenberg School of Management, MA

“The impact of congestion on wasted time, frustration, & losses in productivity is major ...the impact of traffic congestion on energy consumption is immense. In the past two decades, vehicles in the US have seen an increase of 440% in the waste of fuel due to congestion... In the Boston metropolitan area, the number of gallons of fuel wasted due to congestion in 2003 was 60 million with a 362% increase since 1982. ... On the Pacific Coast, according to the Texas Transportation Institute, a typical traveller in the Los Angeles area wasted 93 hours stuck in traffic in 2003, about the same amount of time as he had for vacation.”

<http://www.umassmag.com/umassmagessay.pdf>

Can satellite technology help? ... yes



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Reducing the Carbon Footprint Traffic (congestion) Management (II)

Congestion management: collection/ analysis/ distribution of large amounts of data to intelligent decision making devices to re-route, re-plan or revise travel plans to avoid congestion, thereby reducing the extent of congestion & the impacts on waste of energy & time

Data can be collected terrestrially or via satellite but disseminating an identical data set to all road users or large subsets of data to large groups of road users is what satellites do best (as we know from the success of satellite TV)

Reaching maximum users with minimum infrastructure (preferably using no electrical power at all) amounts to “saving energy”

Existing and emerging space-based applications using Earth Observation and telecommunications could thus make a better environmentally friendly contribution to congestion & fuel waste than terrestrial solutions

Note also some countries have also considered roll-tolling systems via satellite as a disincentive to using cars



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Reducing the Carbon Footprint Tele-Working

Tele-working allows de- motivated workers who waste time & energy in dealing with longer commutes to work to work from home

Tele-working requires good communication links from the home: dilemma!

The greater the potential commute for the worker, the more the potential energy saving

BUT: remote areas are those where telecoms infrastructure is least developed & therefore the least suitable for tele-working

Satellite communications can provide the link no matter how rural the location

Particularly useful for mountainous regions, or those with islands, or simply those far away from an urban centre



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Reducing the Carbon Footprint The Issue of TV

From Land Broadcasting networks to Satellite Broadcasting

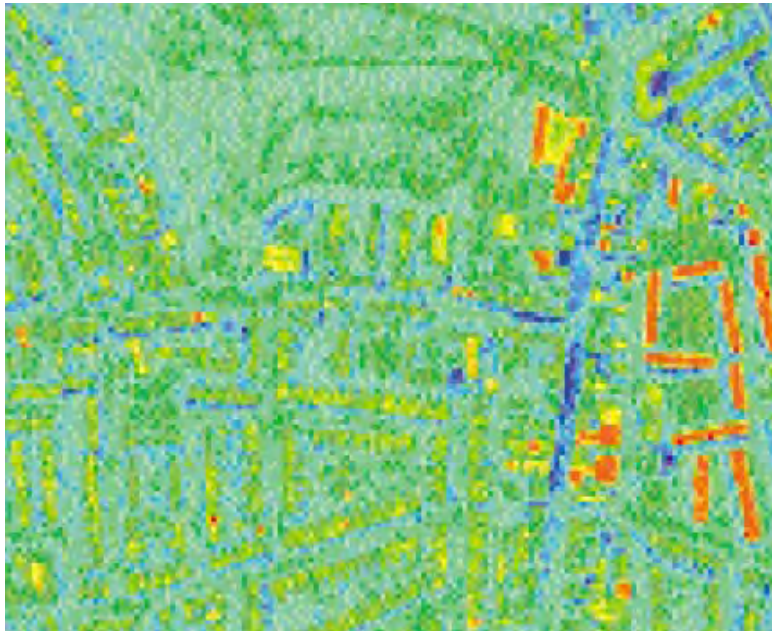
Example: The UK, *source: UK Case4Space*

- 1100 UHF transmitters today provide current UK analogue terrestrial TV (less than 10 channels). The 50 most powerful require 54MW of electricity: 250,000 tons of CO₂ p.a. while satellites use the sun to power transmissions over 15 years generating ZERO CO₂
- The spectrum released in the UK after switch-off of terrestrial networks could carry approximately 14 HDTV channels: the latest European telecommunications satellite launched in Aug 2006 can carry 150 HDTV channels

Satellite-only TV broadcasting in the UK would result in a real 'digital dividend': increased spectral resources & REDUCED CARBON FOOTPRINT

Satellites are extremely efficient (energy & spectrum) at broadcasting the same information to many people, terrestrial solutions are not

Monitoring Carbon Footprint - Heat Loss



Source: Infoterra

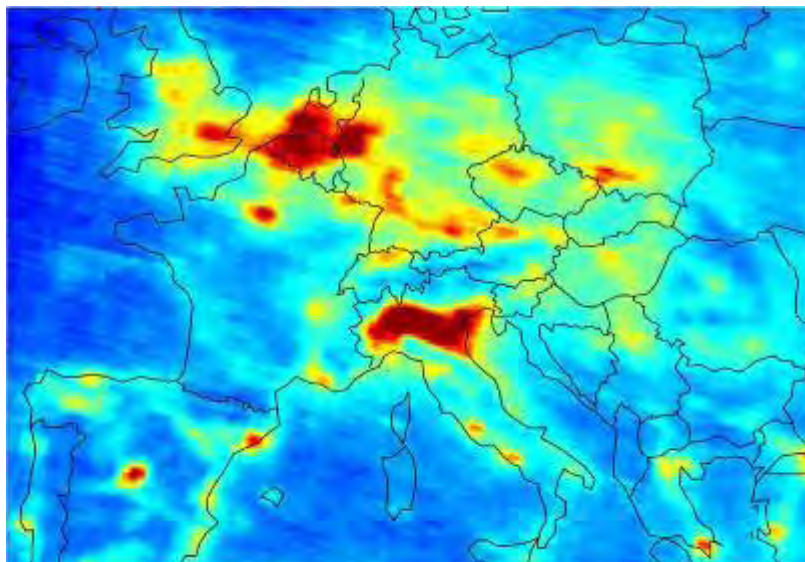
← *Urban Heat Loss as detected by
remote sensing*

*Satellites are ideal tools for
detecting greenhouse emissions*

Monitoring Carbon Footprint - Greenhouse Gases



← *Pollution: What it looks like
from earth*



← *... and from space*