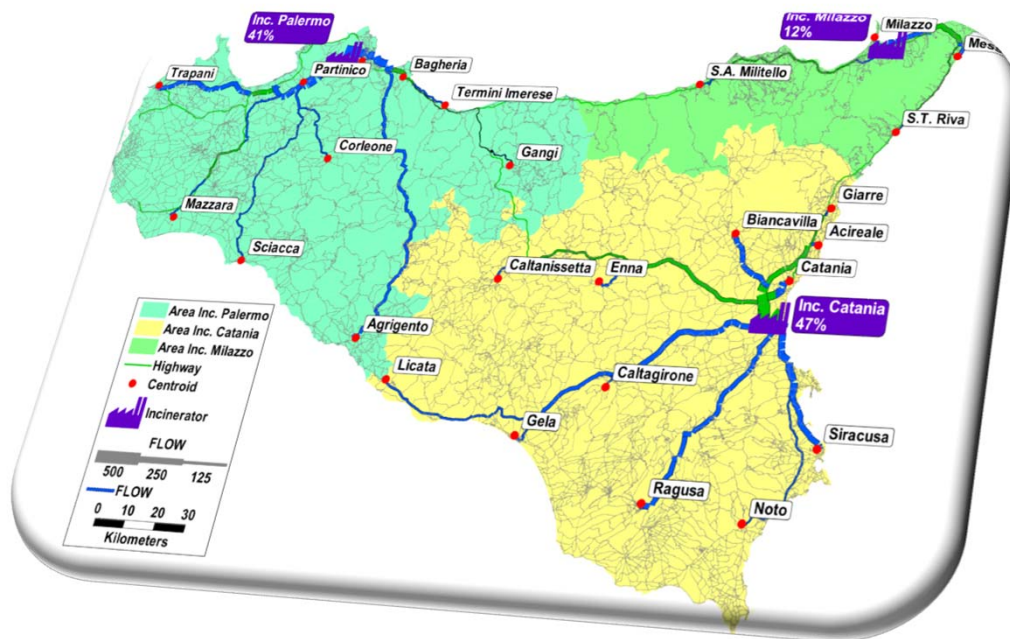




CYPRUS 2016

4th International Conference on Sustainable Solid Waste Management

An approach to islands' self-contained waste management system with the goal of maximizing the recovery while limiting transportation costs

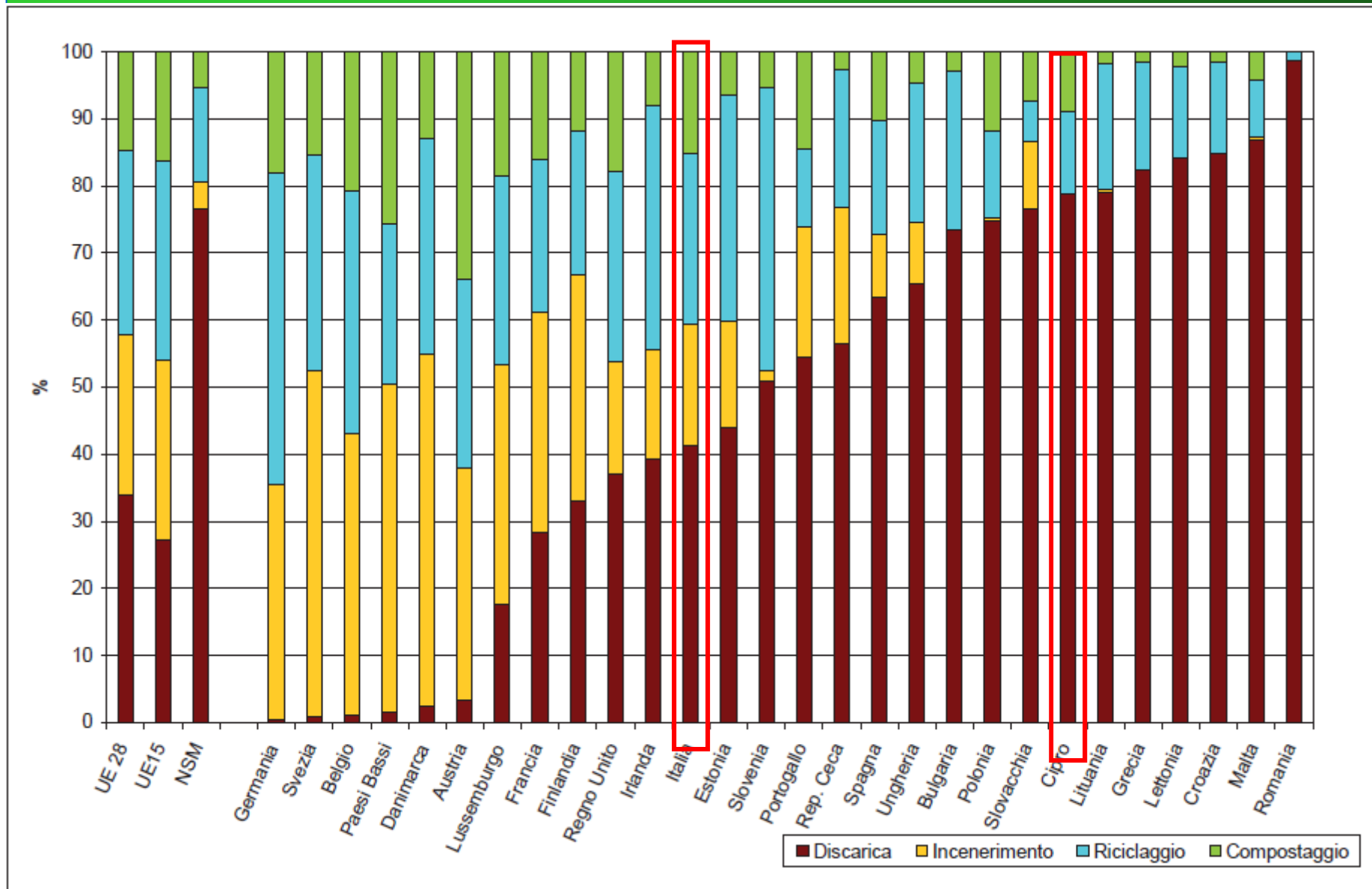


Authors

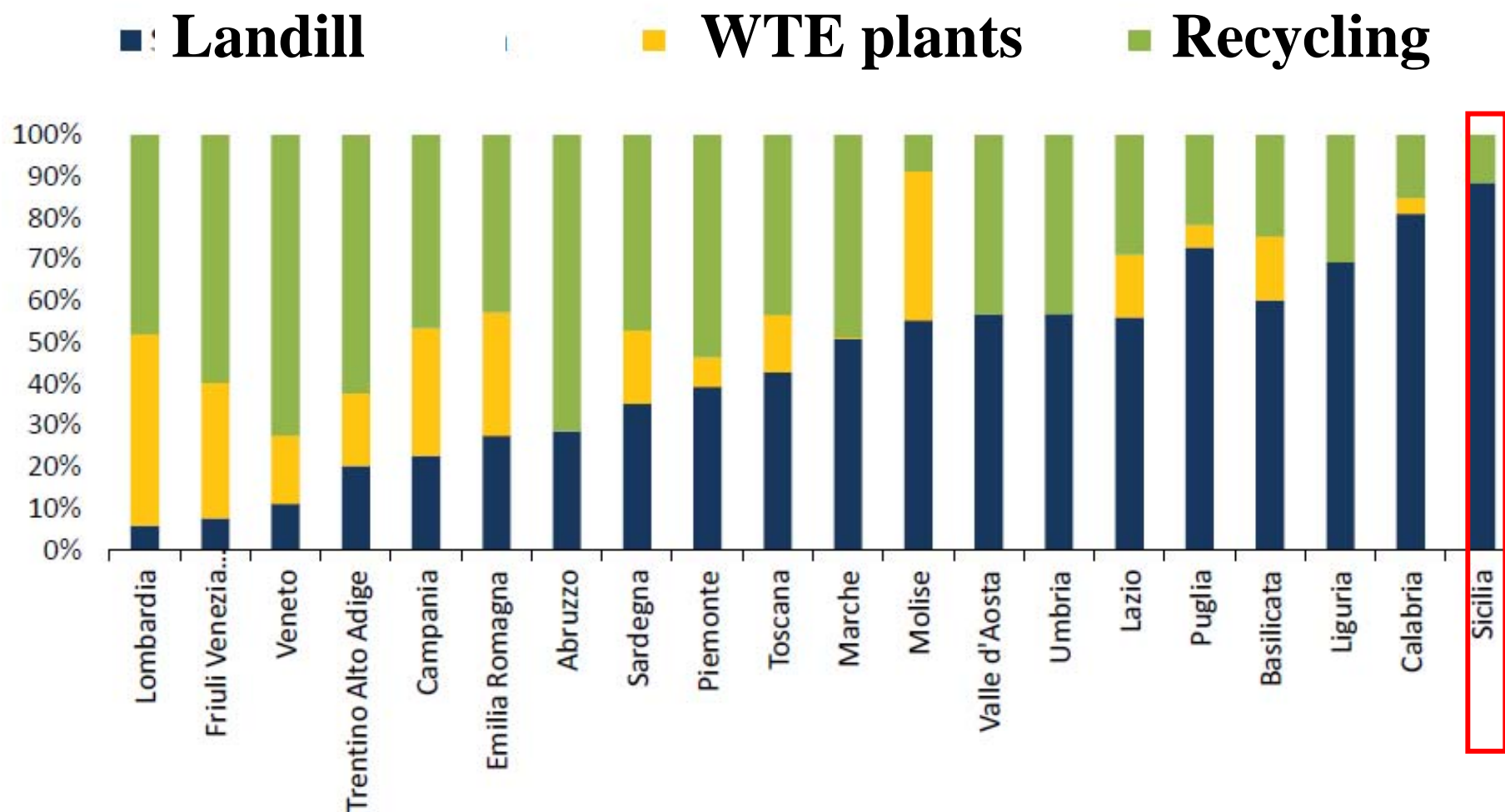
- Nicosia F.G.
- Luciano A.
- Viotti P.
- Fino D.
- Mancini G.

*Limassol, Cyprus
June 23th 2016*

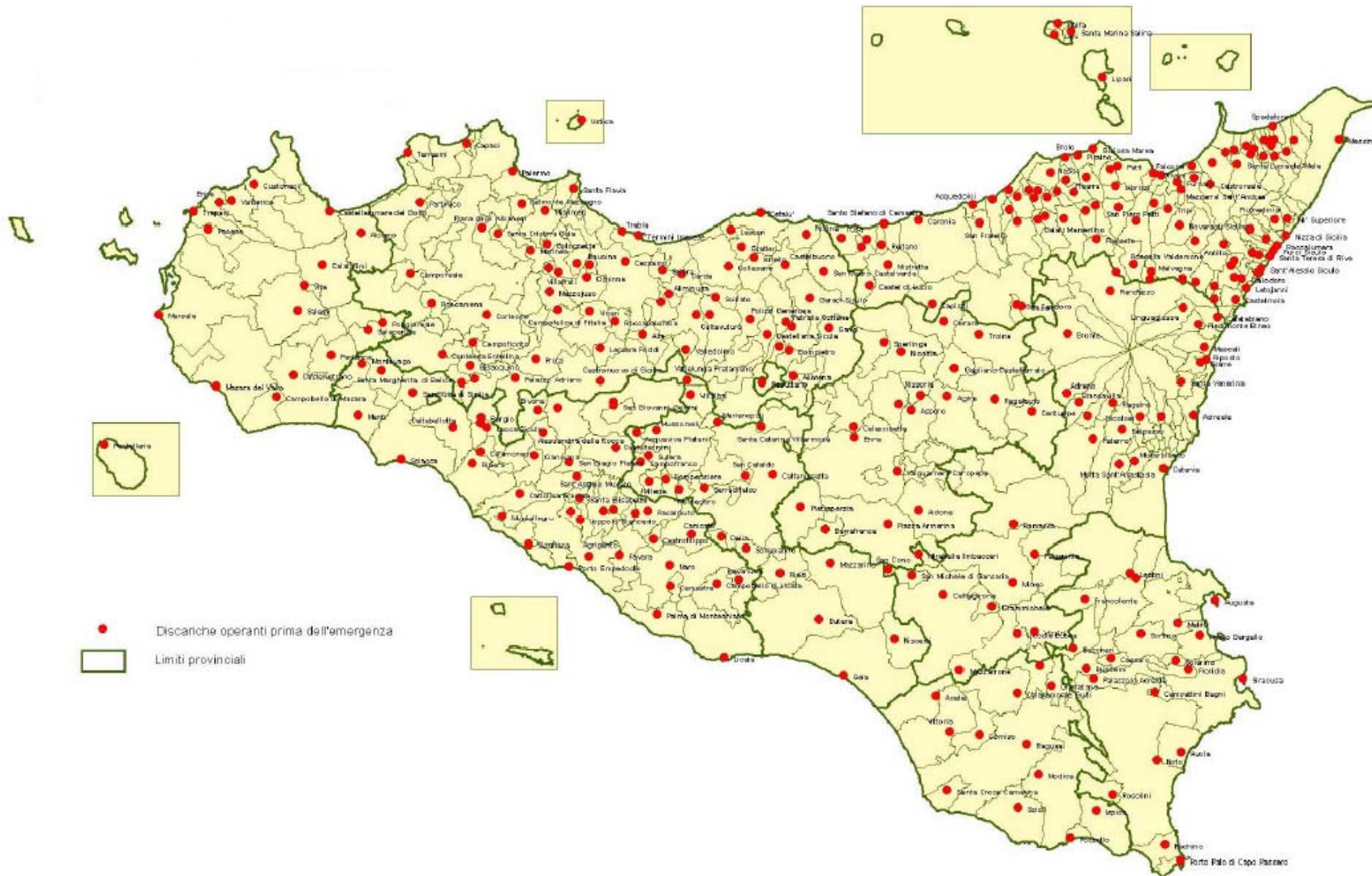
Waste management approach in each country of Europe



Waste management approach in regions of Italy

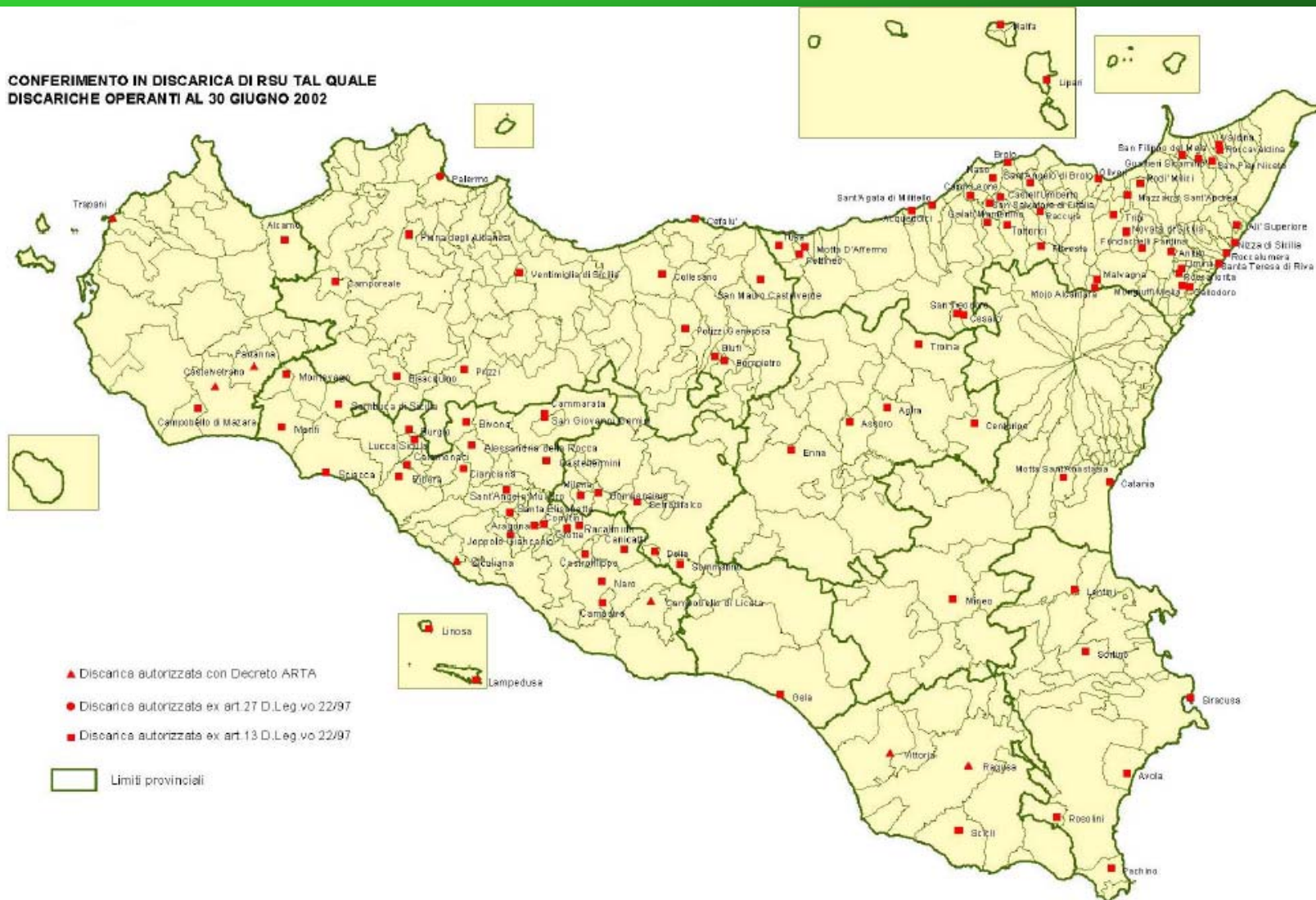


Landfills in in use Sicily before the state of emergency was declared in 1999

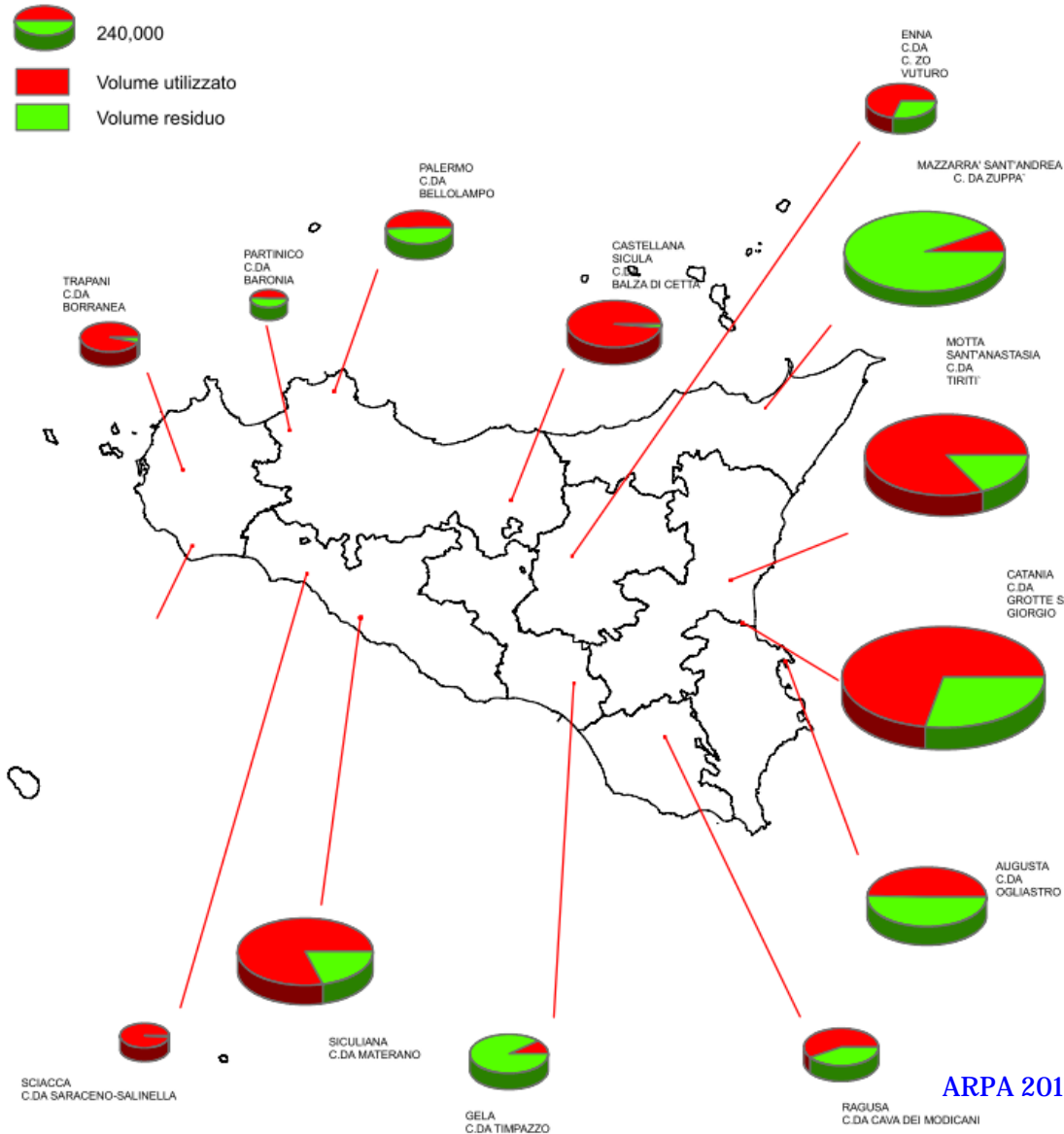


Landfills in use in 2002

CONFERIMENTO IN DISCARICA DI RSU TAL QUALE
DISCARICHE OPERANTI AL 30 GIUGNO 2002



Many of these landfill are almost full



Main objective in Sicily



**TO DRAMATICALLY
REDUCE THE
**PERCENTAGE OF WASTE
 DISPOSAL INTO
LANDFILL****



Development of facilities

Large mechanical/biological waste treatment plants



Poor results from mechanical separation



il recupero di materia da TMB su indifferenziato



Frazione umida da TMB su indifferenziato



the regional government

The current opinion of regional government:shipping the waste abroad

21/6/2016

Sicily to send its rubbish to Austria - The Local

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OPEN

National

Sicily to send its rubbish to Austria

Published: 29 Dec 2014 09:19 GMT+01:00



Trash from the Italian island of Sicily will next year be processed at special treatment plants in Austria.

After years of problems with waste disposal, the Italian island of Sicily has signed a deal to send a significant portion of its increasing piles of trash to Austria for processing.

Sicilian media reported that hundreds of tonnes of garbage will be transferred by ship and train to Austria during 2015, for disposal by specialized waste treatment plants in the central-European country.

The Sicilian Regional Assembly received the green light from Rome for this option, despite criticism by local media for the expected tax hikes required to pay for the transport and processing.

Rosario Crocetta, the former communist and openly-gay president of the regional assembly of Sicily, pushed through the proposals in the face of opposition from the leftist SEL party, which accused the president of failing to properly address the island's mounting environmental problems.

Crocetta became president after achieving a strong anti-Mafia reputation, and has persevered in driving an anti-corruption program, despite several attempts on his life.

Story continues below



....and of course going on with landfill disposal

The national government VS the regional goverment:

Sicily must increase recovery and have 2 WTE plants, one in Catania and one in Palermo

5 or 6 “small” gasification plants close to the existing landfills to reduce transportation costs and impact on the traffic



Goals

Regional waste management system

best combination of typology and location of waste facilities

optimal assignment of waste flows,

reduce the operation costs and the environmental impacts of transportation.

Critical component



Transportation

Complexity of the system



Analytical/simulation tools

Starting from these data

- Area = 25,711 km²
- Population = **5,045,176** inhabitants
- Density = 196.23 inh/km²
- MSW production = about **2,727,570** t/year
- MSW production per capita = 520 kg/capita/year

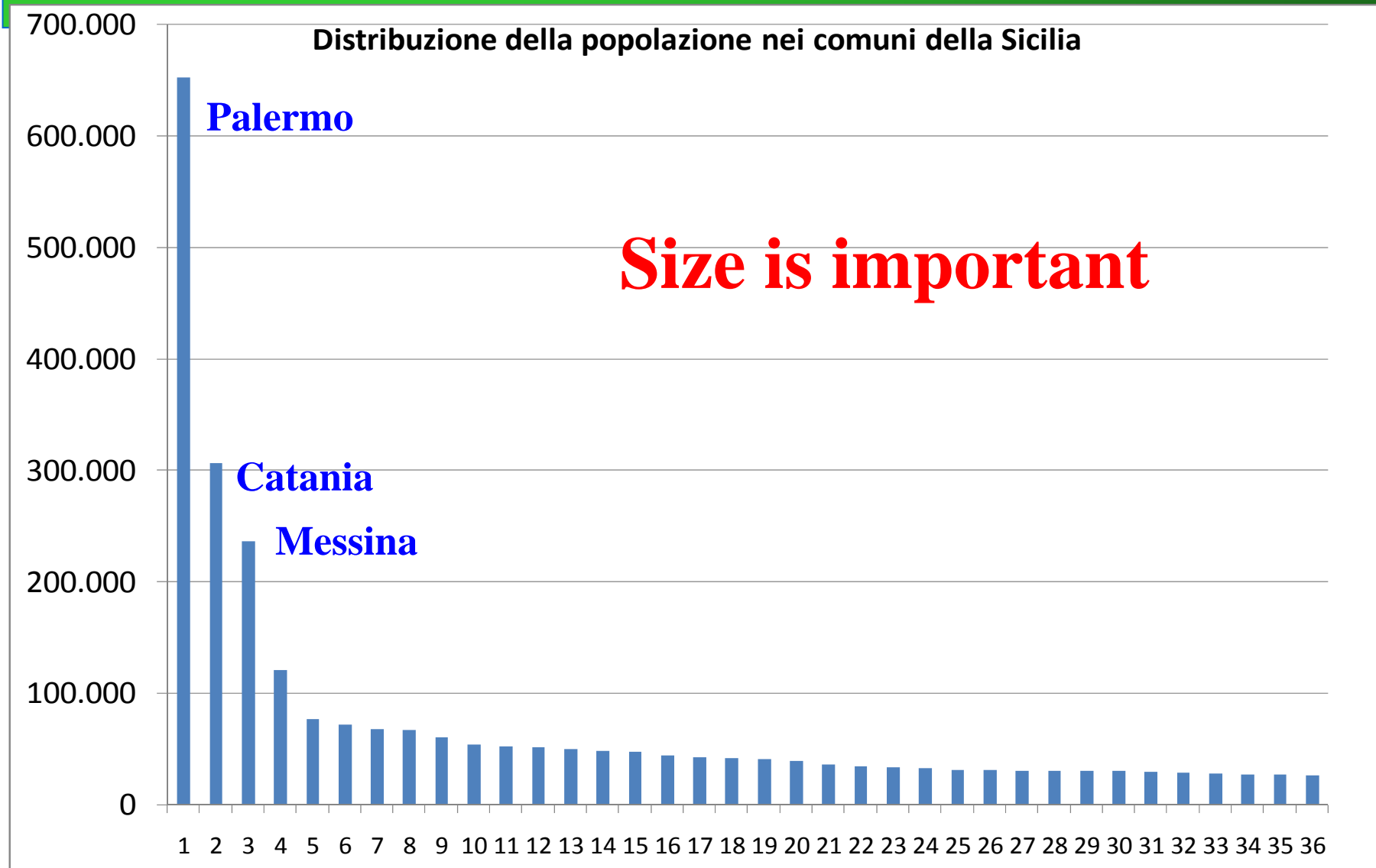
Dominant solution for MSW disposal



Landfills
(**about 90%**)



Distribution sicilian population



METHODOLOGY

Hypothesis for the integrated waste management scenarios in Sicily

Main cities

Palermo - Catania - Messina

Popoulation
1,315,000 inhabitants

Waste
710,250 tons/y

Small towns

Popoulation
3,736,000 inhabitants

Waste
2,017,320 tons/y

METHODOLOGY

Hypothesis for the integrated waste management scenarios in Sicily

Percentage of recovery for waste category in large cities and small towns.

	Large Cities	Small cities and village	Sicily	
Inhabitants	1,315,000 (26%)	3,736,000 (74%)	5,051,000 (100%)	
Total waste produced (tons/y)	710,250 (26%)	2,017,320 (74%)	2,727,570 (100%)	
Waste components				
tons/y	Compost	24,149 (0.9%)	484,158 (17.8%)	508,307 (19%)
	Secondary Raw Materials	122,909 (4,5%)	560,918 (20.6%)	683,827 (25%)
	Refuse Derived Fuel	214,284 (7.9%)	344,358 (12.6%)	558,642 (20%)
	Total recovered waste	361,342 (13.2%)	1,389,434 (50.9%)	1,750,776 (64%)
	Waste disposed to landfill	348,908 (12.8%)	627,886 (23.0%)	976,794 (36%)

METHODOLOGY

Hypothesis for the integrated waste management scenarios in Sicily

Five scenarios

for waste management in the region were proposed in order to investigate the related environmental and economic transportation costs.

A recovery rate equal to 50% of the total waste produced (50%MSW) in Sicily (about 1,300,000 tons/y) was considered for all the scenarios, in an optimistic management prospective characterized by high rates of waste collection in the small towns.

METHODOLOGY

Hypothesis of integrated waste management in Sicily

Scenario 1

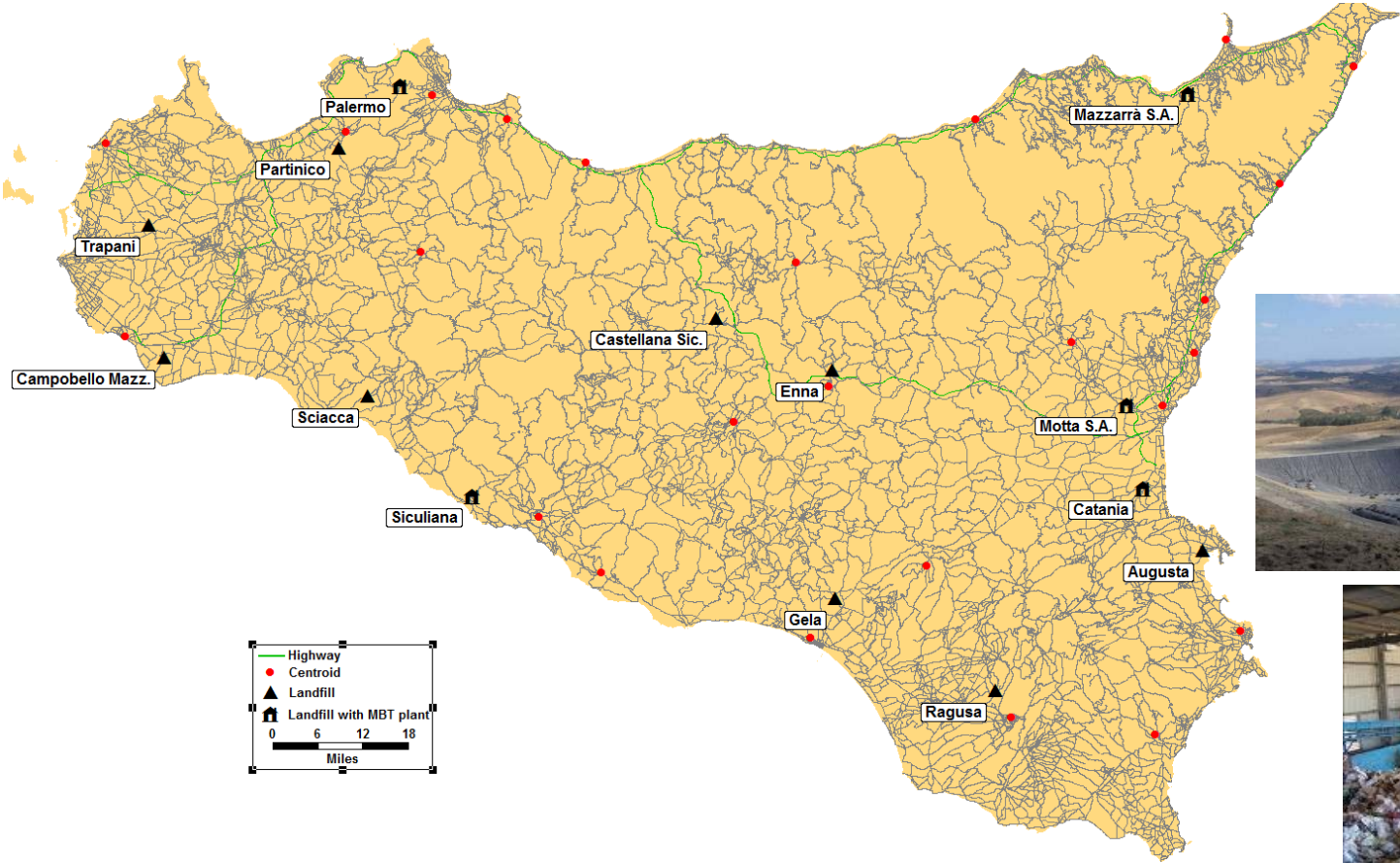
50% of MSW



Mechanical Biological Treatment



Landfills (n. 14)



METHODOLOGY

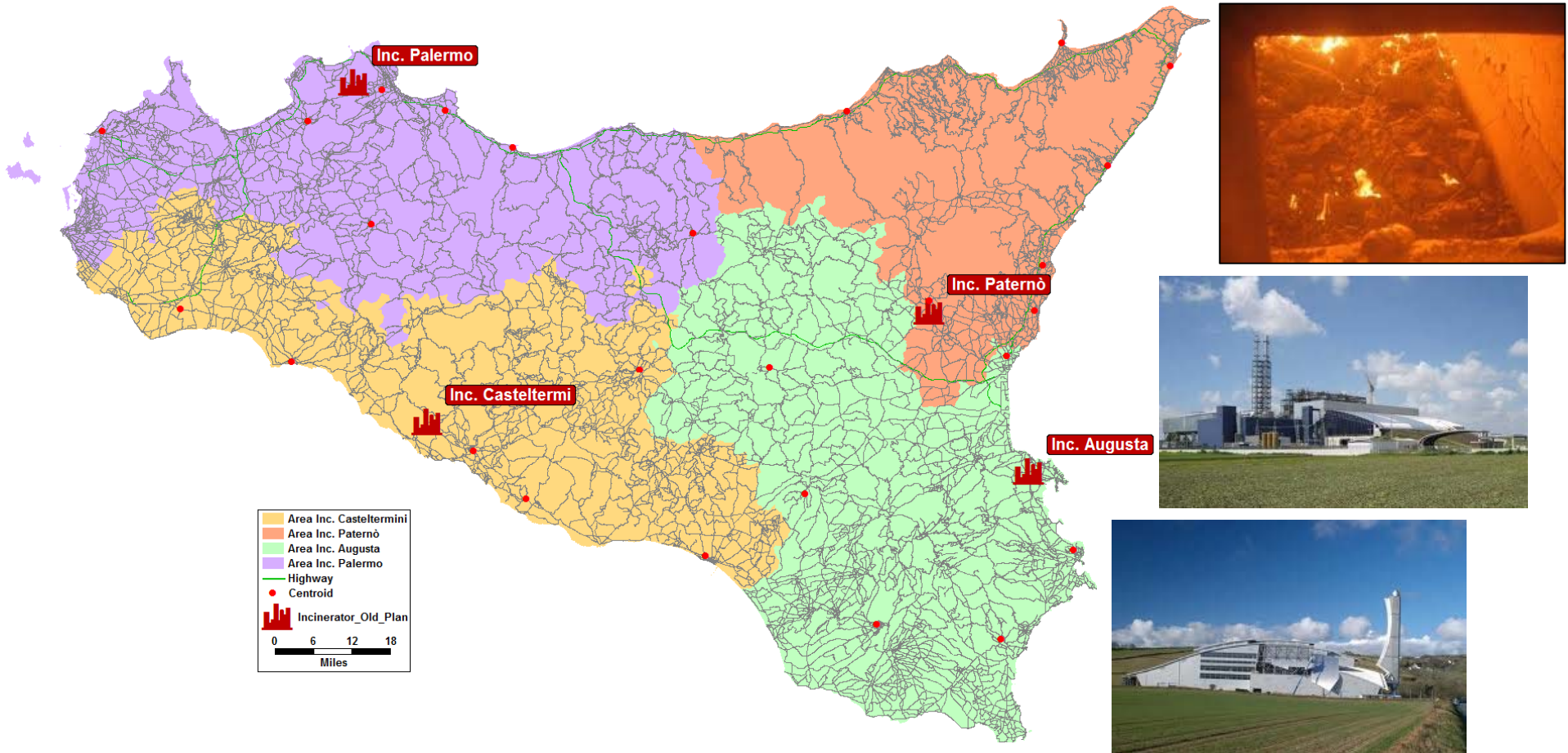
Hypothesis of integrated waste management in Sicily

Scenario 2

50% of MSW



Large Incinerators (n. 4)

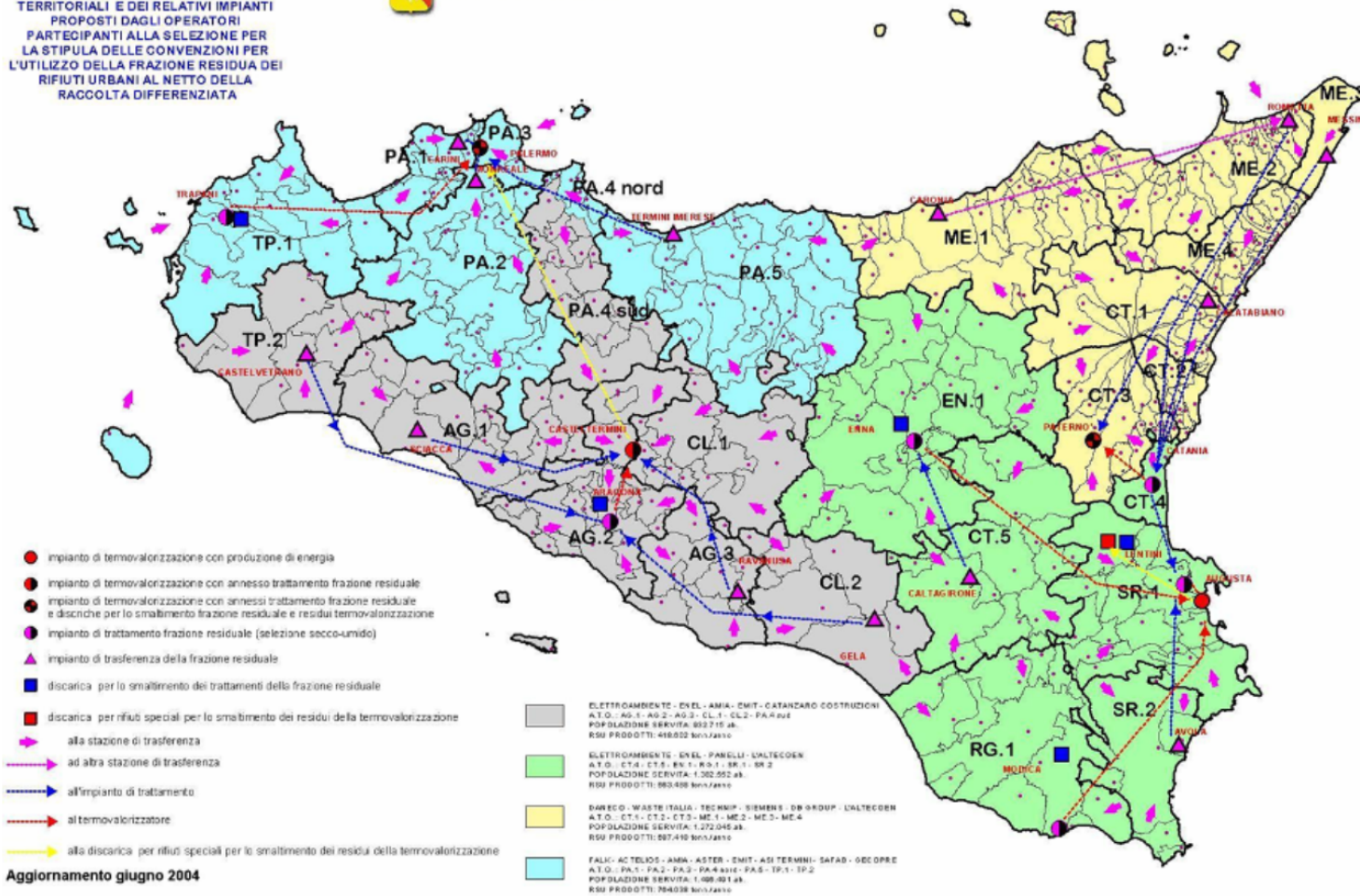


The unbelievable transport model

CARTOGRAFIA DELLA SICILIA RECANTE LA SUDDIVISIONE NEGLI AMBITI TERRITORIALI E DEI RELATIVI IMPIANTI PROPOSTI DAGLI OPERATORI PARTECIPANTI ALLA SELEZIONE PER LA STIPULA DELLE CONVENZIONI PER L'UTILIZZO DELLA FRAZIONE RESIDUA DEI RIFIUTI URBANI AL NETTO DELLA RACCOLTA DIFFERENZIATA



Ufficio del Commissario Delegato per l'Emergenza Rifiuti e la Tutela delle Acque

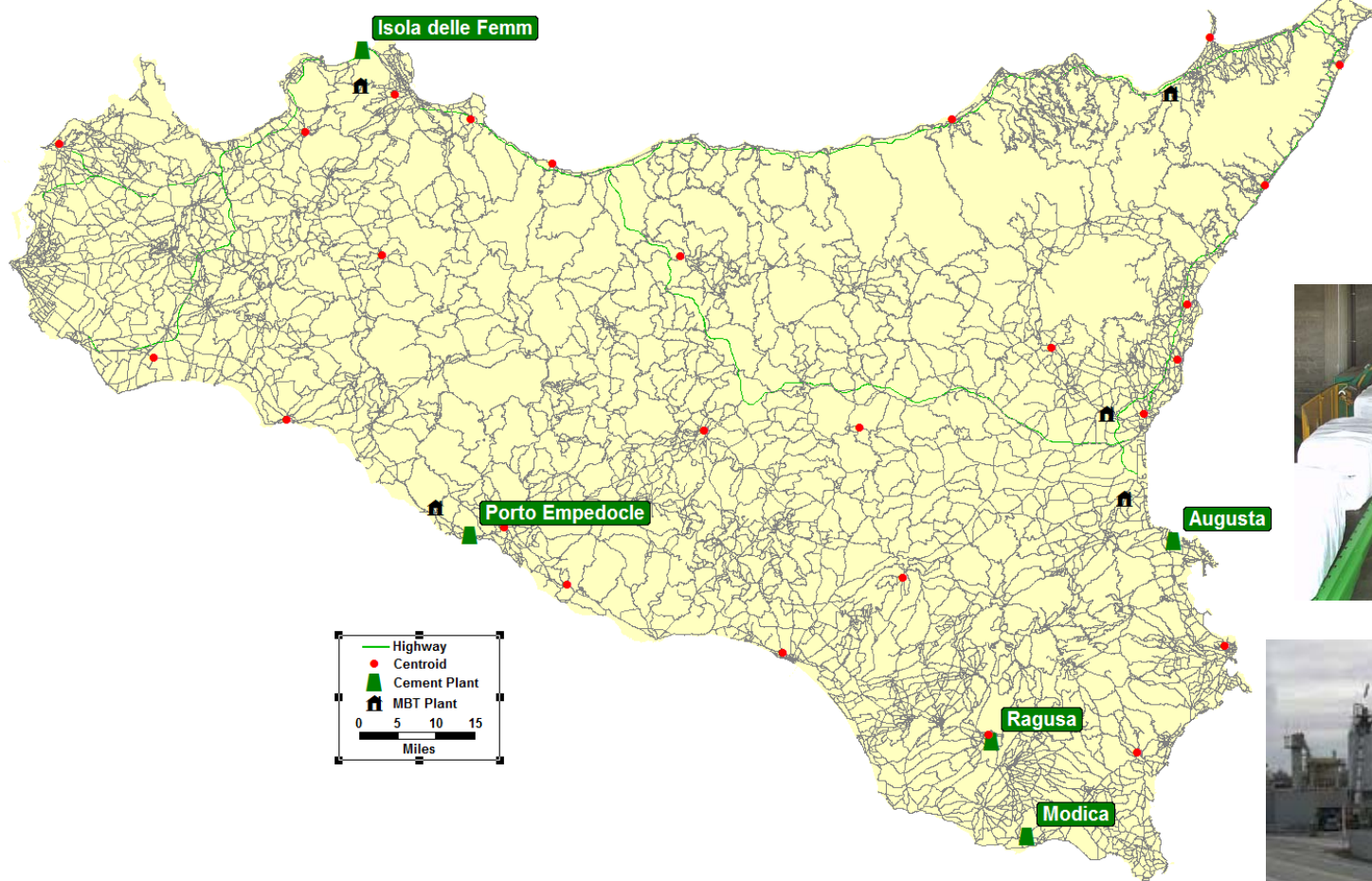


METHODOLOGY

Hypothesis of integrated waste management in Sicily

Scenario 3

50% of MSW \Rightarrow Mechanical Biological Treatment \Rightarrow RDF in cement plants (n. 5)



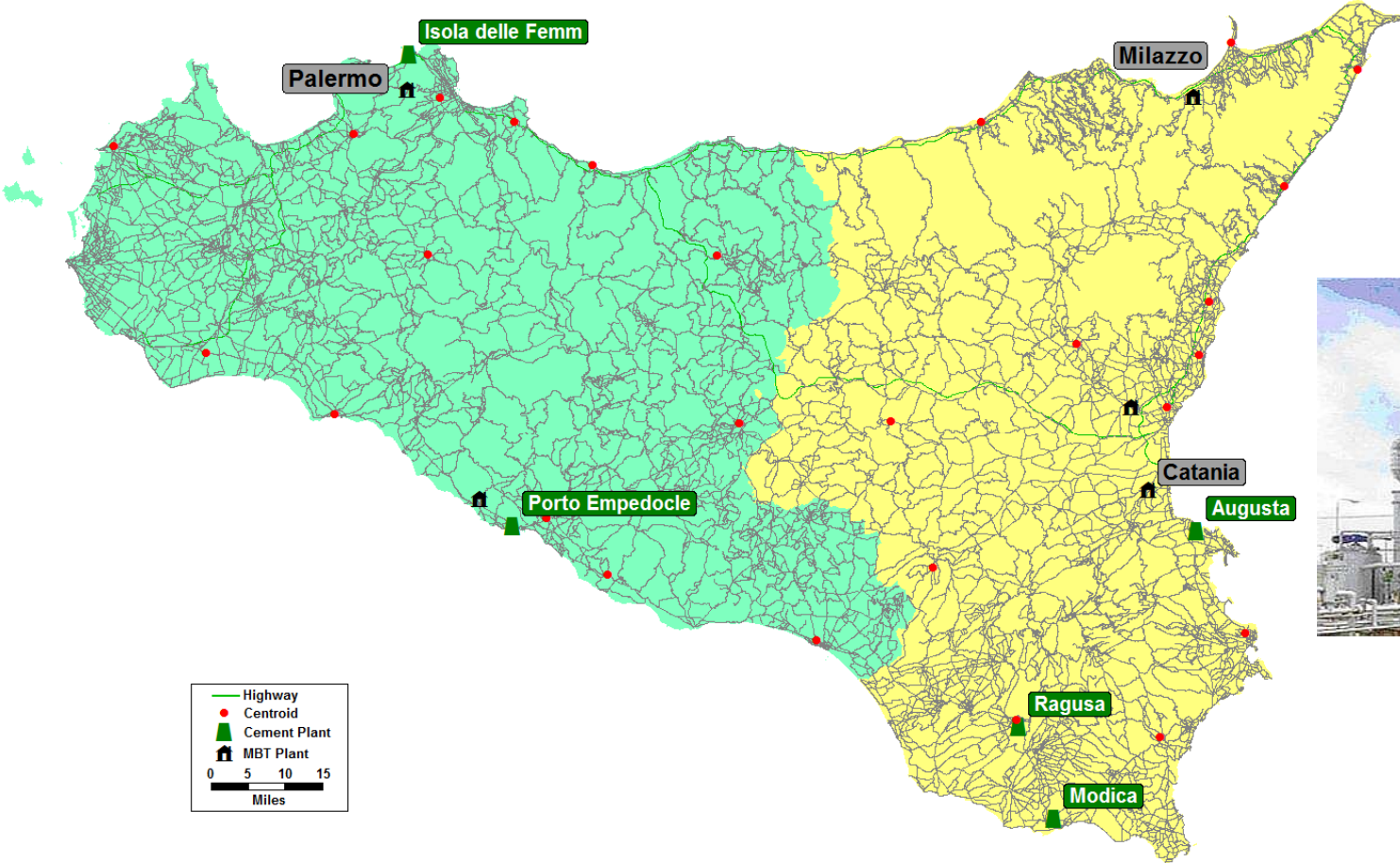
METHODOLOGY

Hypothesis of integrated waste management in Sicily

Scenario 4

50% of MSW \Rightarrow Mechanical Biological Treatment \Rightarrow RDF in cement plants (n. 5)

+
gasifiers (n. 3)



METHODOLOGY

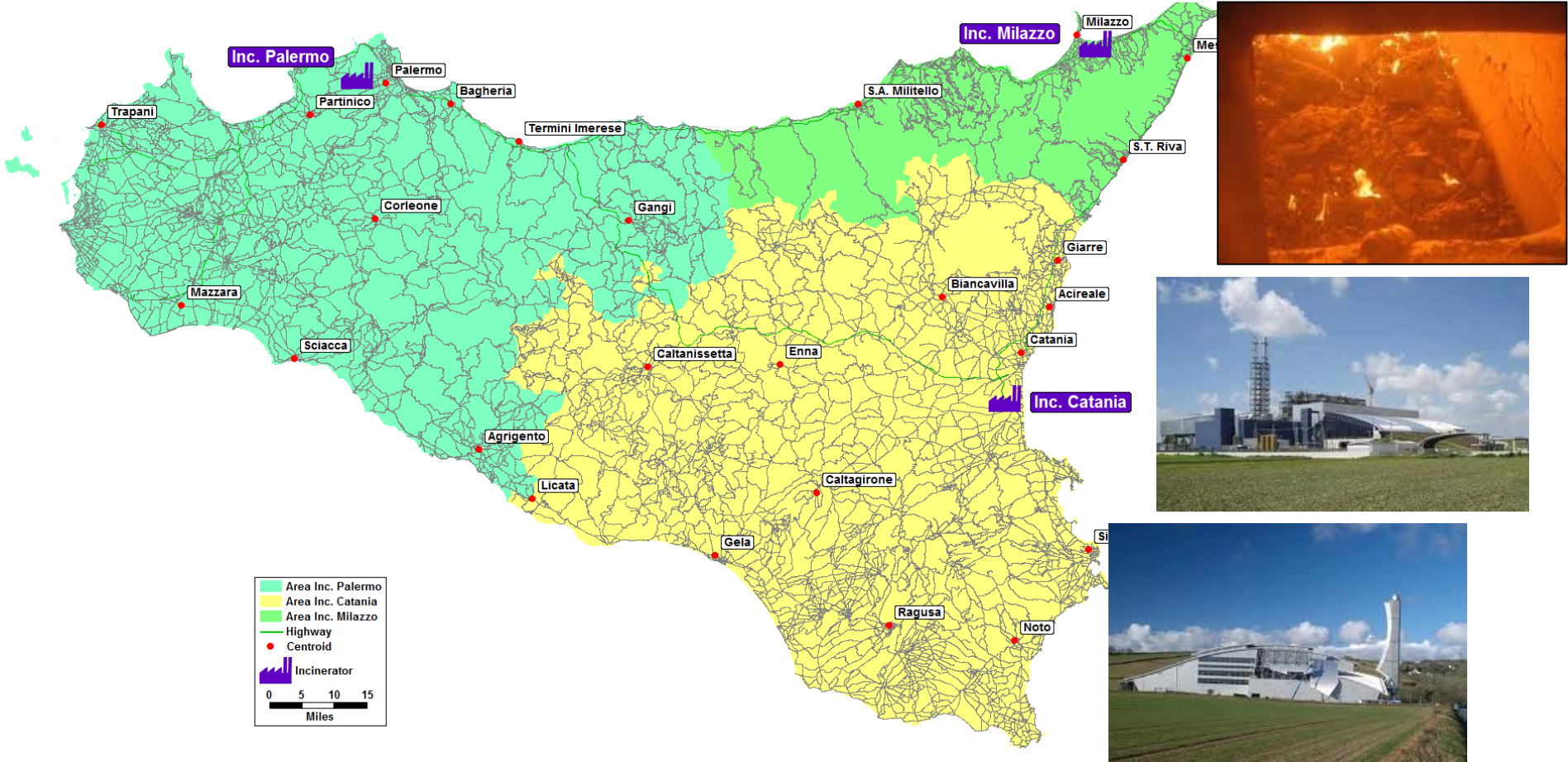
Hypothesis of integrated waste management in Sicily

Scenario 5

50% of MSW



Large Incinerators (n. 3)



METHODOLOGY

The procedure is based on a mathematical model running within a **GIS software platform**, able to include all relevant socio-economic and territorial data.

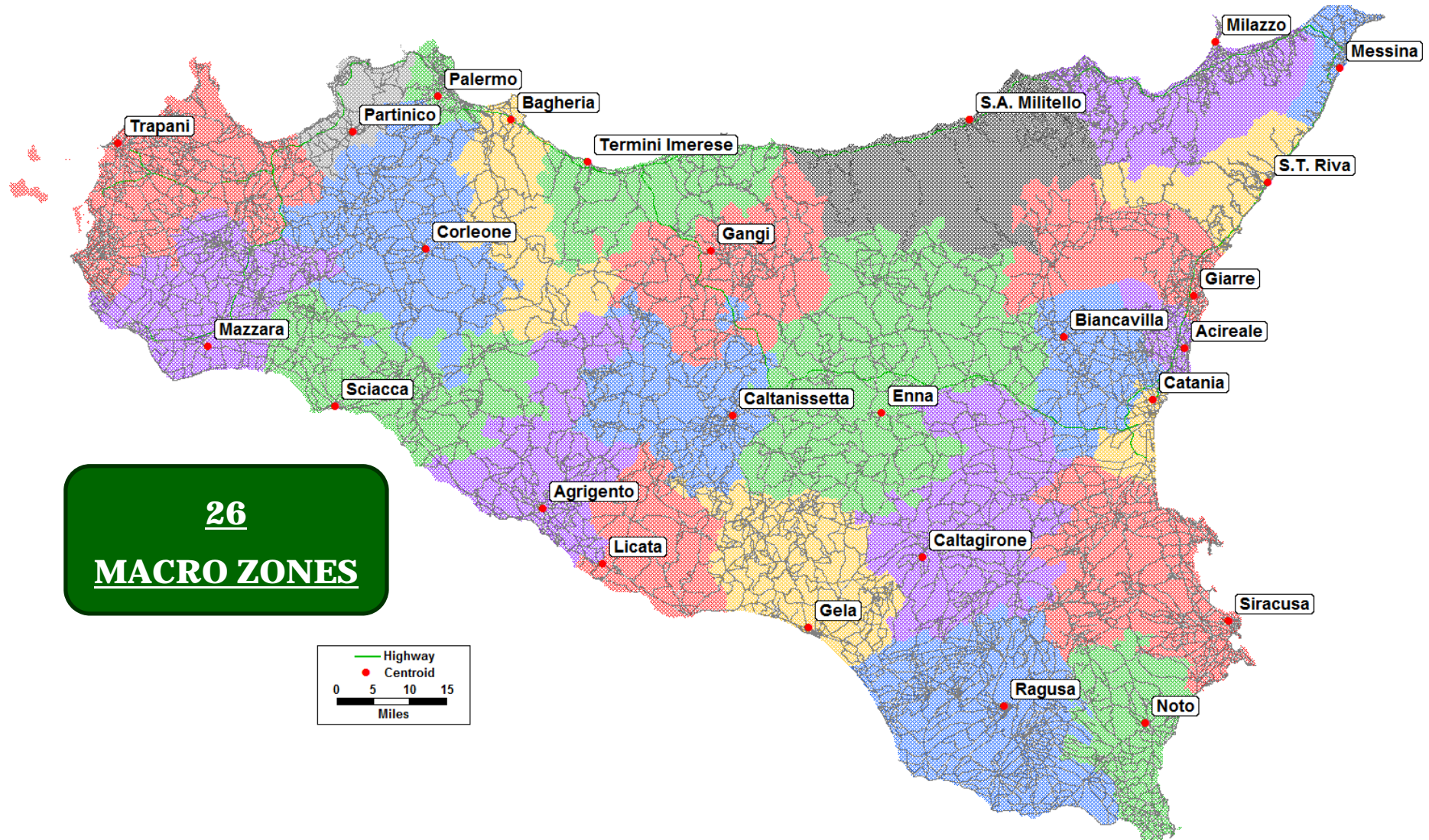


TransCad was used to develop a model that:

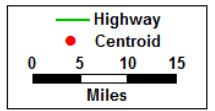
- combines **GIS** and **transportation modeling** capabilities in a single integrated platform;
- can create and customize maps, build and maintain geographic data sets, and perform many different types of spatial analysis.

METHODOLOGY

Zoning



26
MACRO ZONES



METHODOLOGY

TransCAD
Transportation Planning Software

File Edit Map Dataview Selection Tools Procedures Networks/Paths Route Systems Planning Transit Routing/Logistics Statistics Window Help

Stade

Statali

0 of 2477

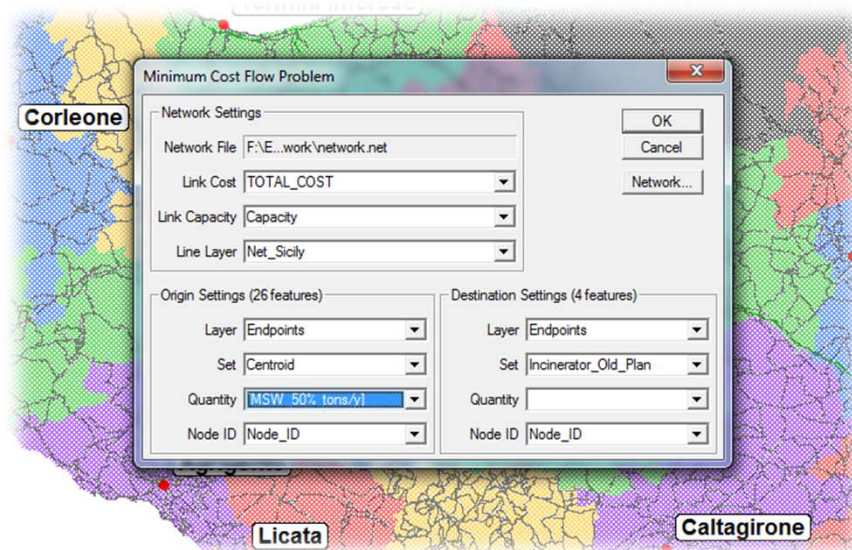
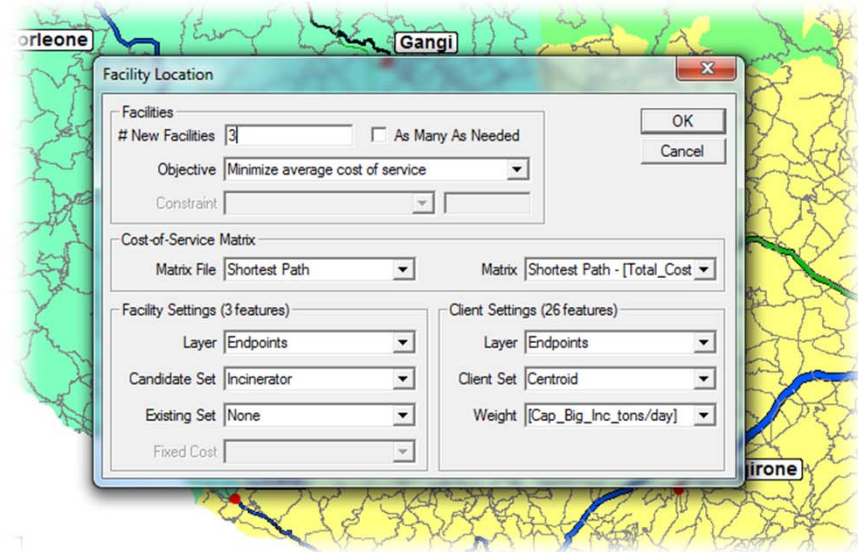
Display Manager

- Comuni
- Centri Urbani
- ATO
- Stade
 - No Label
 - Sets
 - Selection
 - No Label
 - Altre strade
 - No Label
 - Autostrade**
 - No Label
 - Provinciali
 - No Label
 - Statali
 - No Label
 - Endpoint

Map scale: 1 Centimeters = 8,171.70844 Meters (1:8) (15.795890, 36.712046) Network: q:\...scad\sicilia\network\network.net

METHODOLOGY

“Facility location”



“Minimum-cost flow”

METHODOLOGY

Definition of transportation cost

$$C_{Tr} = C_f + C_t + C_{pt} + C_{tm}$$

C_{Tr} = Cost of transportation

C_f = Fuel Cost

C_t = Tires Cost

C_{pt} = Property Tax

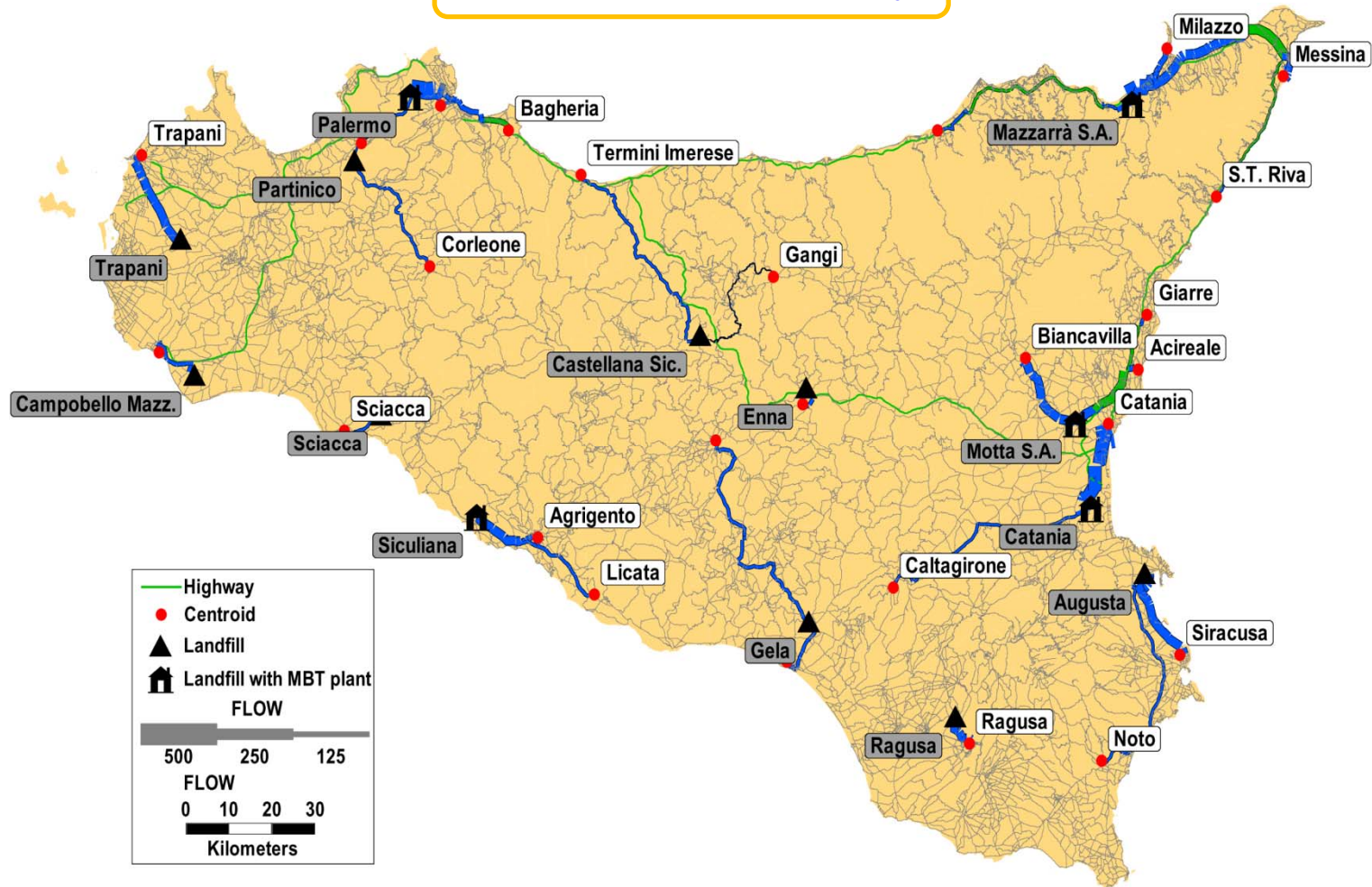
C_{tm} = Truck Maintenance Costs

Using the above specific costs and assuming and **average speeds** of 30 km/h in the urban road network and 55 km/h in the extra-urban road network, a **unit transportation cost** of 0.11 €/ton-km was estimated.

RESULTS AND DISCUSSION

Scenario 1

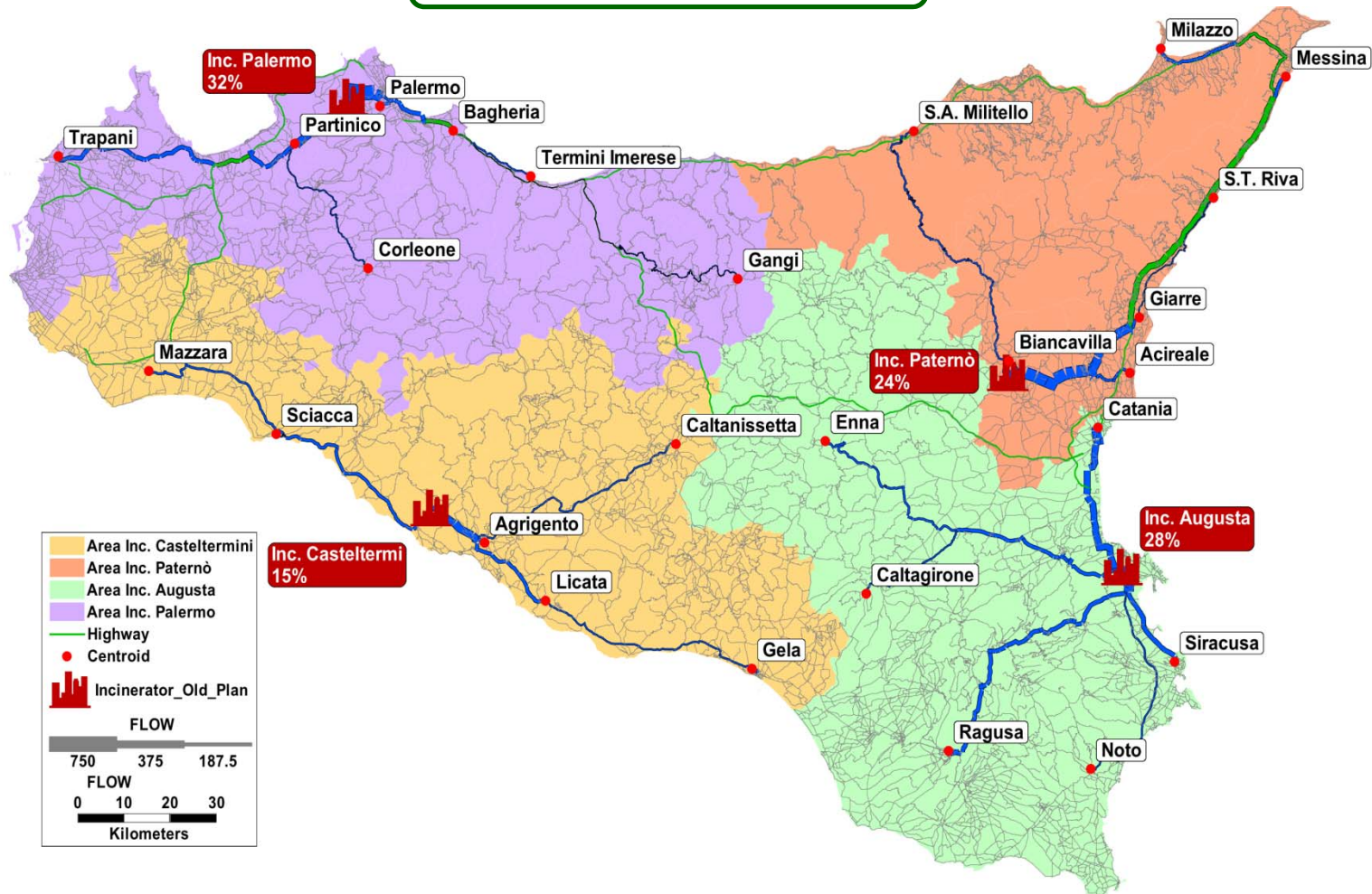
Total Cost: 7,951 €/day



RESULTS AND DISCUSSION

Scenario 2

Total Cost: 14,689 €/day



RESULTS AND DISCUSSION

Scenario 3a (1/2)

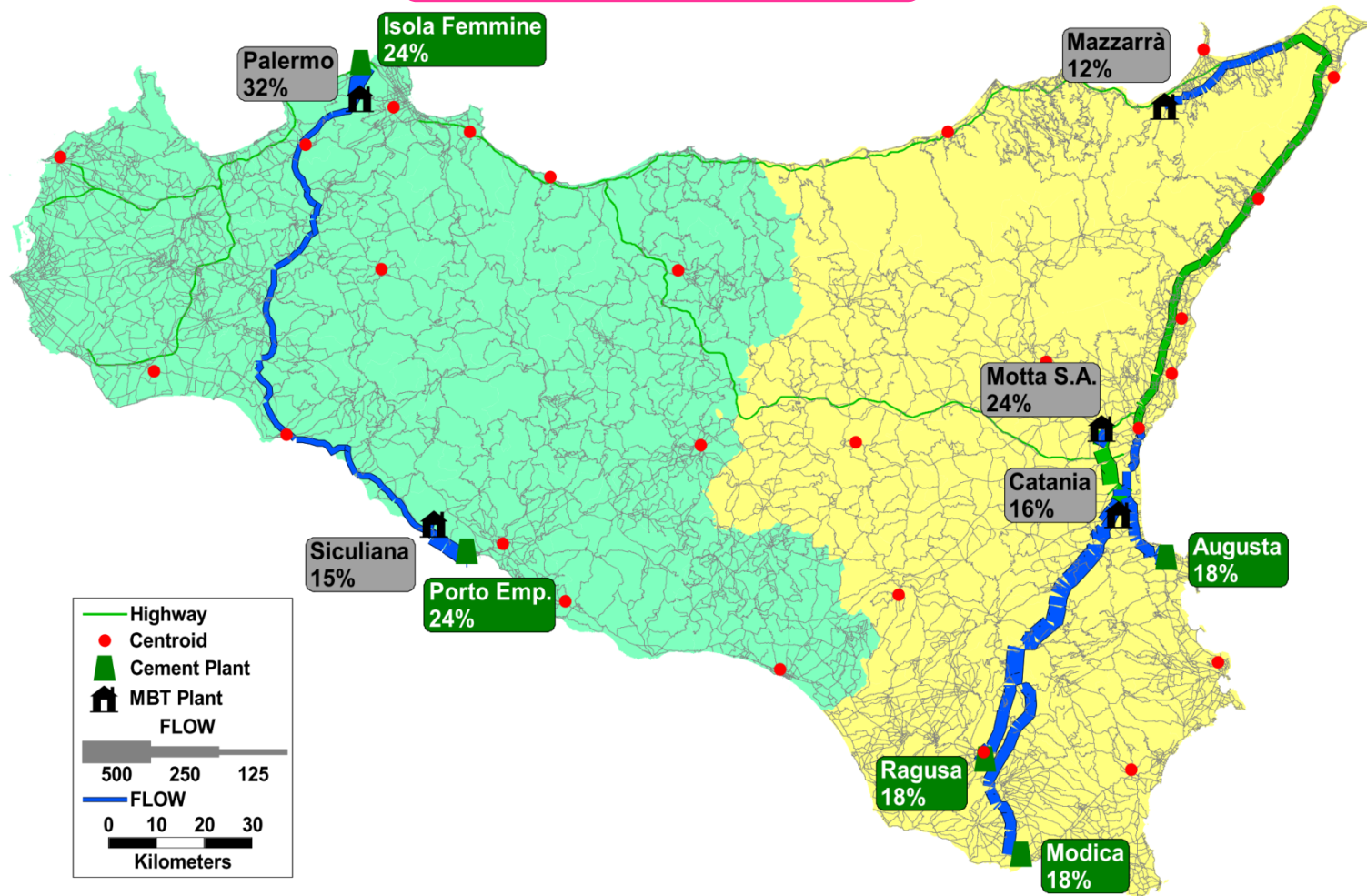
Total Cost: 11,992 €/day



RESULTS AND DISCUSSION

Scenario 3b (2/2)

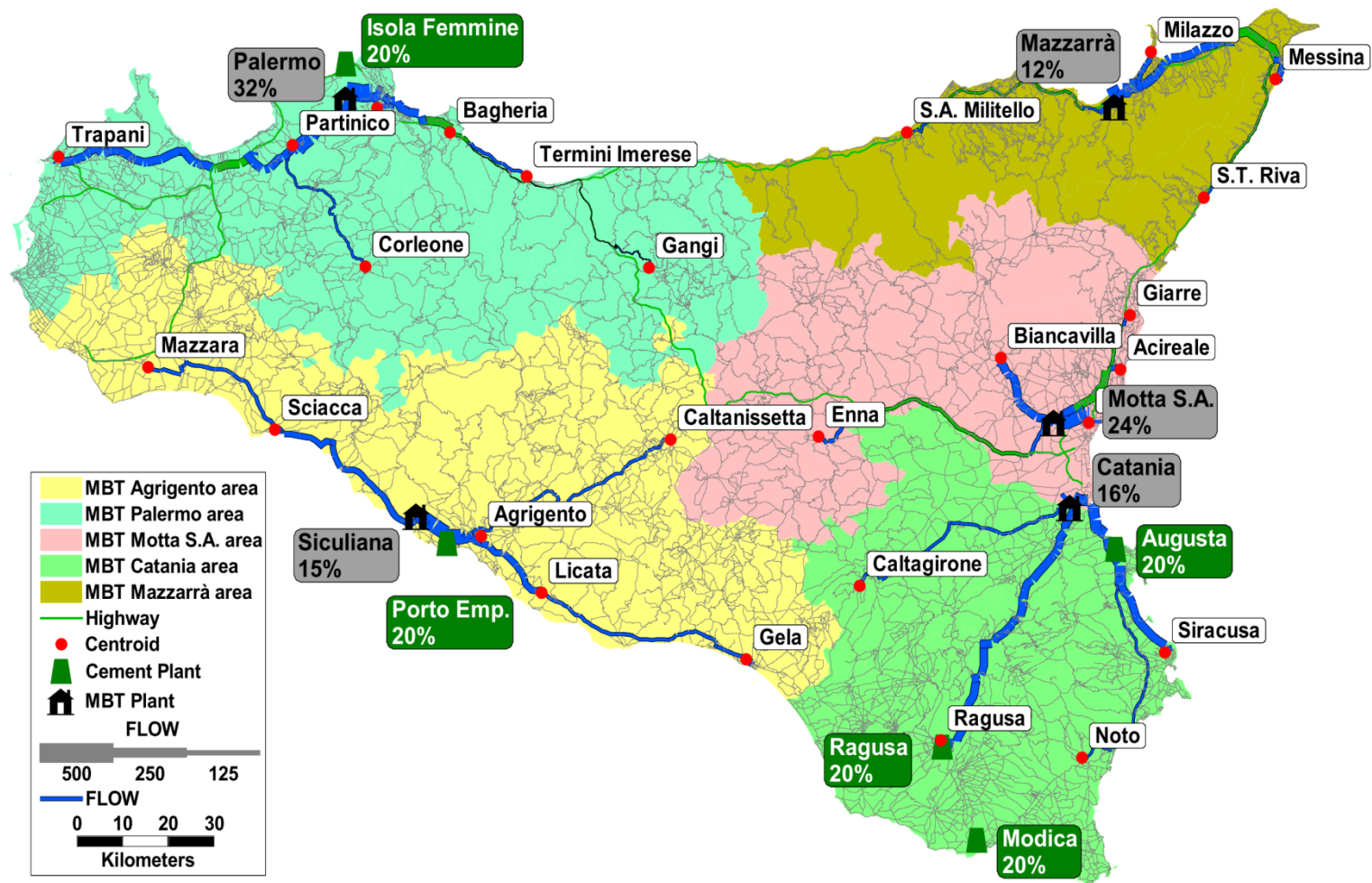
Total Cost: 9,529 €/day



RESULTS AND DISCUSSION

Scenario 4a (1/2)

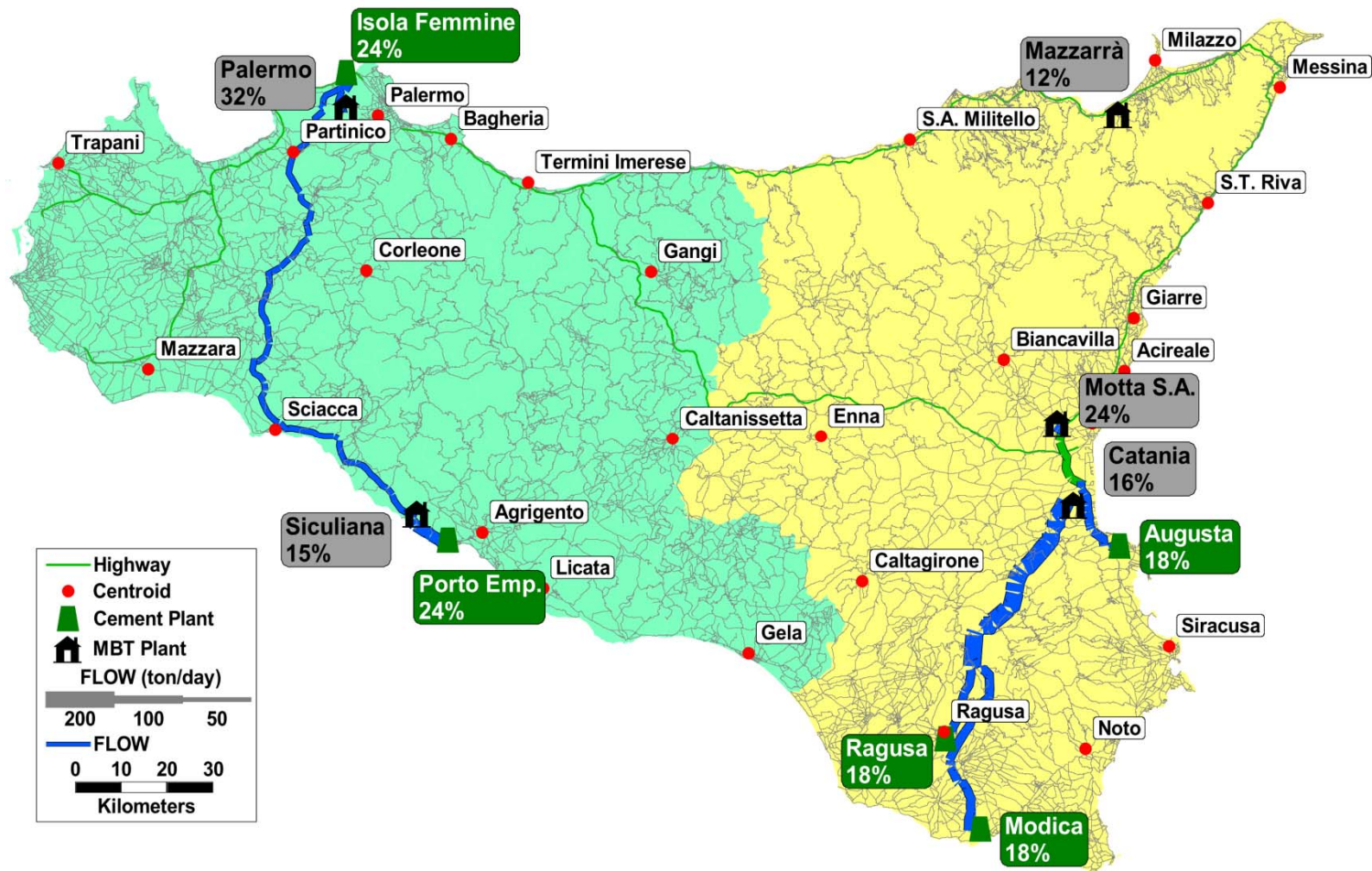
Total Cost: 11,992 €/day



RESULTS AND DISCUSSION

Scenario 4b (2/2)

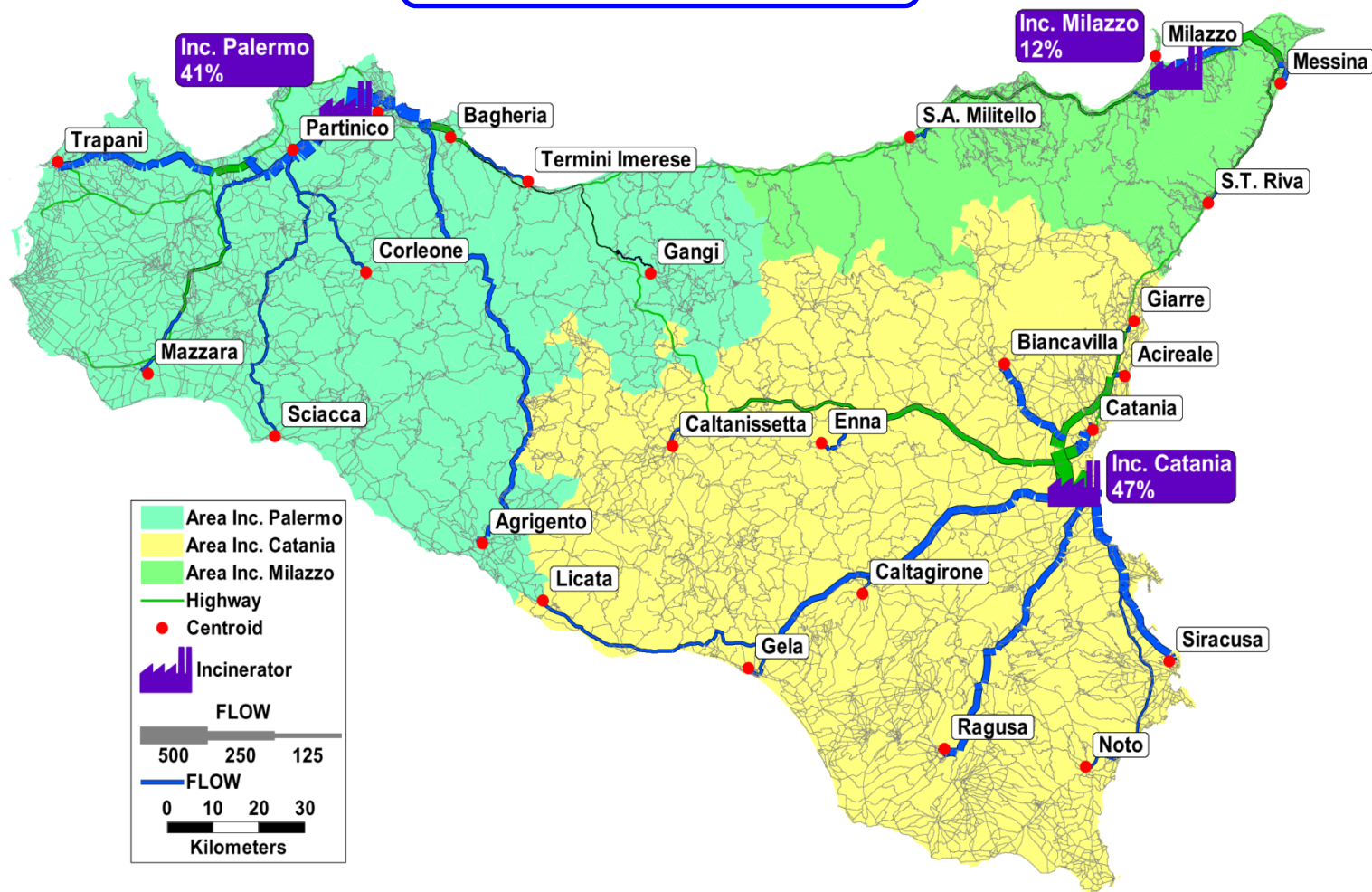
Total Cost: 3,049 €/day



RESULTS AND DISCUSSION

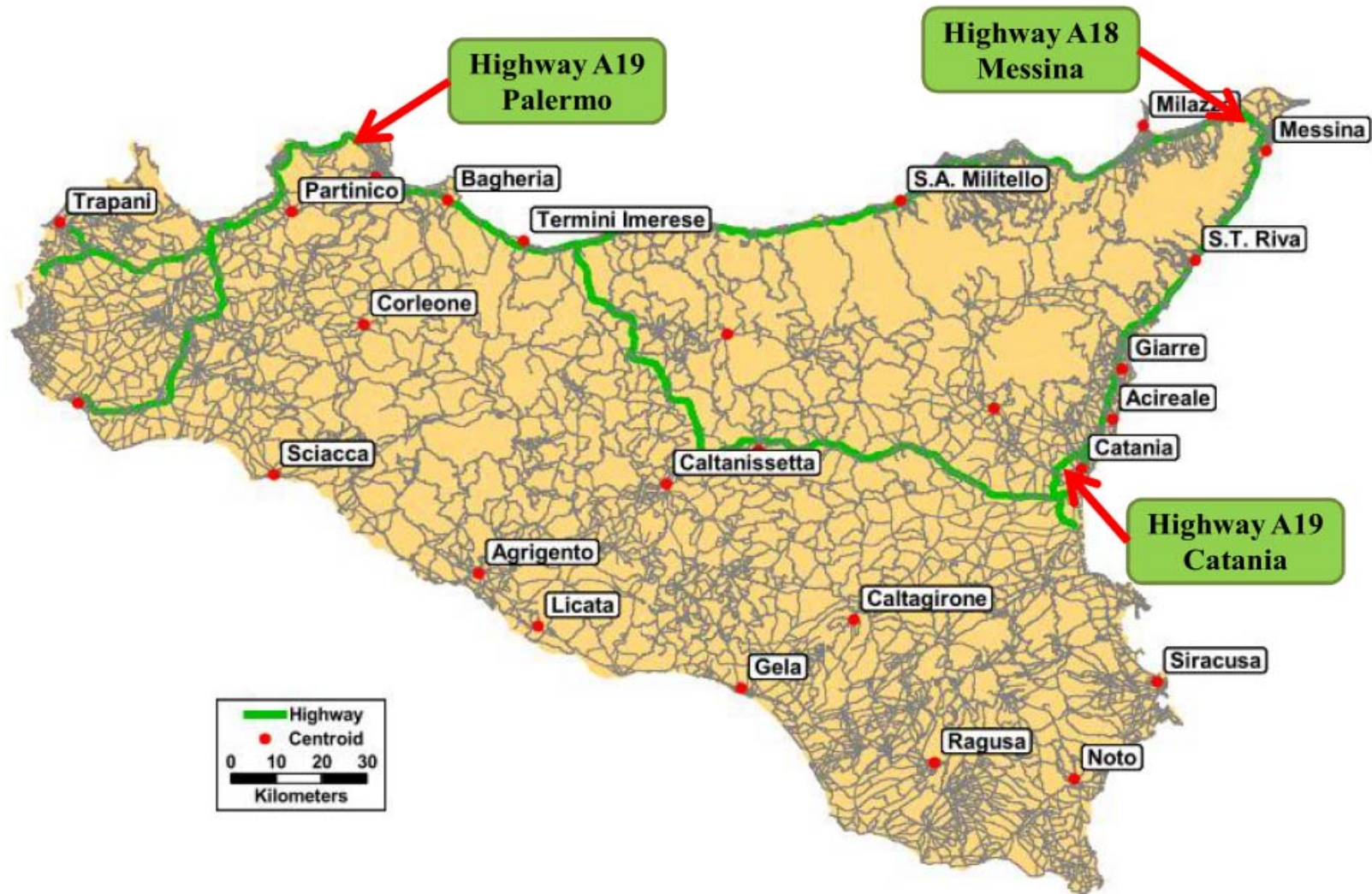
Scenario 5

Total Cost: 15,203 €

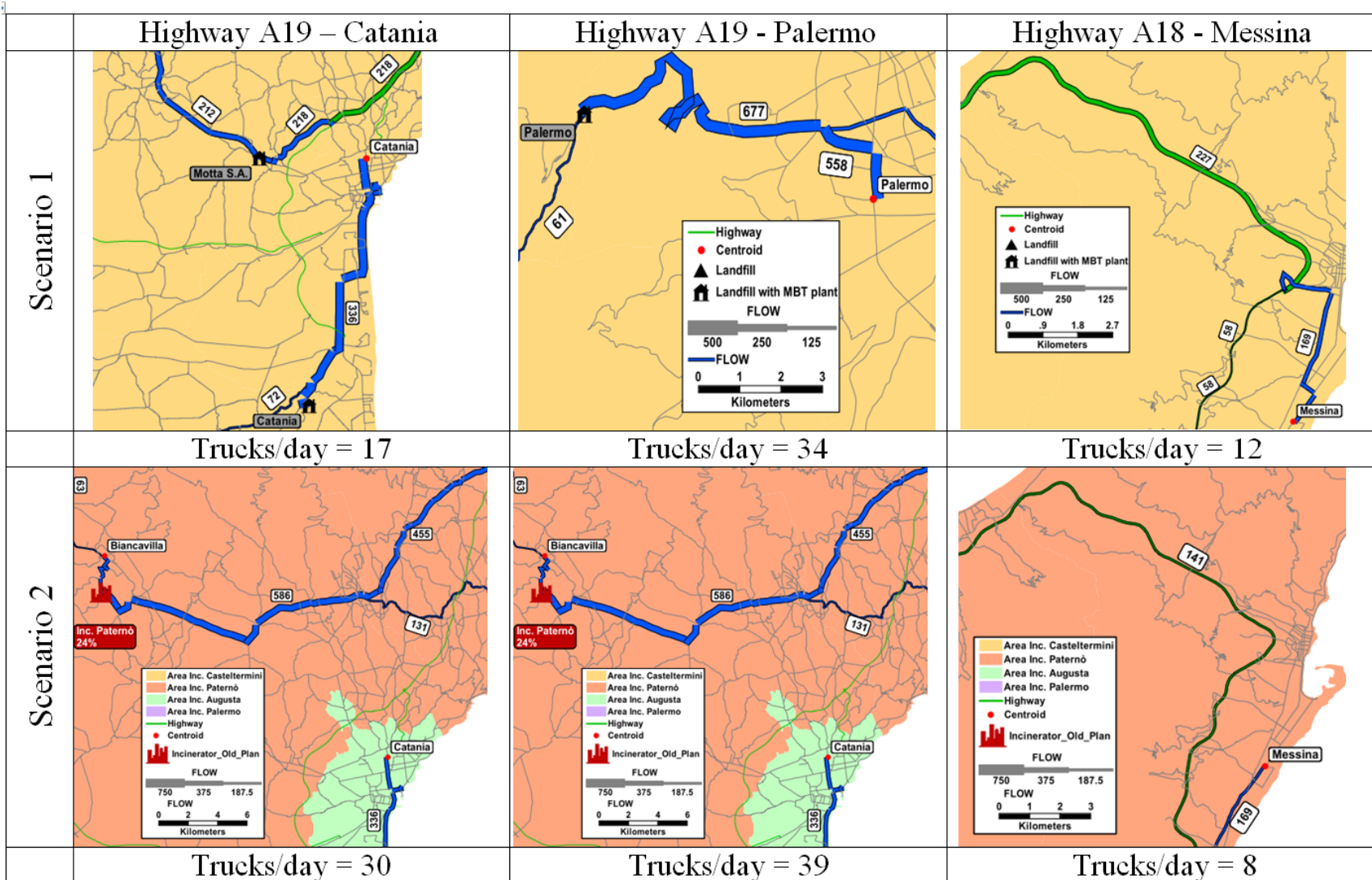


RESULTS AND DISCUSSION

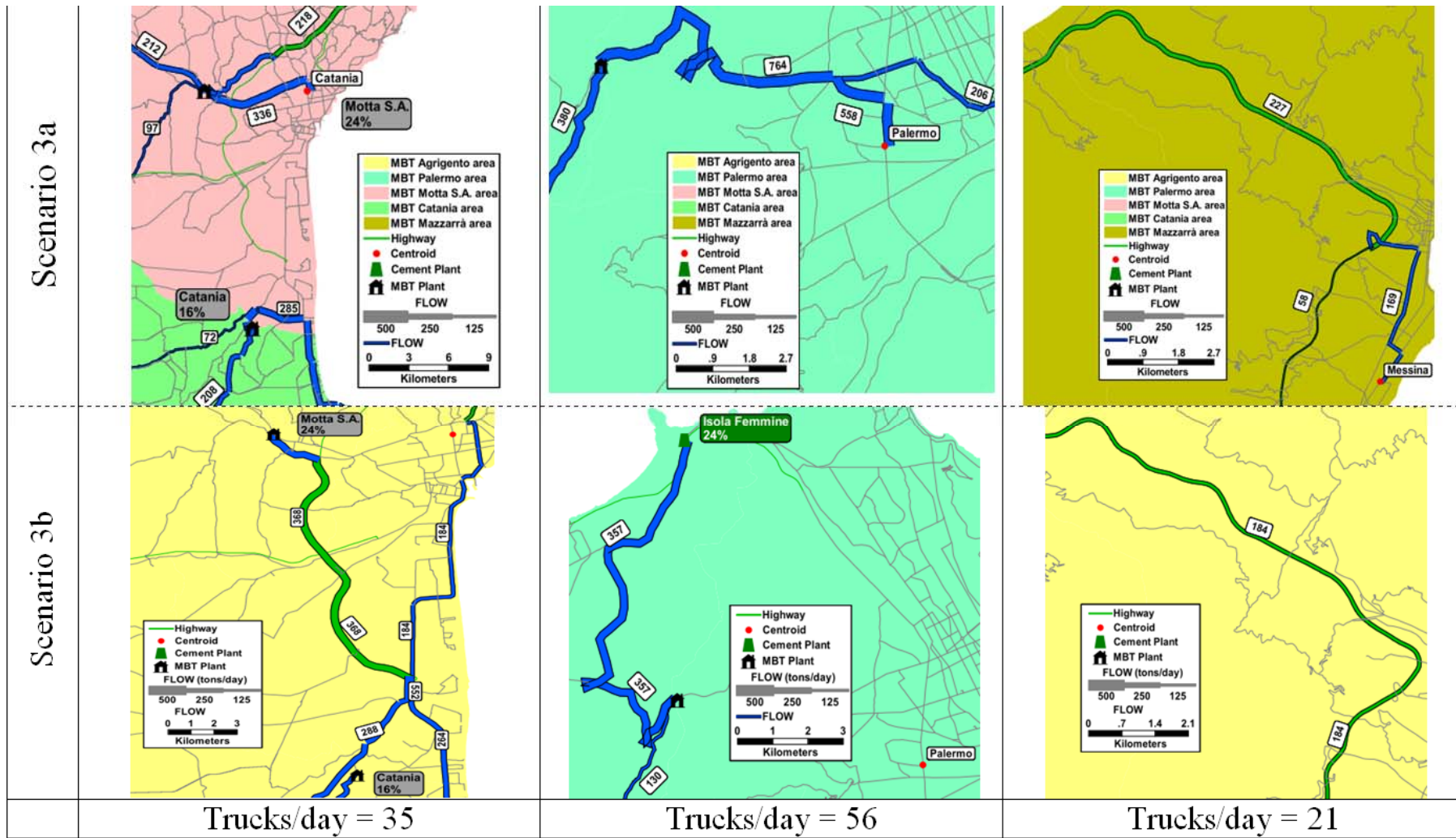
Three critical sections of the road network in Sicily



RESULTS AND DISCUSSION



RESULTS AND DISCUSSION



RESULTS AND DISCUSSION

Comparison of the number of truck/day due to the waste transportation in three critical sections of road network in Sicily for all the investigated scenarios

	Highway A19 – Catania (truck/day)	Highway A19 – Palermo (truck/day)	Highway A18 – Messina (truck/day)
Scenario 1	17	34	12
Scenario 2	30	39	8
Scenario 3a+3b	35	56	21
Scenario 4a+4b	28	46	12
Scenario 5	47	45	11

RESULTS AND DISCUSSION

Comparison of the number of truck/day due to the waste transportation in three critical sections of road network in Sicily for all the investigated scenarios

	Highway A19 – Catania (truck/day)	Highway A19 – Palermo (truck/day)	Highway A18 – Messina (truck/day)
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Scenario 2	30	39	8
Scenario 3a+3b	35	56	21
Scenario 4a+4b	28	46	12
Scenario 5	47	45	11

Scenario 1: **63 truck/day**

lower number of “truck per day”

less impacting on traffic

do not fulfill European Union guidelines

RESULTS AND DISCUSSION

Comparison of the number of truck/day due to the waste transportation in three critical sections of road network in Sicily for all the investigated scenarios

	Highway A19 – Catania (truck/day)	Highway A19 – Palermo (truck/day)	Highway A18 – Messina (truck/day)
Scenario 1	17	34	12
Scenario 2	30	39	8
Scenario 3a+3b	35	56	21
Scenario 4a+4b	28	46	12
Scenario 5	47	45	11

Scenario 2: 77 truck/day

low impact on traffic flow

not accepted by public opinion

RESULTS AND DISCUSSION

Comparison of the number of truck/day due to the waste transportation in three critical sections of road network in Sicily for all the investigated scenarios

	Highway A19 – Catania (truck/day)	Highway A19 – Palermo (truck/day)	Highway A18 – Messina (truck/day)
Scenario 1	17	34	12
Scenario 2	30	39	8
Scenario 3a+3b	35	56	21
Scenario 4a+4b	28	46	12
Scenario 5	47	45	11

Scenario 3: 112 truck/day

the higher impact on traffic flow

the more cost-effective than the other scenarios

RESULTS AND DISCUSSION

Comparison of the number of truck/day due to the waste transportation in three critical sections of road network in Sicily for all the investigated scenarios

	Highway A19 – Catania (truck/day)	Highway A19 – Palermo (truck/day)	Highway A18 – Messina (truck/day)
Scenario 1	17	34	12
Scenario 2	30	39	8
Scenario 3a+3b	35	56	21
Scenario 4a+4b	28	46	12
Scenario 5	47	45	11

Scenario 4: **86 truck/day**

the impact on traffic flow drops considerably

RESULTS AND DISCUSSION

Comparison of the number of truck/day due to the waste transportation in three critical sections of road network in Sicily for all the investigated scenarios

	Highway A19 – Catania (truck/day)	Highway A19 – Palermo (truck/day)	Highway A18 – Messina (truck/day)
Scenario 1	17	34	12
Scenario 2	30	39	8
Scenario 3a+3b	35	56	21
Scenario 4a+4b	28	46	12
Scenario 5	47	45	11

Scenario 5: 103 truck/day

Traffic flows moderately high

SOME CONCLUSIONS

To eliminate the costs to build up incinerators (scenarios 2 and 5), scenarios 3 and 4 are the more suitable. In particular **scenario 4**, consisting into addressing and treating the remaining 50% of MSW in five MBT plants and the RDF, here produced, then disposed to the existing cement plants in Sicily and in three gasifier (located in Palermo, Catania and Milazzo), is the least impacting on the road traffic.

However transportation costs and impacts issues appears to be less important if other factors (energy efficiency, emissions, overall costs) are included in a holistic evaluation of the future waste management in Sicily. **Scenario 5** gain importance.

Transportation issues are not so critical compared to treatment and disposal issues

the unsustainable present



wastewater



WASTE



Mechanical separation

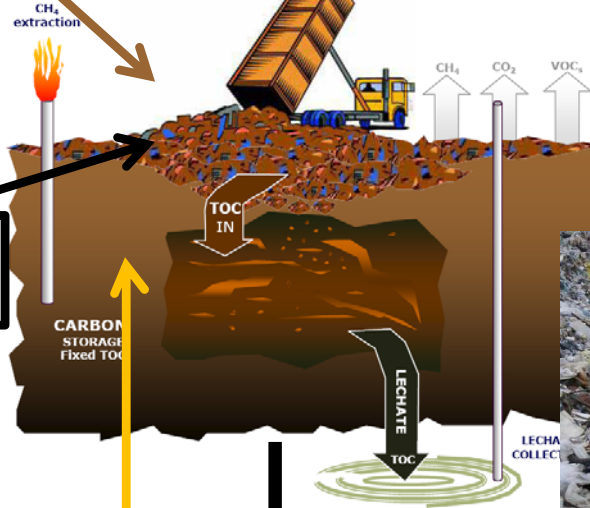
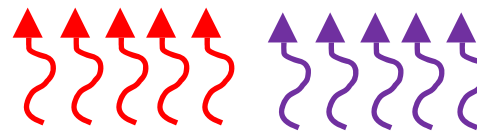
Dry waste

sludge

Air pollution

CO₂

CH₄



“Organic” waste

Water bodies pollution



The sustainable future???



Last news from Italy



The Italian political landscape was reshaped this month as two candidates from the anti-establishment [Five Star Movement](#) (M5S) were elected to lead the cities of Rome and Turin, presenting a direct challenge to the centre-left prime minister, Matteo Renzi.

The same happened in all the runoff ballots in Sicily

Italy's Five Star Movement now has to translate protest into problem-solving





MANIFESTAZIONE Viale Herghele in via degli Psalotti MORALITÀ MOI TUTTI



North of Italy (Verona)



North of Italy (Verona)



Sicily (large cities)... Catania



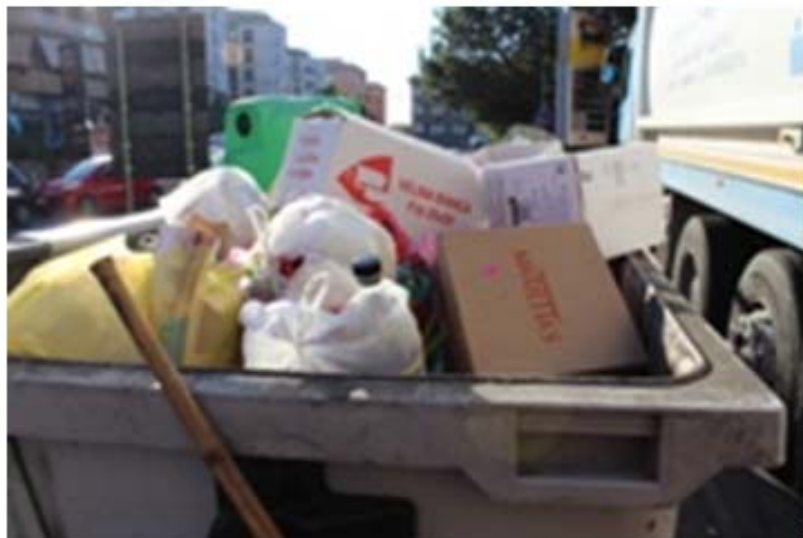
Sicily (large cities)... Catania



Sicily (large cities)... Catania



Sicily (large cities)... Catania



Sicily (large cities)... Catania



Sicily (large cities)... Catania



The everlasting Match: Incineration Versus Recycling



Ignorance and rigidity cause..... zero discussion

Incinirators?
NEVER

WTE or death....Your
death

Zero
waste

Zero brain



“miraculous” solutions.... for urban wastes???...in Sicily???

Molecular dissociation



pyrolysis



gasification



....and why not plasma??



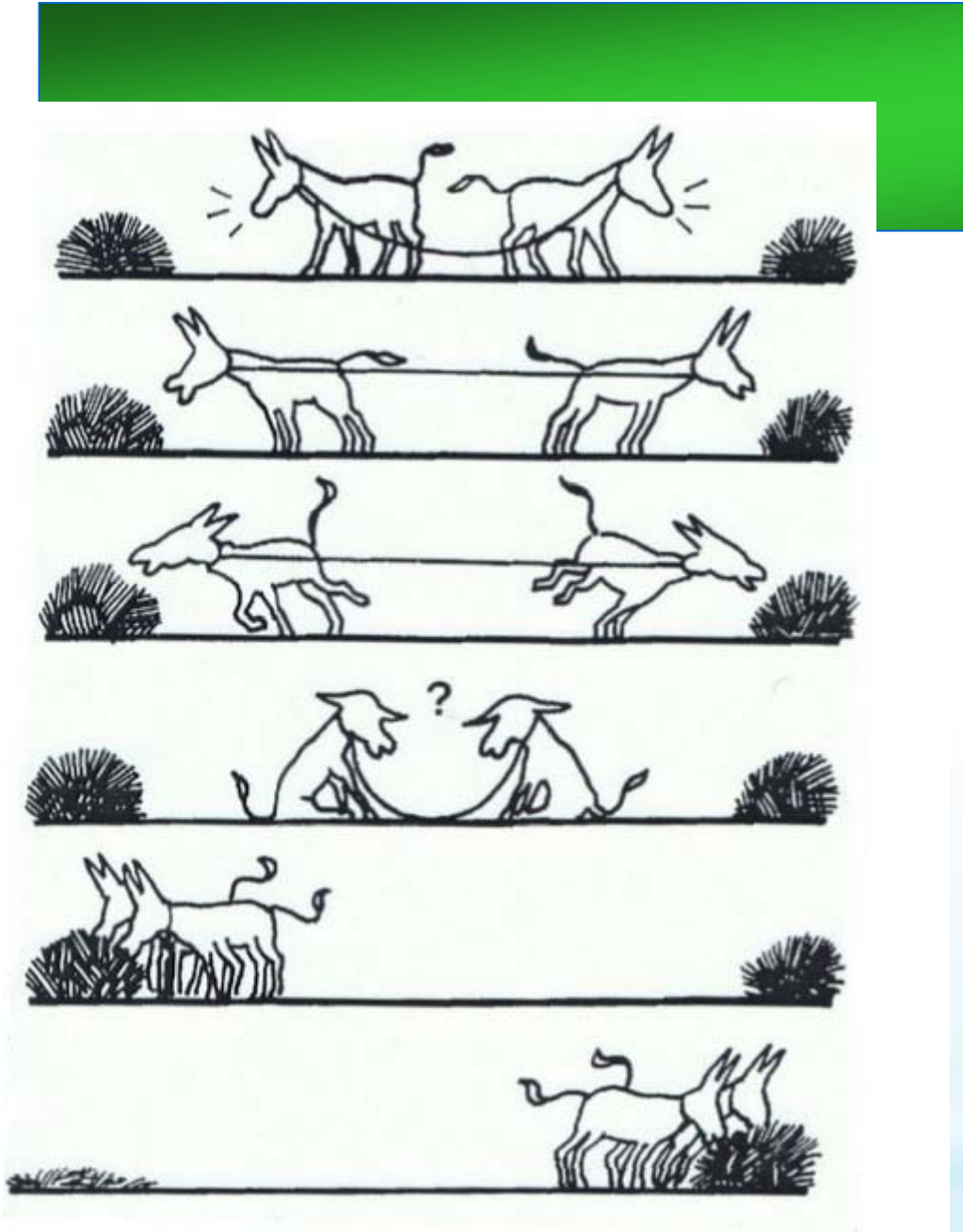
The risks for the region



www.dailym.com - 06THYU

The risks for the region





Thanks for your attention

