



The APICE outcomes in Venice pilot area

ARPA Veneto and Veneto Region/CORILA

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E. Gissi

Final conference - Venice, 8th November 2012

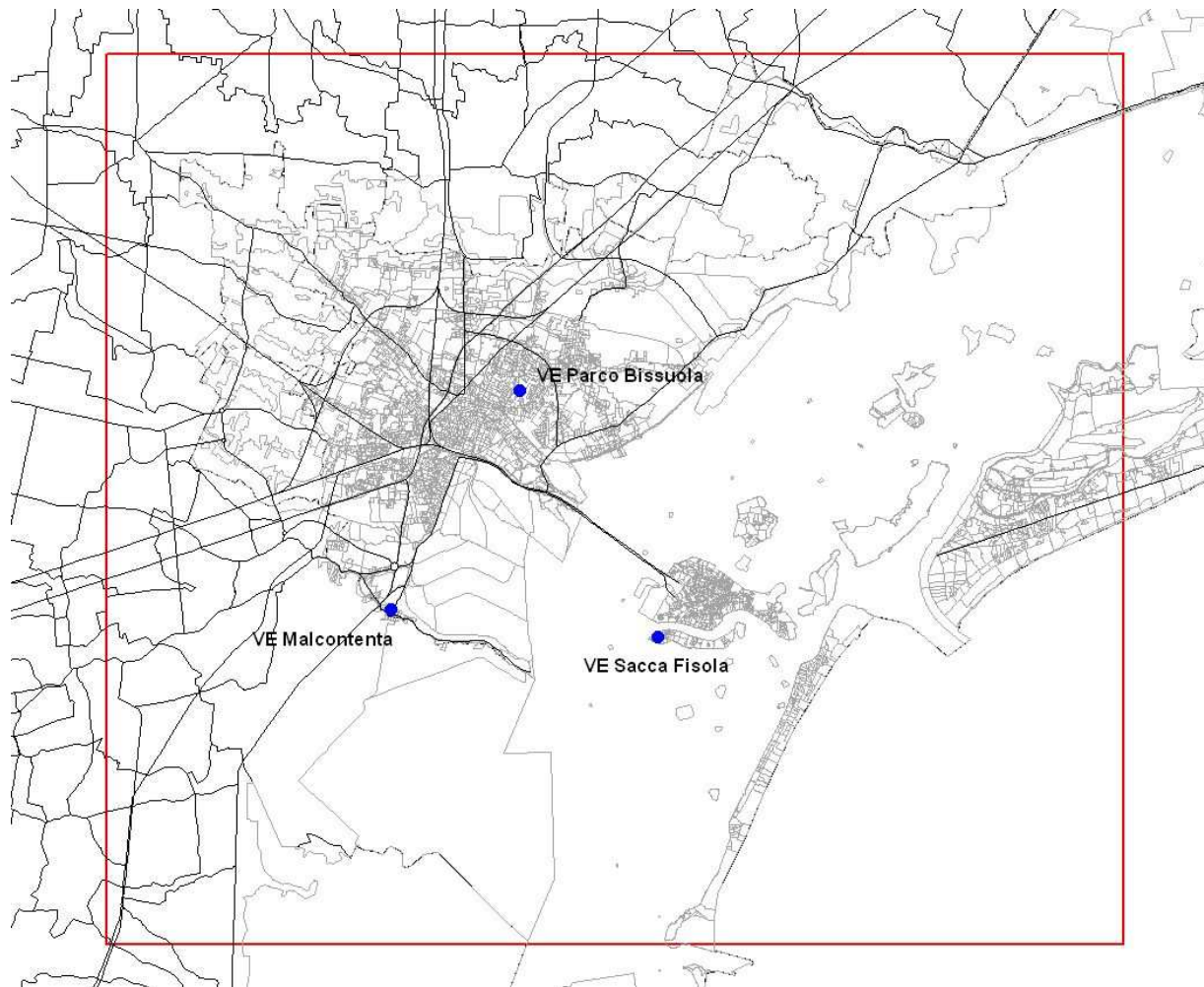




APICE roadmap

1. Long monitoring campaign (PM2.5 chemical speciation)
2. Semi Volatile Organic Compounds analysis
3. PMF application on the air quality database
4. Regional and local emission inventories
5. Bottom up emission inventory for port activities
6. CTM implementation and SA analysis for a summer and a winter scenario
7. 2020 emission projection and CTM simulation
8. 2020 emission mitigation scenario and CTM simulation

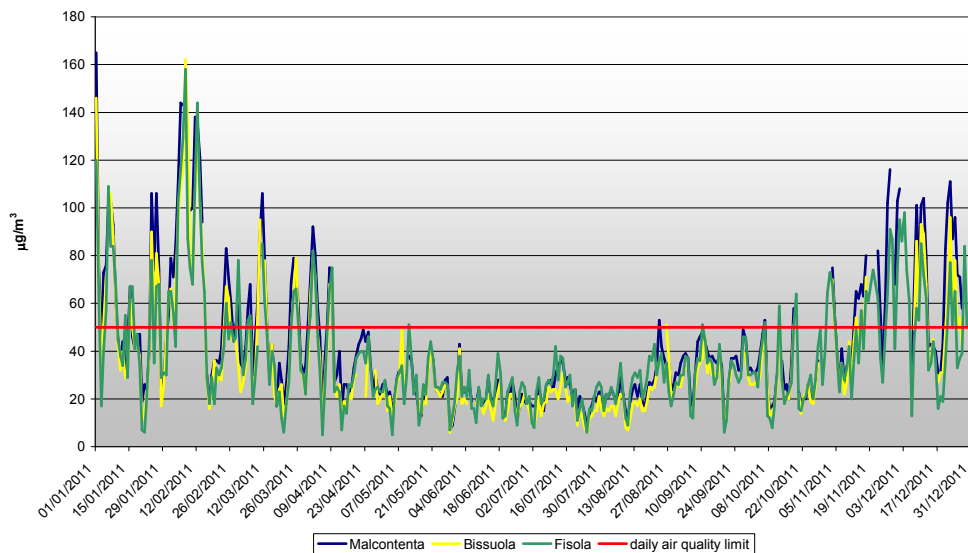
Long monitoring campaign: some results



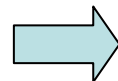
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Long monitoring campaign: some results

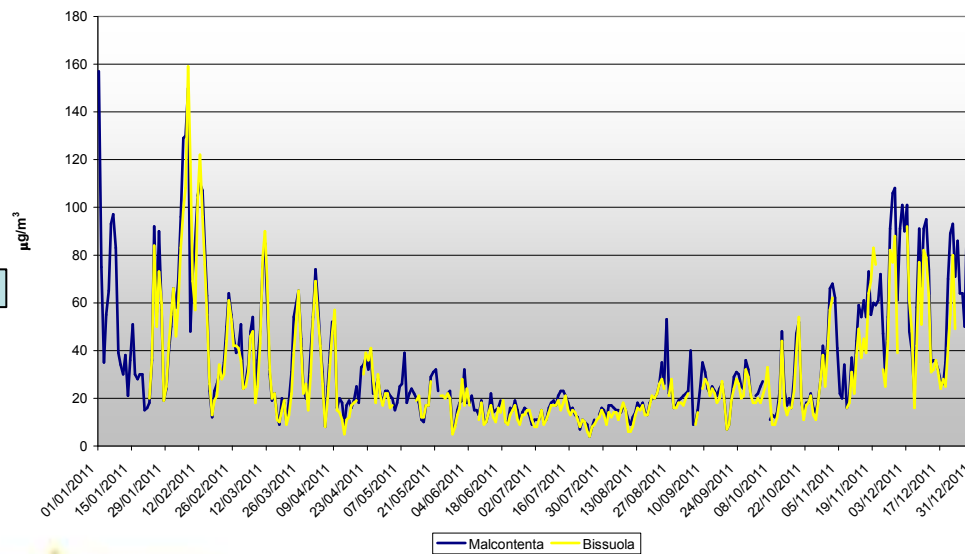
PM10 - 2011 daily concentrations



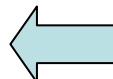
very high winter daily PM levels, with very frequent exceedances of the 50 $\mu\text{g}/\text{m}^3$ daily threshold for the protection of human health



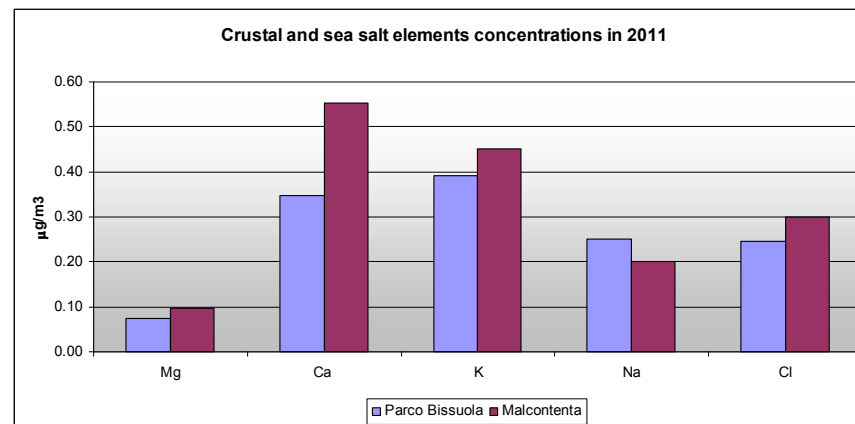
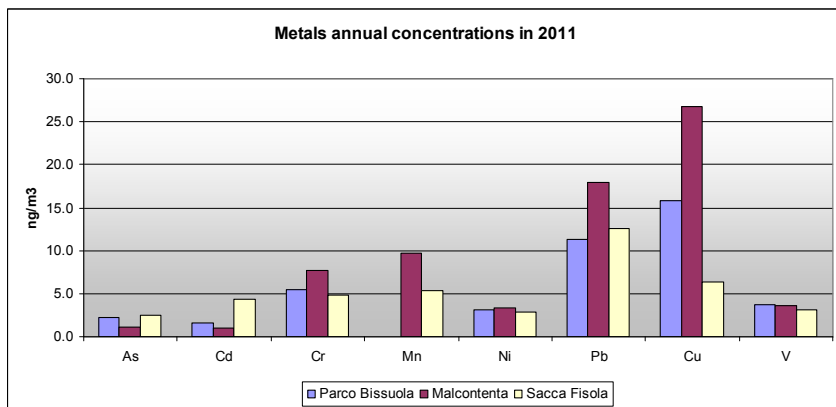
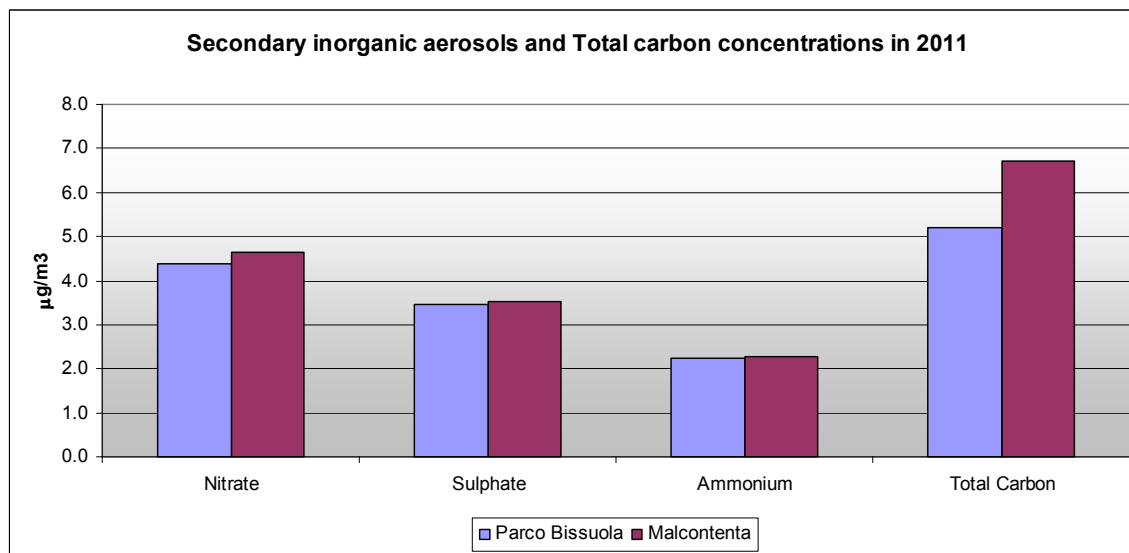
PM2.5 - 2011 daily concentrations



very high PM2.5/PM10 ratio, especially in winter time



Long monitoring campaign: some results



Semivolatile Organics Monitoring

Emitted within combustion gases then condensed on PM

More than 100 semivolatile compounds tracked
without sample preparation (quantified or estimated)
then selected (65) and grouped for PMF as:

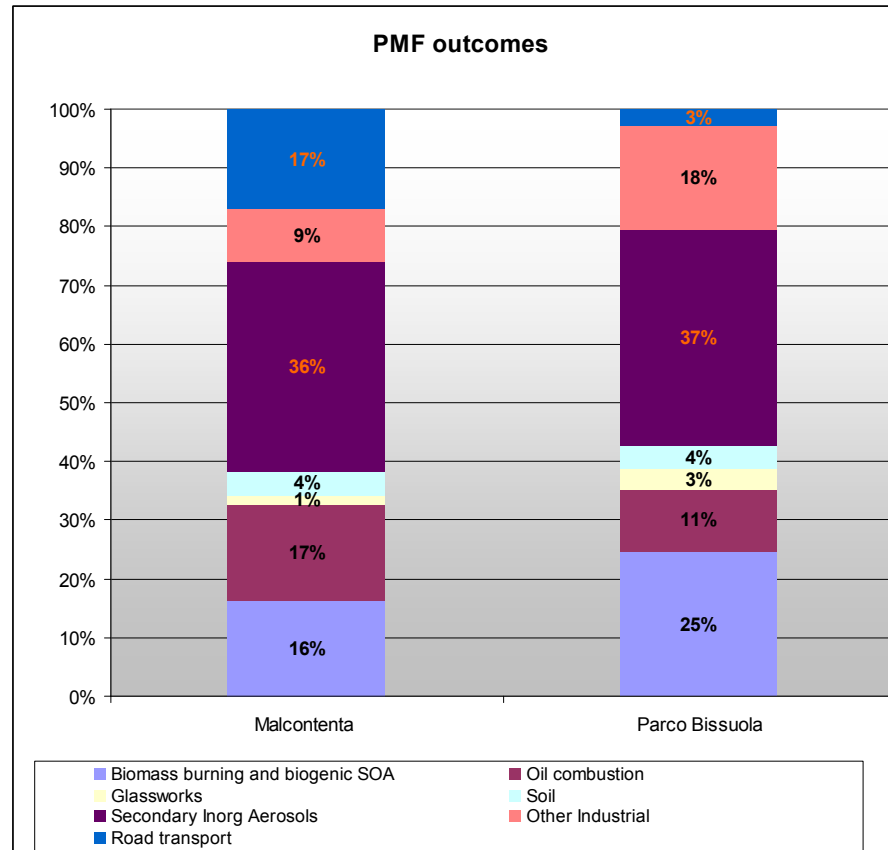
- ALK Alkanes (linear hydrocarbons 17- 40 carbon atoms)
- PAH Polycyclic Aromatic Hydrocarbons (up to 6 rings)
- HOPA Hopanes (biomarkers, from oil and lubricants)
- BBT Biomass Burning Tracers (high molecular weight)

**SVOC seasonal average concentrations [ng/m³]
267 days of synchronous samples
(warm season March 21st – September 20th)**

Cold season ng/m ³	ALK	PAH	HOPA	BBT
URBAN bckgnd	19.4	5.7	4.4	5.1
INDUSTRIAL bckgnd	26.4	8.2	6.9	8.2

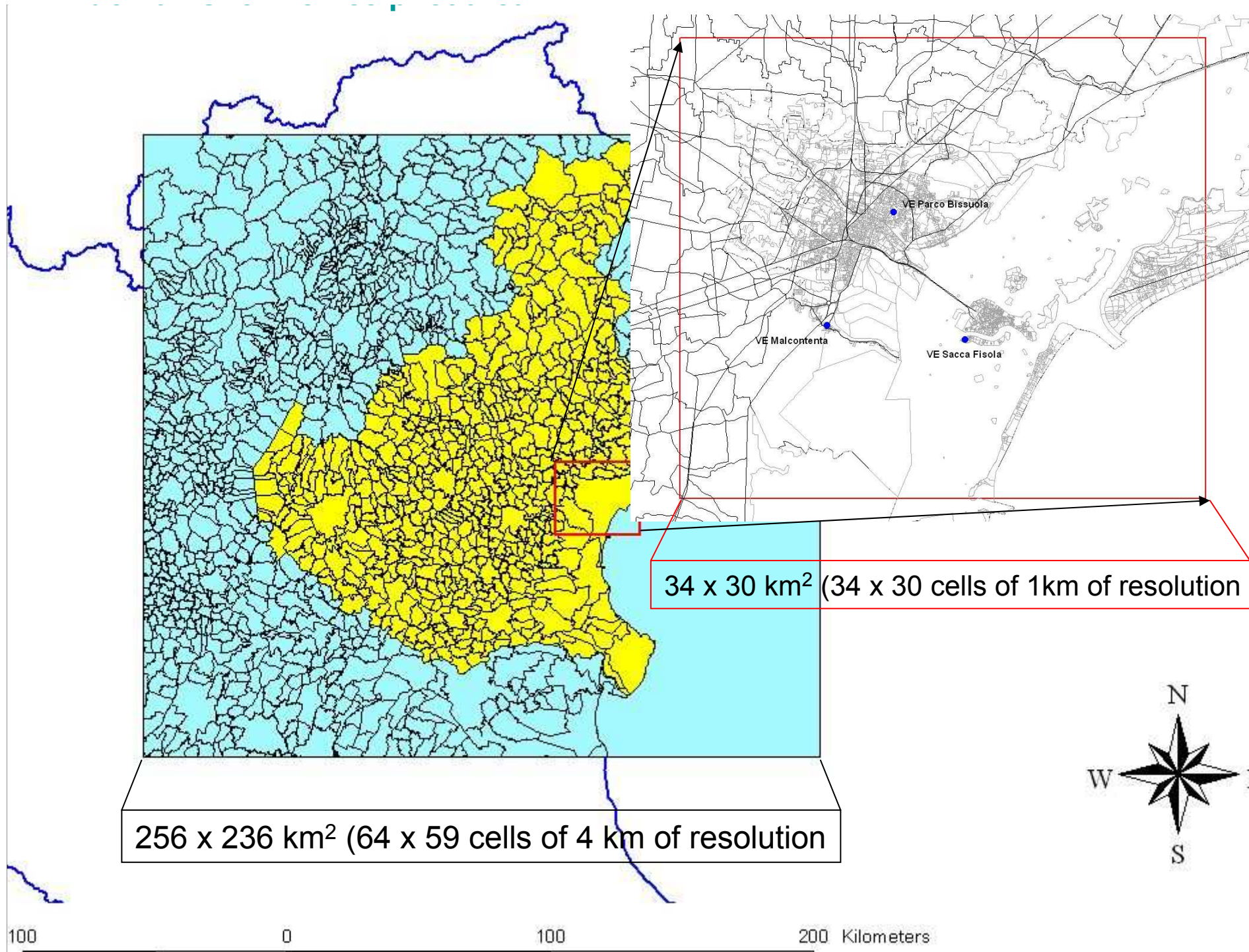
Warm season ng/m ³	ALK	PAH	HOPA	BBT
URBAN bckgnd	8.5	0.3	1.4	0.5
INDUSTRIAL bckgnd	8.5	0.5	2.1	0.6

PMF source apportionment of PM annual concentration



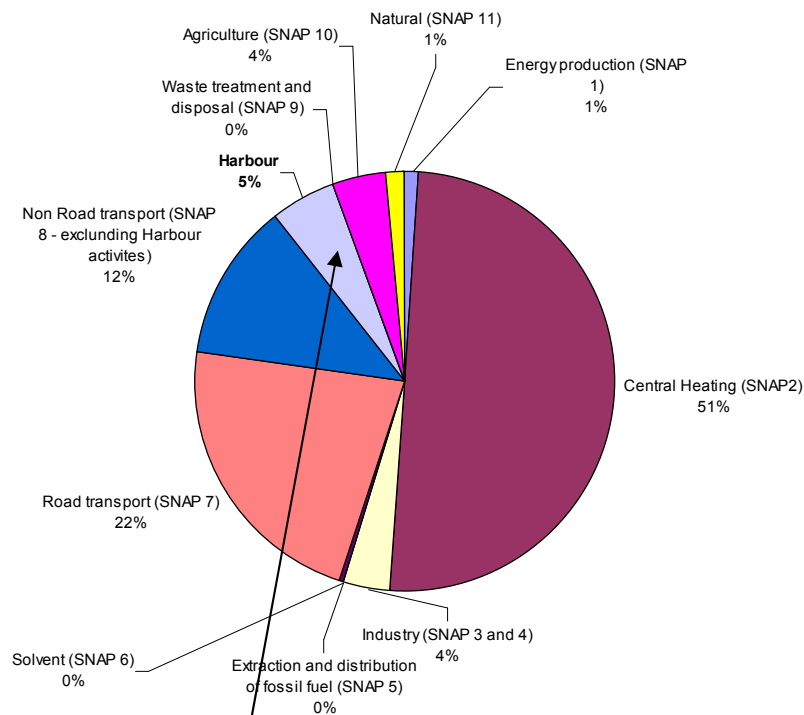
provided by
UNIGE

SA from oil combustion tracer	Annual
Malcontenta	17%
Parco Bissuola	11%
Sacca Fisola	13%

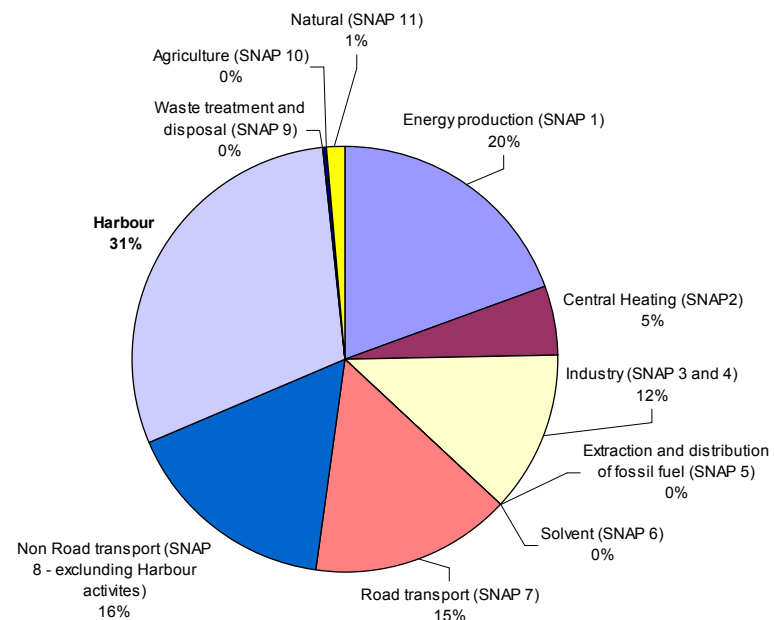


APICE emissions database for the present scenario – 2011 projection

PM2.5 emission - Veneto Region 2011 projection



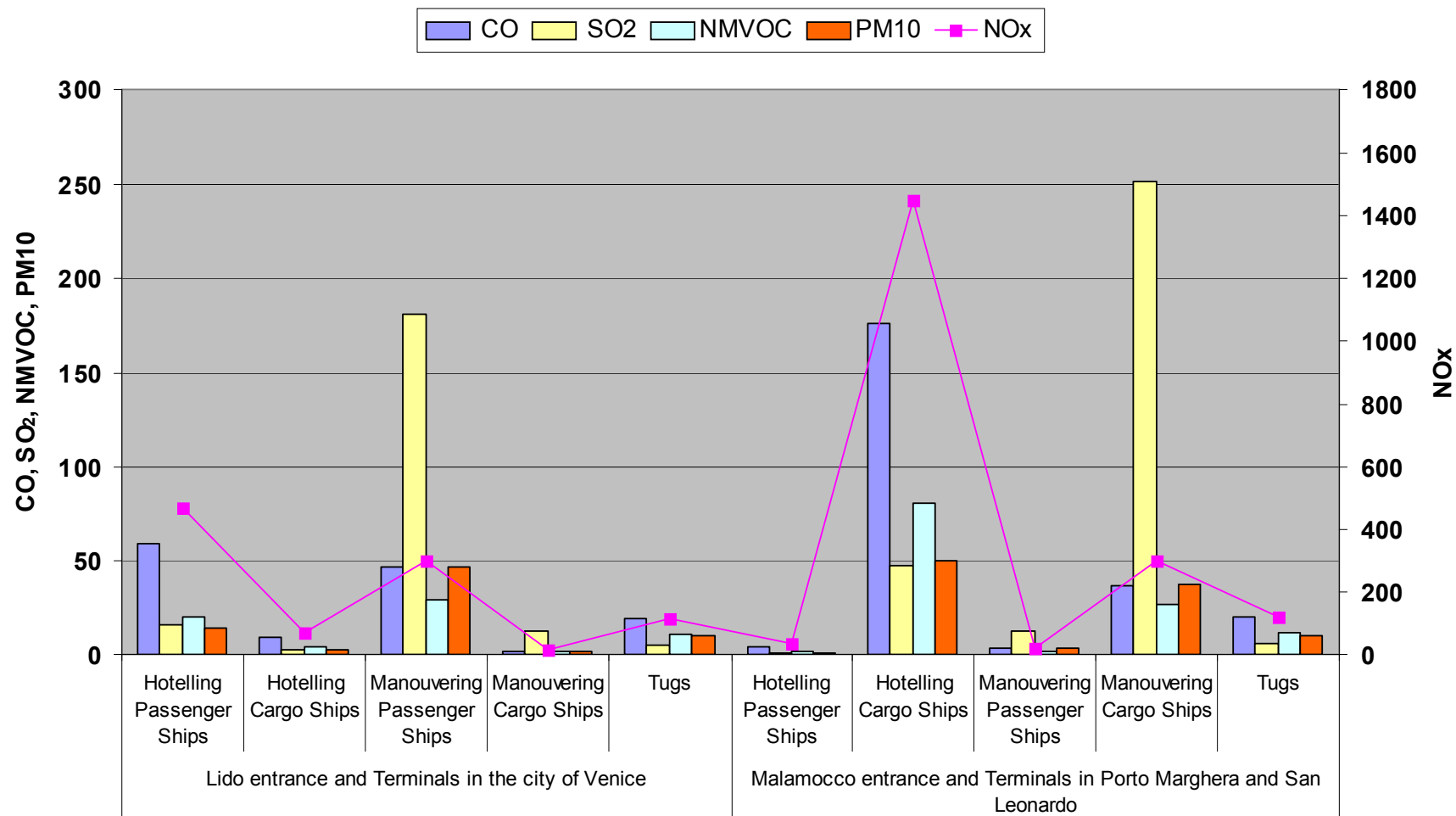
PM2.5 emission - Nest domain 2011 projection



The harbour contribution in the regional domain comprehends the cruise phase emissions too.

Harbour activities: 2011 bottom up emissions database

Emissions 2011 (Mg)



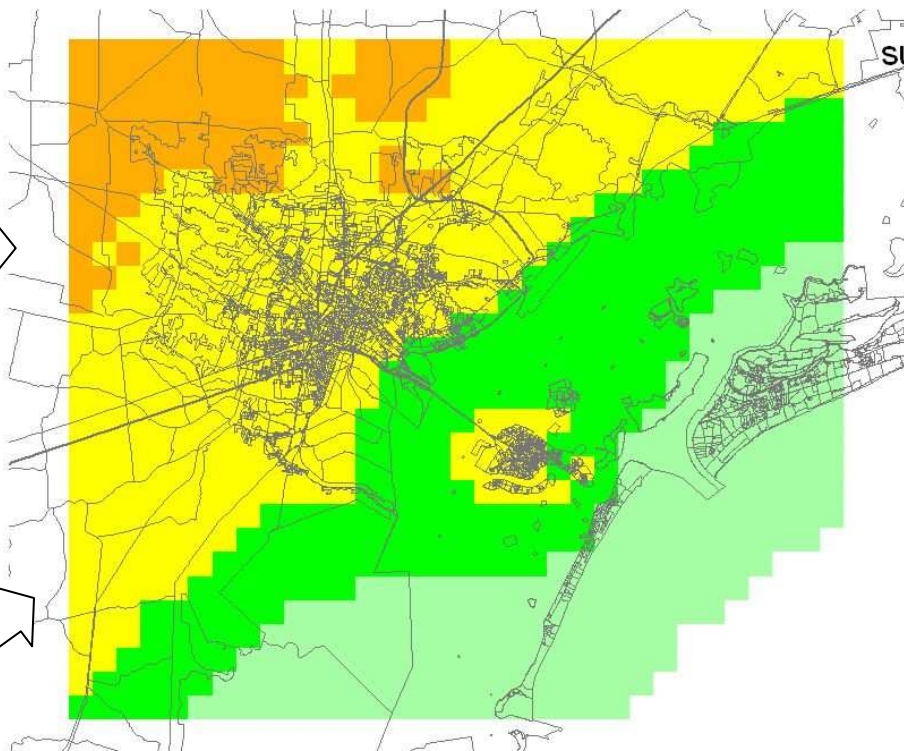
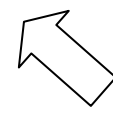
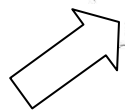
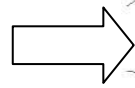
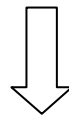
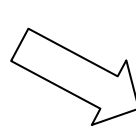
APICE outcomes: summer 2011 (from June to August)

biogenic secondary organic aerosols (SOA)

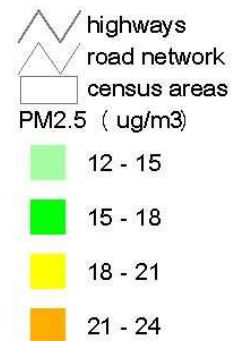
boundary conditions

extra nest contribution

nest contribution



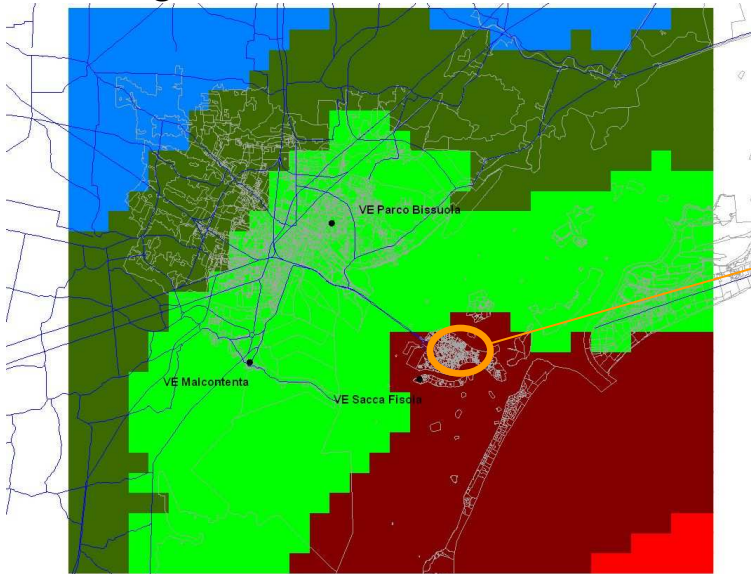
PM2.5
summer average
2011



sea salt and
crustal
contributions

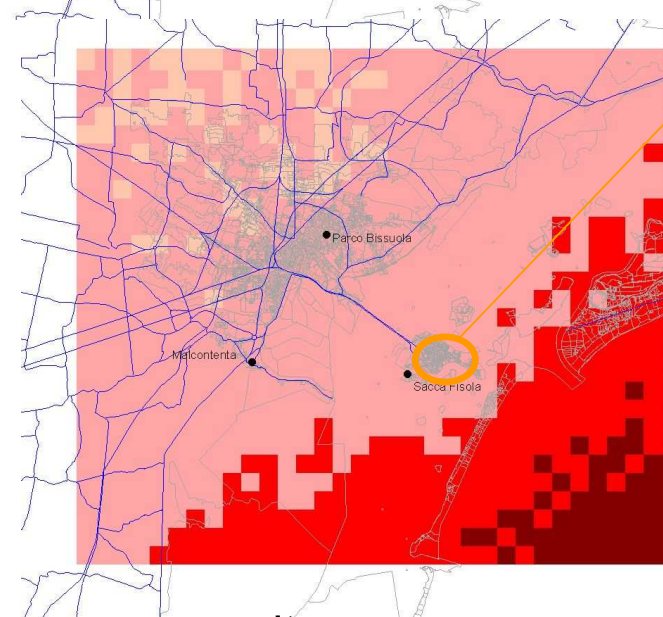
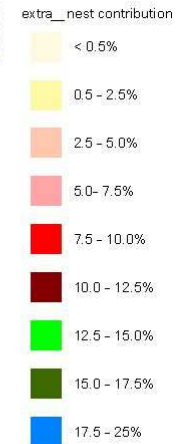
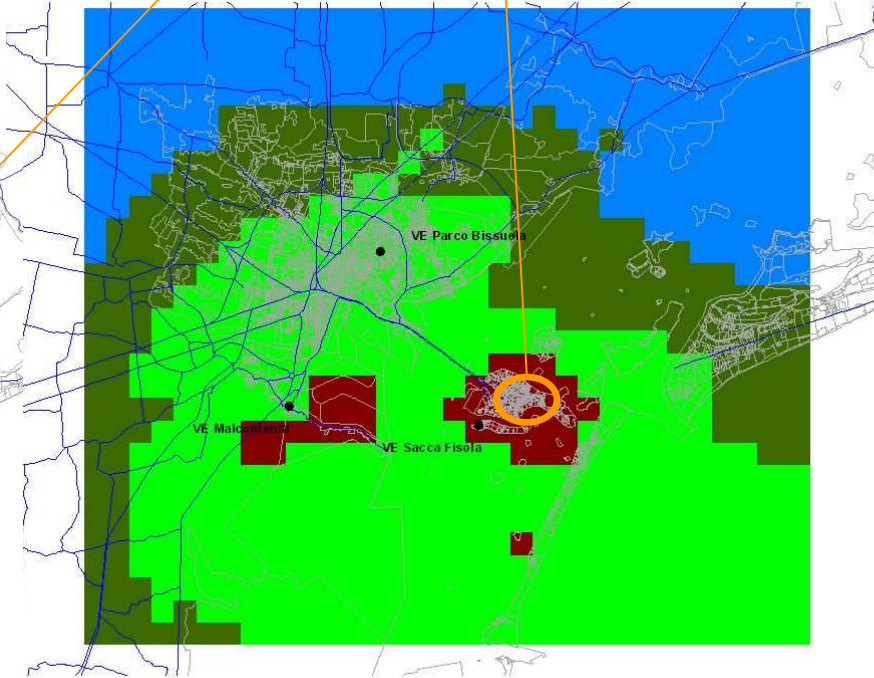
CTM source apportionment: summer 2011 biogenic aerosol and extra_nest contribution

biogenic soa



biogenic: 12%
sea salt: 6%
extra nest : 12% } 30%

extra nest contribution



sea salt

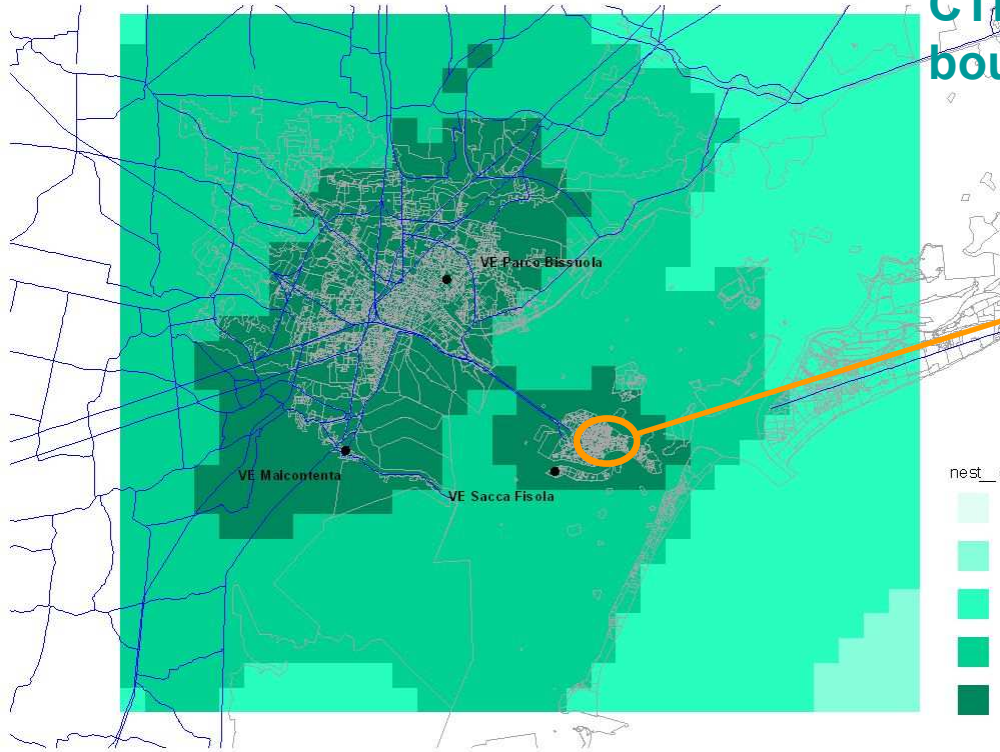


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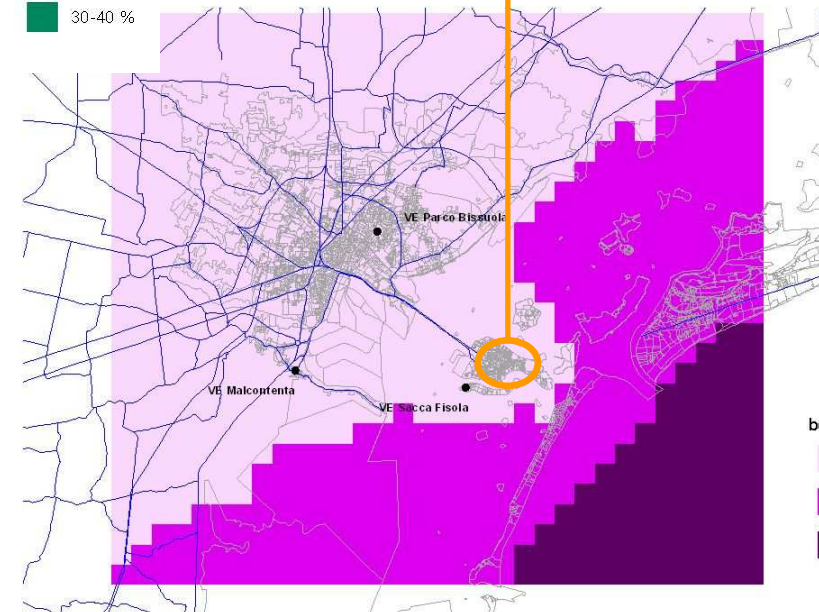


Agencia Regionale per la Prevenzione
e Protezione Ambientale del Veneto

CTM source apportionment: summer 2011 boundary conditions and nest contribution

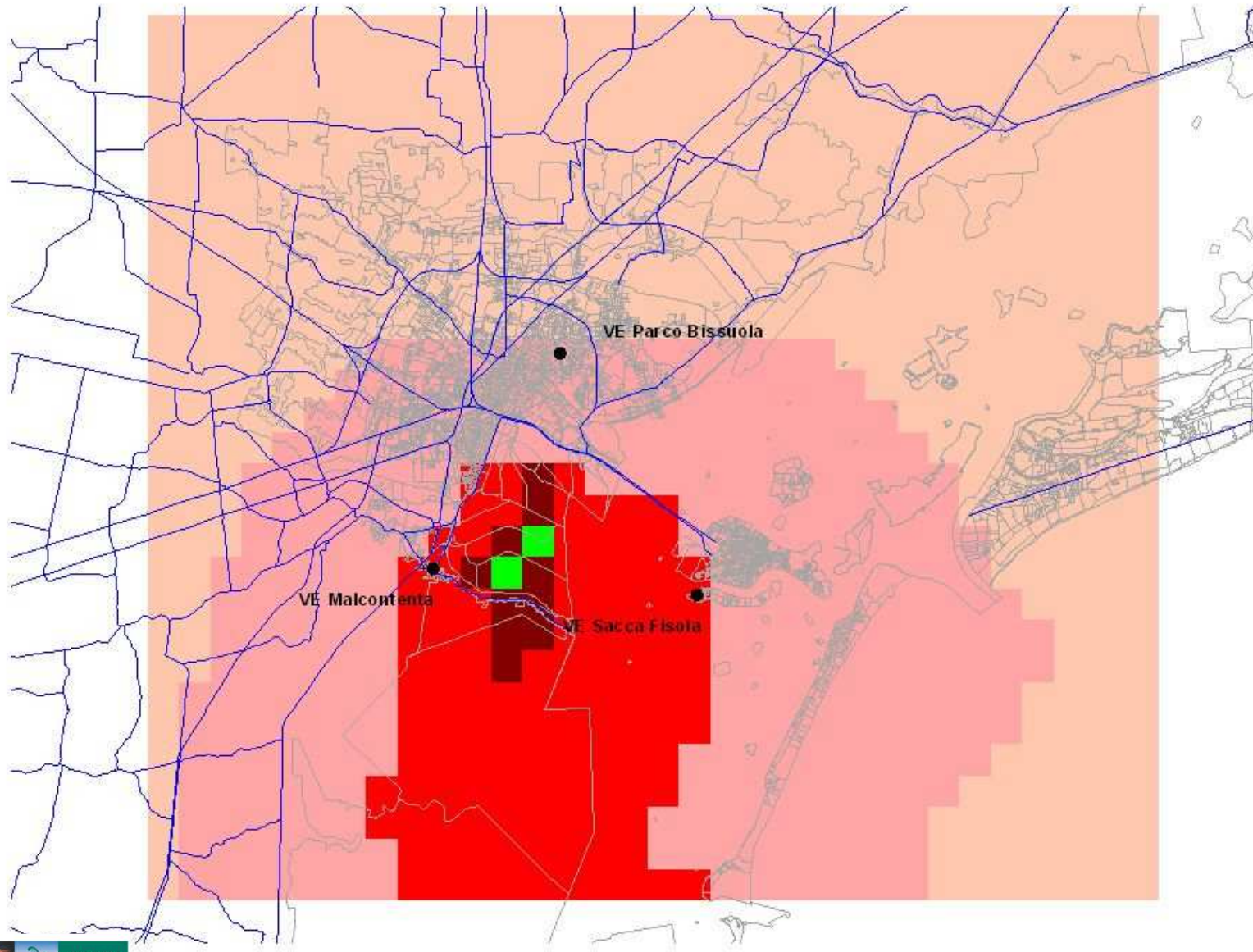


nest: 35%
boundary conditions: 35%

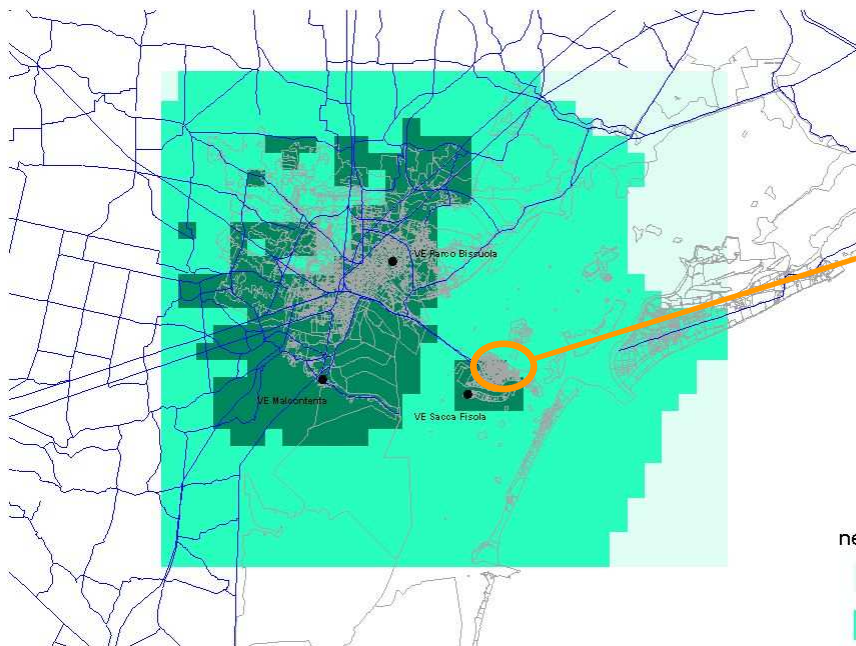


In summer the wind blows from N – NE during the morning, then turns from E – SE during the afternoon, following the sea breeze regime.

CTM source apportionment: summer 2011 harbour contribution

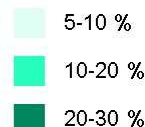


CTM source apportionment: winter scenario (15th Nov -15th Dec 2011) boundary conditions and nest contribution

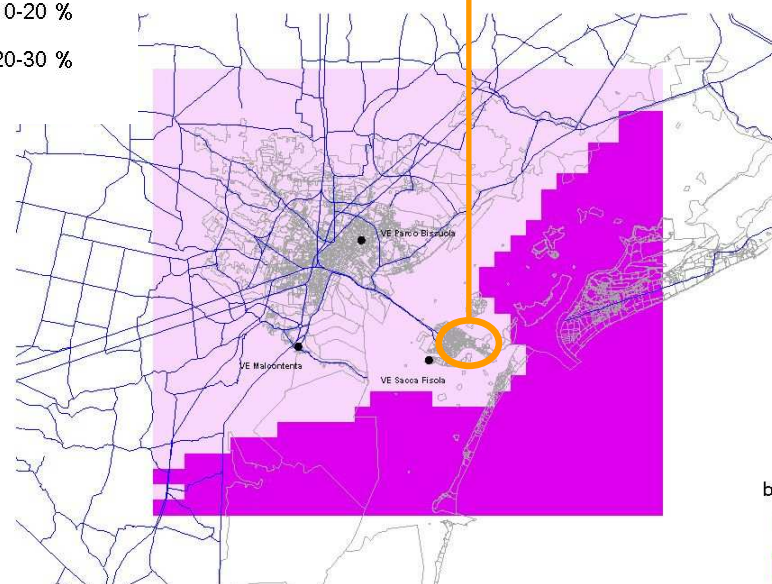


nest: 21%
boundary conditions: 17%

nest_contribution



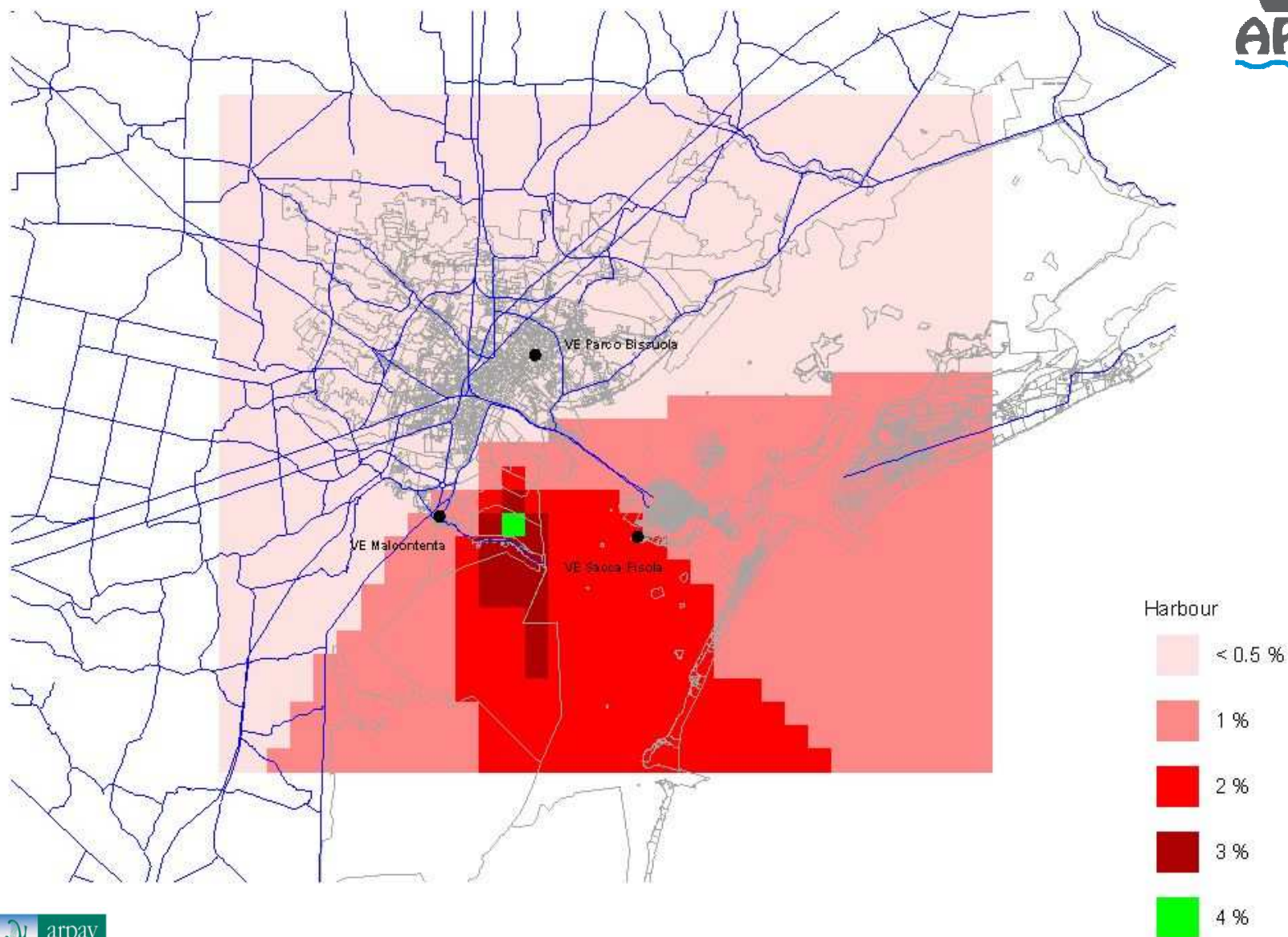
In the winter simulation scenario the wind blows mainly from N – NW: the influence of the main domain area, external to the nest, with high density of anthropogenic emissions, increases significantly in respect to the summer scenario. Moreover in winter the heating emissions become the first PM2.5 source.



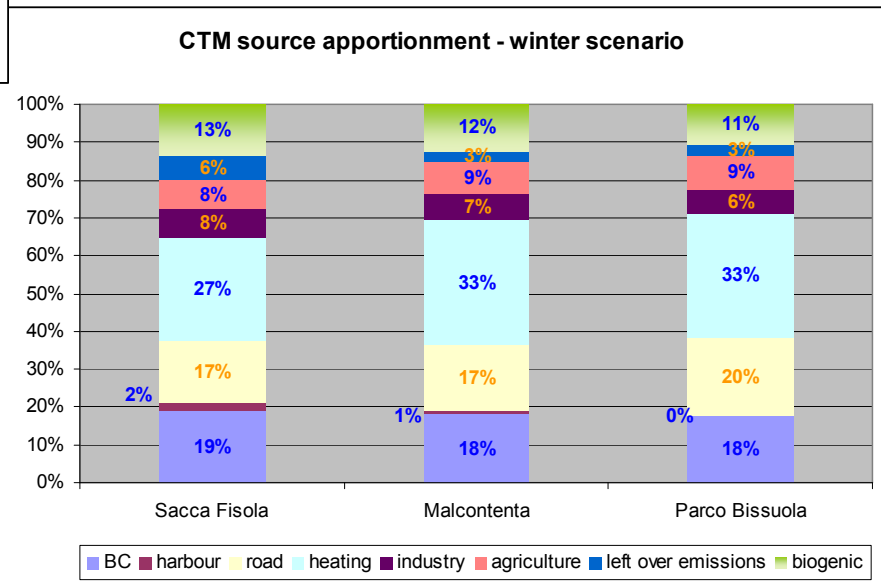
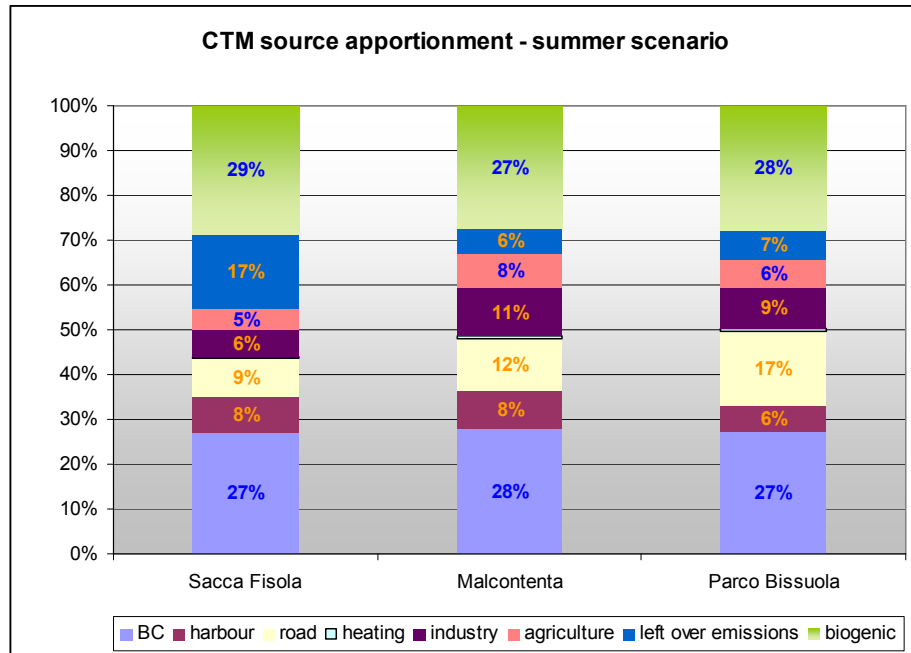
boundary conditions



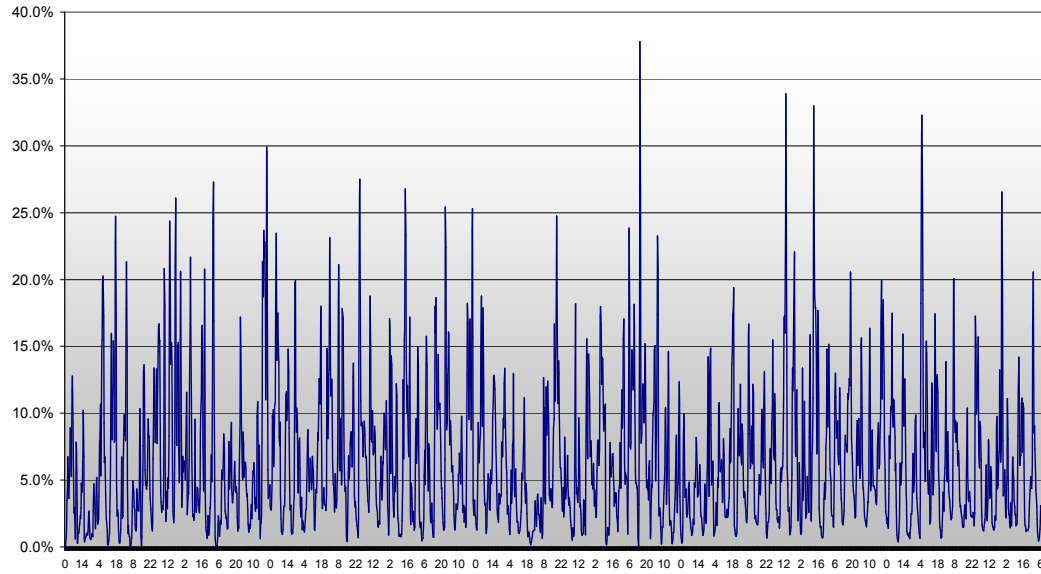
CTM source apportionment: winter (15th Nov -15th Dec 2011) harbour contribution



CTM source apportionment: focus on monitoring sites

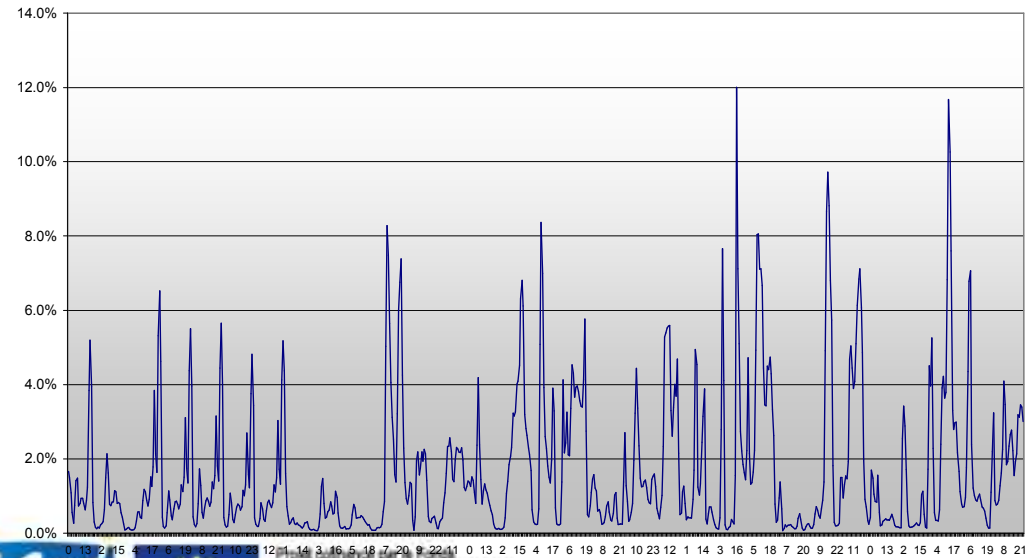


Hourly harbour contribution on Sacca Fisola - summer scenario



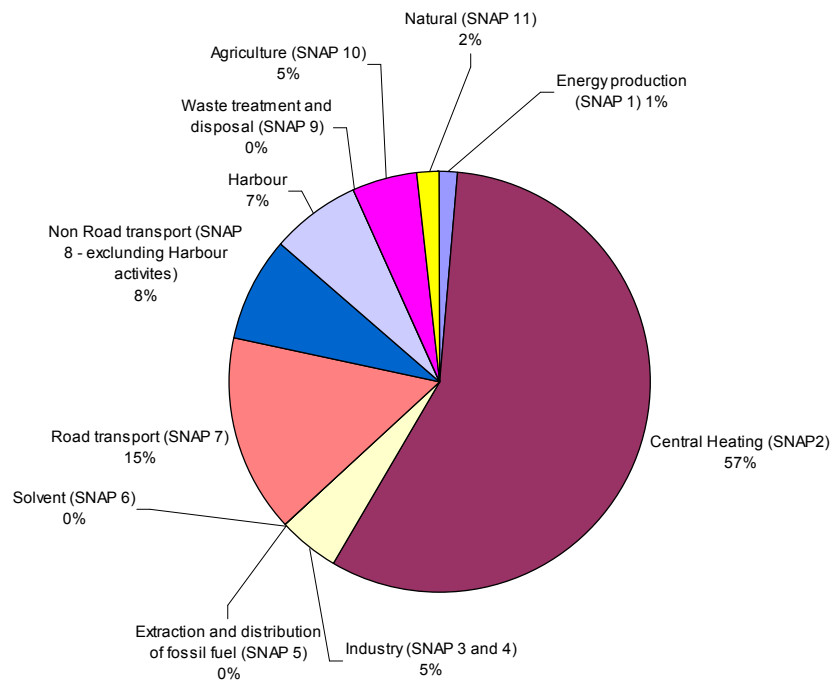
Harbour contribution on hourly basis

Hourly harbour contribution on Sacca Fisola - winter scenario

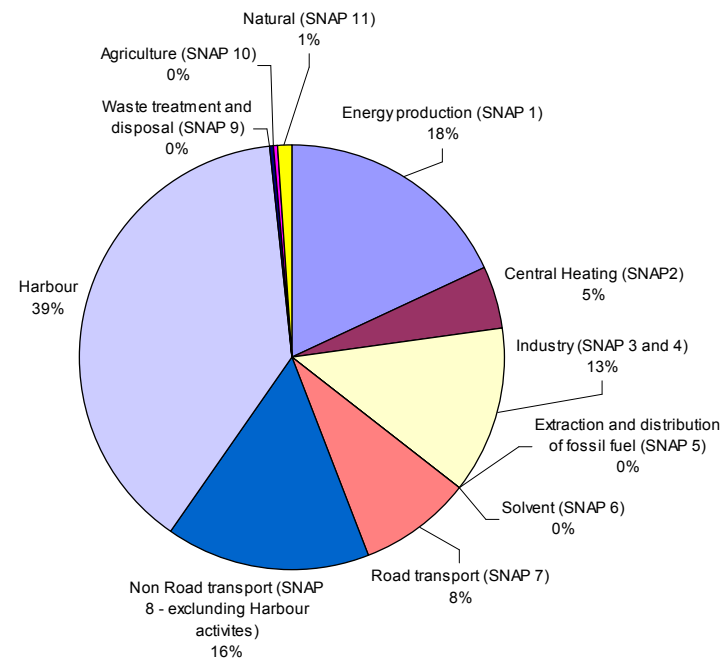


APICE emissions database for the future scenario - 2020 projection

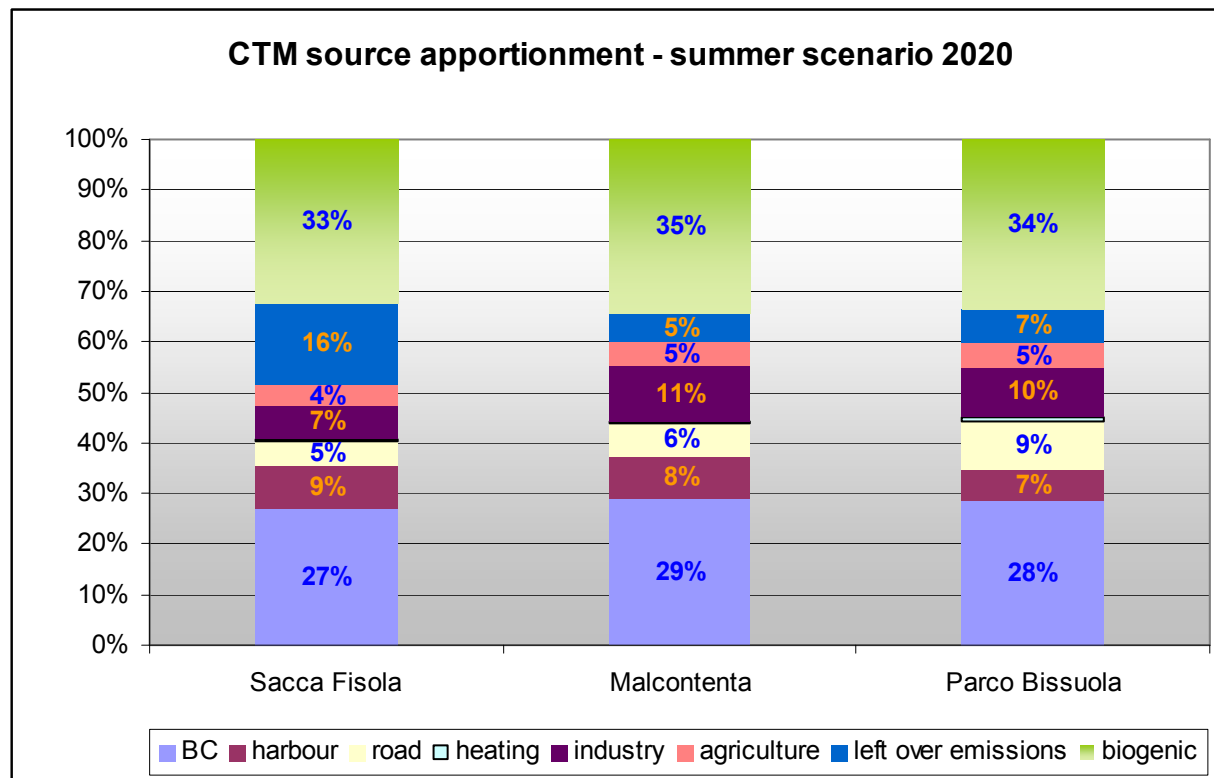
PM2.5 emission - Veneto Region 2020 projection



PM2.5 emission - Nest domain 2020 projection



CTM source apportionment for 2020 summer scenario



➔ little increase of harbour and industry influence;

➔ significant decrease of road transport impact

The boundary conditions are unchanged in respect to the present scenario

Local adaptation plan - Venice

MANDATE (by Italian Lgs D 155/2010)



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Local adaptation plan - Venice

MANDATE (by Italian Lgs D 155/2010)



APICE Transnational mandate

_ environmental management of Port activities within coastal areas

Local issues

- _ Venice Lagoon is under Special Law for the protection and Management of its environment;
- _ Venice Lagoon is the main destination for tourism (8 millions in 2008);
- _ Venice Lagoon is a Zone of Special Protection, Nature 2000 site;
- _ Venice Lagoon is a UNESCO site;



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APICE *for* Venice – Measures

Rank	Ship Emissions	cod
I	Agreements (with Agenti Marittimi, Companies, Terminals, etc) for cleaner ships	M18
I	Air emissions inspection on board	M17
I	Retrofitting technologies: scrubbers (hotelling and manouvering)	M19
II	Change in fuel while maneuvering (from Lido Inlet to Marittima Station)	M14
II	Alternative fuel: Liquefied Natural Gas (LNG)	M16
III	On-Shore power (hotelling)	M11

Rank	Coordination, Monitoring, Inventoring, Communicating	cod
I	Coastal Air Quality Steering/Working Committee/Group	M72
II	Monitoring and control (protocol or agreement between stakeholders, etc)	M73
III	Data Sharing: Inventoring Emissions and Monitoring concentrations as the base for planning	M71



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APICE *for* Venice – Measures

Advantages, disadvantages, barriers, uncertainties

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APICE *for* Venice – Measures: 1. Ships Emissions

Action 1.1: Agreements with Ship Owners for cleaner ships (as Blue Flag II)

Action 1.2: Air emissions inspection on board

Action 1.3: Retrofitting technologies: scrubbers (hotelling and manouvering)

Scenario hypothesis:

fuel at 0.1% content of sulphure (MGO/MDO) from Lido Inlet to Marittima

Scenarios comparison	CO	COV	NH ₃	NO _x	PM ₁₀	PM _{2.5}	SO ₂
At 2020/ at2020+mitigation	-0.3%	0.0%	0.0%	-0.4%	-7.5%	-7.5%	-15.5%
At 2011/at 2020+mitigation	52.0%	38.0%	0.0%	30.0%	25.0%	25.0%	-51.0%

Stakeholders: Venice Port Authority, Venice Terminal Passengers, Municipality of Venice, Harbour Master, Customs Agency, Ship Owners

Implementation: voluntary agreement between stakeholders,

Uncertainties:

about Blue flag II – low Sulphure fuel while manouvreing: costs and availability of fuels prices; schedule under discussion; percentage of reduction under discussion;

About scrubbers: voluntary action based on preferences of ship owners; probably more robust for old vessels; question of noise; requirement on sea-water scrubbers (closed loop). not to produce effects of acidification and eutrophization inside the Venice Lagoon



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APICE *for* Venice – Measures: 1. Ships Emissions

Action 1.4: Cold Ironing in Stazione Marittima in 2020 for Cruises (hotelling)

Scenario hypothesis: Cold Ironing at Marittima with 4 Berths, for 90% of traffic

Scenarios comparison	CO	COV	NH ₃	NO _x	PM ₁₀	PM _{2.5}	SO ₂
<i>Cold Ironing Abatement with respect to Emissions of Marittima – at 2020</i>							
At 2020/ at2020+cold ironing	-58%	-58%	-	-60%	-59%	-59%	-61%
<i>Cold Ironing Abatement with respect to the Total Emissions of the Port – at 2020</i>							
At 2020/ at2020+cold ironing	-5.4%	-4.4%	0.0%	-6.5%	-2.6%	-2.9%	3.8%

Stakeholders: Venice Port Authority, Venice Terminal Passengers, Municipality of Venice, Harbour Master, Customs Agency, Ship Owners

Implementation: Infrastructure predisposition; Agreements between stakeholders and Ship Owners; Systems of Energy production.

Uncertainties: costs; energy production and emissions; voluntary action by Ship Owners; no technical standard for electrification; ship safety at berth.



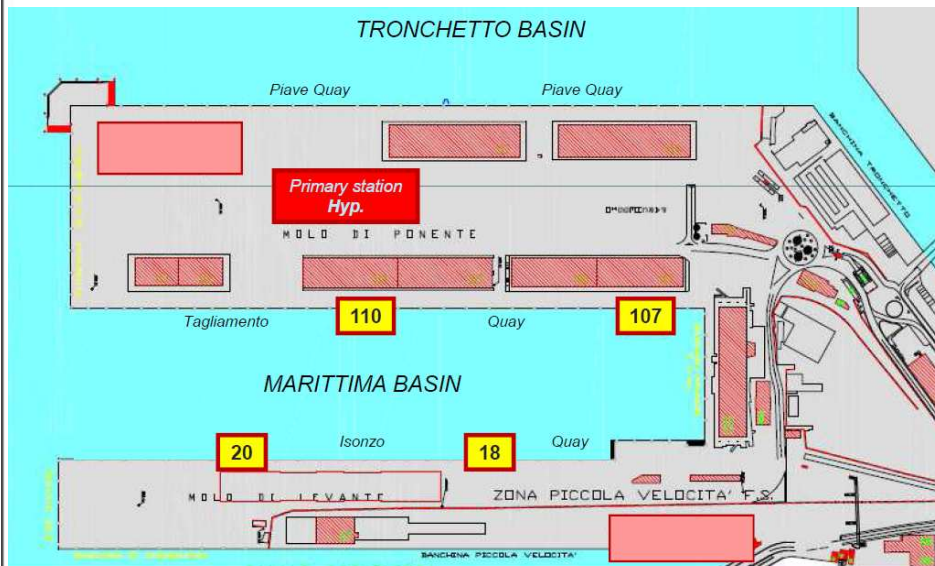
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APICE for Venice – Measures: 1. Ships Emissions

Action 1.4: Cold Ironing in Stazione Marittima in 2020 for Cruises (hotelling)

(i) Energy production by Fusina Power Plant

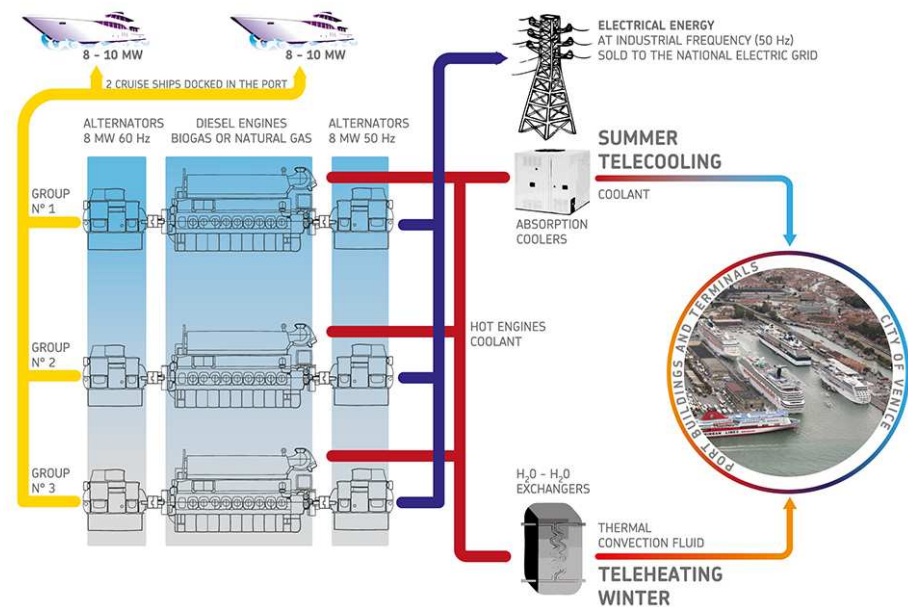
Source: Venice Port Authority, 2012



- _ 4 Berths, for 90% of Vessel
- _ Initial Investment: 55 Mlns of Euros;
- _ Emissions in Fusina
- _ High cost for Frequency transformation
- _ Vessels safety at berth
- _ Cooperation with ENEL Power Plant for energy production.

(ii) Bivalent combined heat and energy system

Source: Venice Terminal Passengers, 2012



- _ 2 Berths
- _ Initial Investment: 15 – 24 Mlns Euros
- _ Gas provisionings
- _ noise and emissions to be verified



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APICE *for* Venice – Measures: 1. Ships Emissions

Action 1.5: Alternative fuel: Liquefied Natural Gas (LNG)

Source/Emissions	CO2	NOx	SOx	PM
EMSA, 2009	25-30%	85%	100%	50%
Rolls-Royce, 2009	23%	92%	100%	98%
Wartsila, 2009	20%	80%	100%	100%

Potential of emissions reduction on single engines, dual-fuel motors with respect to diesel; Source: Varies.

Stakeholders:

-Local level: Venice Port Authority, Venice Terminal Passengers, Municipality of Venice, Harbour Master, Customs Agency, Ship Owners;

-International Level: Network of Ports of the Northern Adriatic Sea, Network of Motorways of the Sea, Home Ports for Cruises

Implementation: coordination of legislative innovation, infrastructural actions, and voluntary agreements – clusters of private and public innovation; clusters of Home Ports

Uncertainties: Contextual conditions with respect to Technical feasibility (vessels, port infrastructure); uncertainties in governance issues (coordination, cooperation, networks), LNG availability



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APICE *for* Venice – Measures: 2. Road Traffic Emissions

Action 2.1: Engines emissions reduction

Action 2.2: Improvement of road system (to avoid congestion) – for an Intelligent traffic system

Action 2.3: Improvement of rail transport rate from Port traffic

Scenario hypothesis: % of change in Engines according to Fleet renewal (source: ARPAV)

Scenarios comparison	CO	COV	NH ₃	NO _x	PM ₁₀	PM _{2.5}	SO ₂
At 2011/at 2020+fleet renewal	-15%	+9%	-	-13%	+26%	+3%	+79%

Stakeholders: multiples, at local, regional and national levels

Implementation: Acknowledgment of EU Standars (Euro VI from January 2013); Incentives for Fleet renewal at National level in 2007-2008; voluntary agreement of transport operators,

Uncertainties:

About Road transport: Negotiation at National and Regional level, with scarce local enforceability; voluntary action based on preferences of transport operators;

About Rail Transport rate: Policy orientations at National and European level; rail infrastructure to be negotiated with National Rail System Operator; some indications from the Draft of the Italian Plan for Logistics (2012), phase of concertation with National Stakeholders in the direction of improvement of Rail transport (26/07/2012)



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APICE *for* Venice – Measures: 2. Road Traffic Emissions

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I	Coastal Air Quality Steering/Working Committee/Group	M72
II	Monitoring and control (protocol or agreement between stakeholders, etc)	M73
III	Data Sharing: Inventoring Emissions and Monitoring concentrations as the base for planning	M71
IV	Communication strategy	M74

In line with the approach of **concertation between stakeholders**, great attention is given to measure group 7, titled «Coordination, Monitoring, Inventoring, Communicating», towards the constitution of a **Coastal Air Quality Steering/Working Group** in charge to coordinate and to integrate the activities going on about Air Quality, according to each stakeholder’s competences and roles.

Those actions attains on a high ranking position, as to witness the great interest on the necessity to corrdinate and to capitalize **results, data and actions**.

Mainstreaming of LAP within Venice knowledge framework as driver for the sustainable development in the Venetian port-city

Voluntary agreements

- _ **Blue Flag II edition**: agreement with Shipowners anticipating 2020 requirements in fuels;
- _ Agreement between Venice Port Authority, Venice Harbour Master, Venice Custom Agency, to extend the recent **agreement on controls**, towards a perspective of sharing data to update emissions inventory and related management activities;
- _ Establishing a **permanent table** between stakeholders with respect to monitoring and controls for air quality; modalities will be defined by participants with respect to their roles and competences;

_ **Regional Plan for Air Quality of Veneto** (Piano di Risanamento e Tutela dell'Atmosfera, PRTRA), under revision: acquisition of APICE results in terms of emissions inventories and of action plan as preliminary studies for the local action plan for Venice compartment (by Regional Law);

_ **Regional Masterplan of Veneto** (Piano Territoriale Regionale di Coordinamento, PTRC), under revision: acquisition on transport indications and environmental results within the Regional Masterplan updating activities: rationalization and optimization of infrastructure; mobility policies, environmental compatibility and landscape quality.

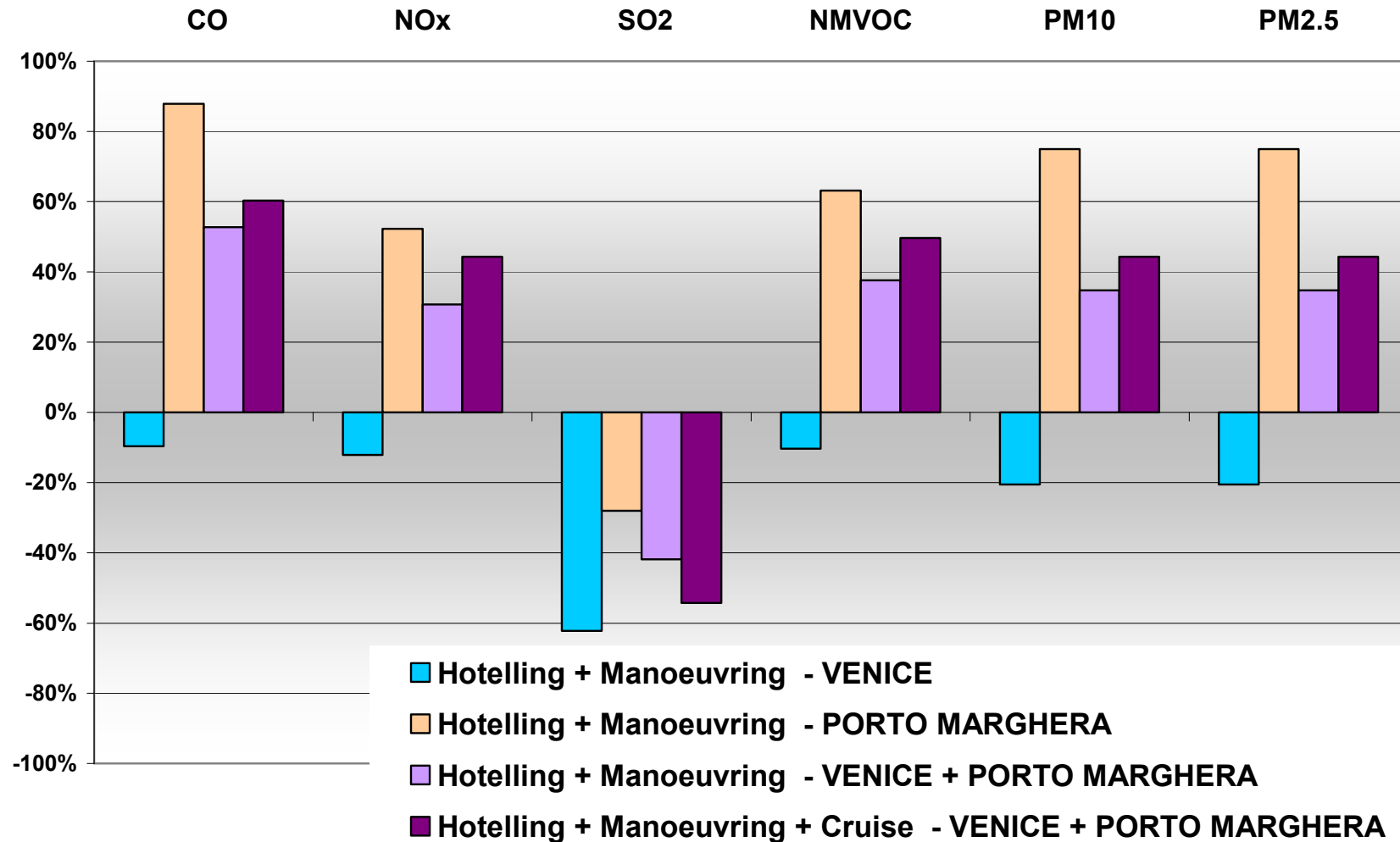
Planning



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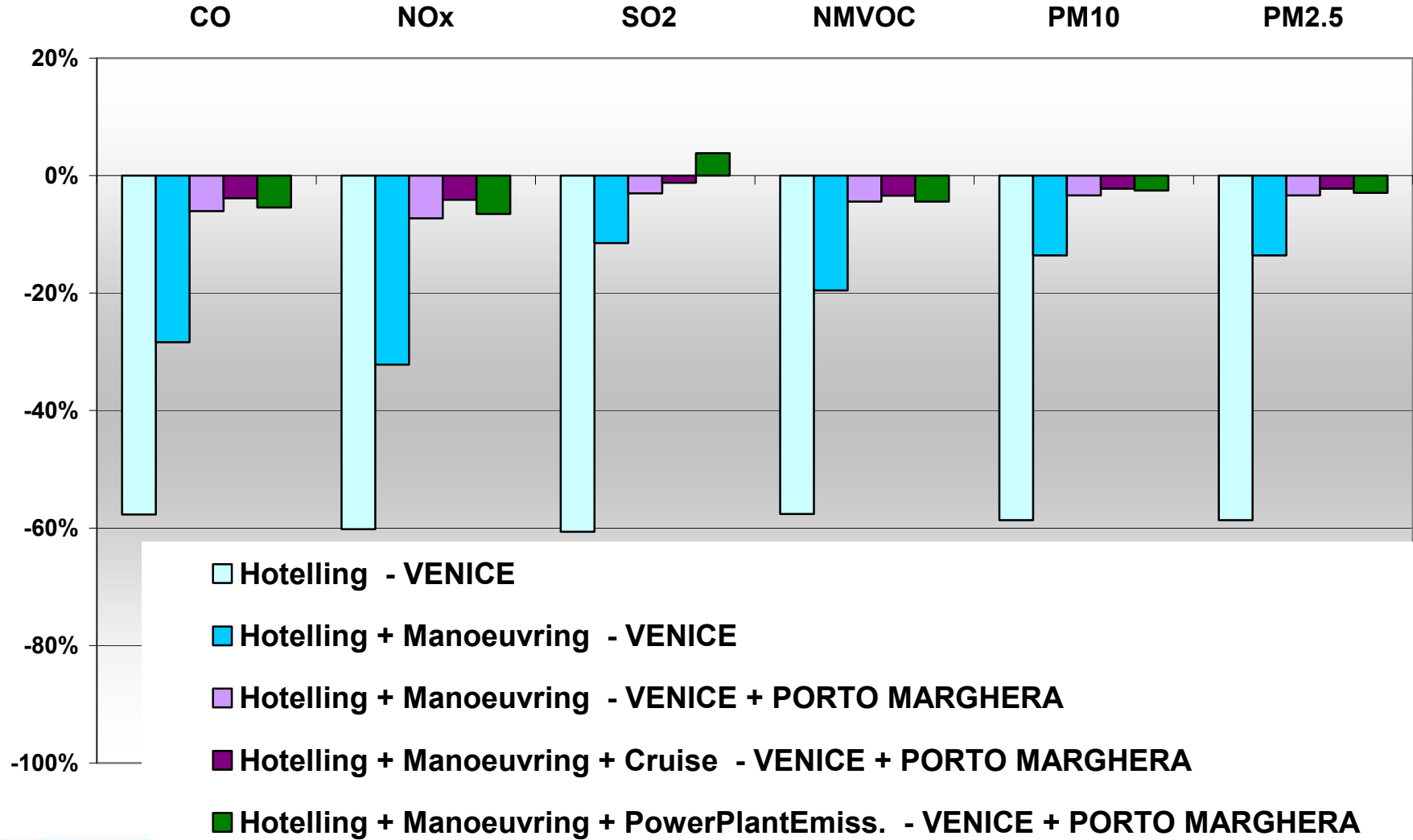
2020 vs 2011 Emissions - base future scenario

[(2020-2011)/2011 in %]



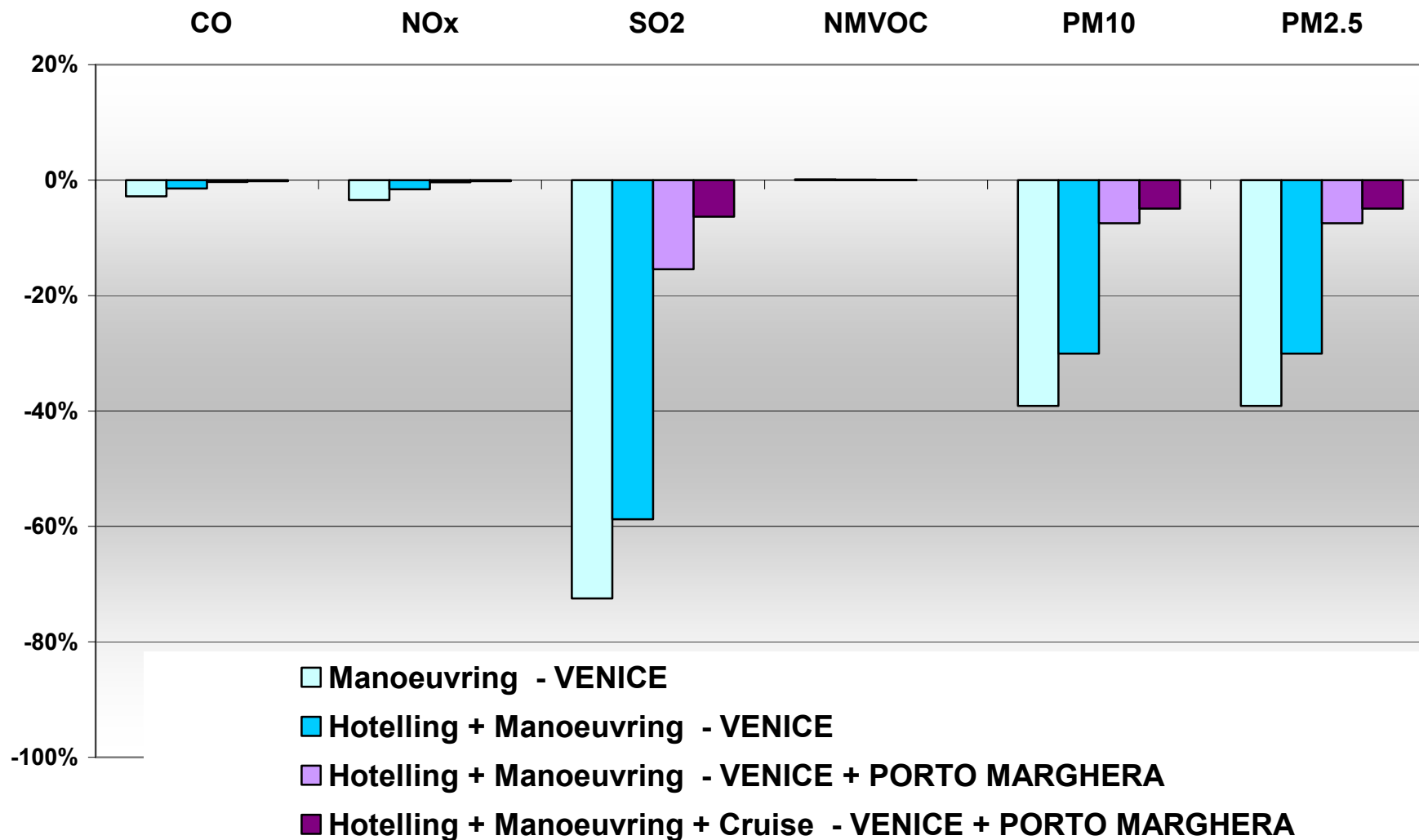
2020-scen vs 2020 Emissions - cold ironing scenario

[(2020 cold ironing scenario-2020 base)/2020 base in %]

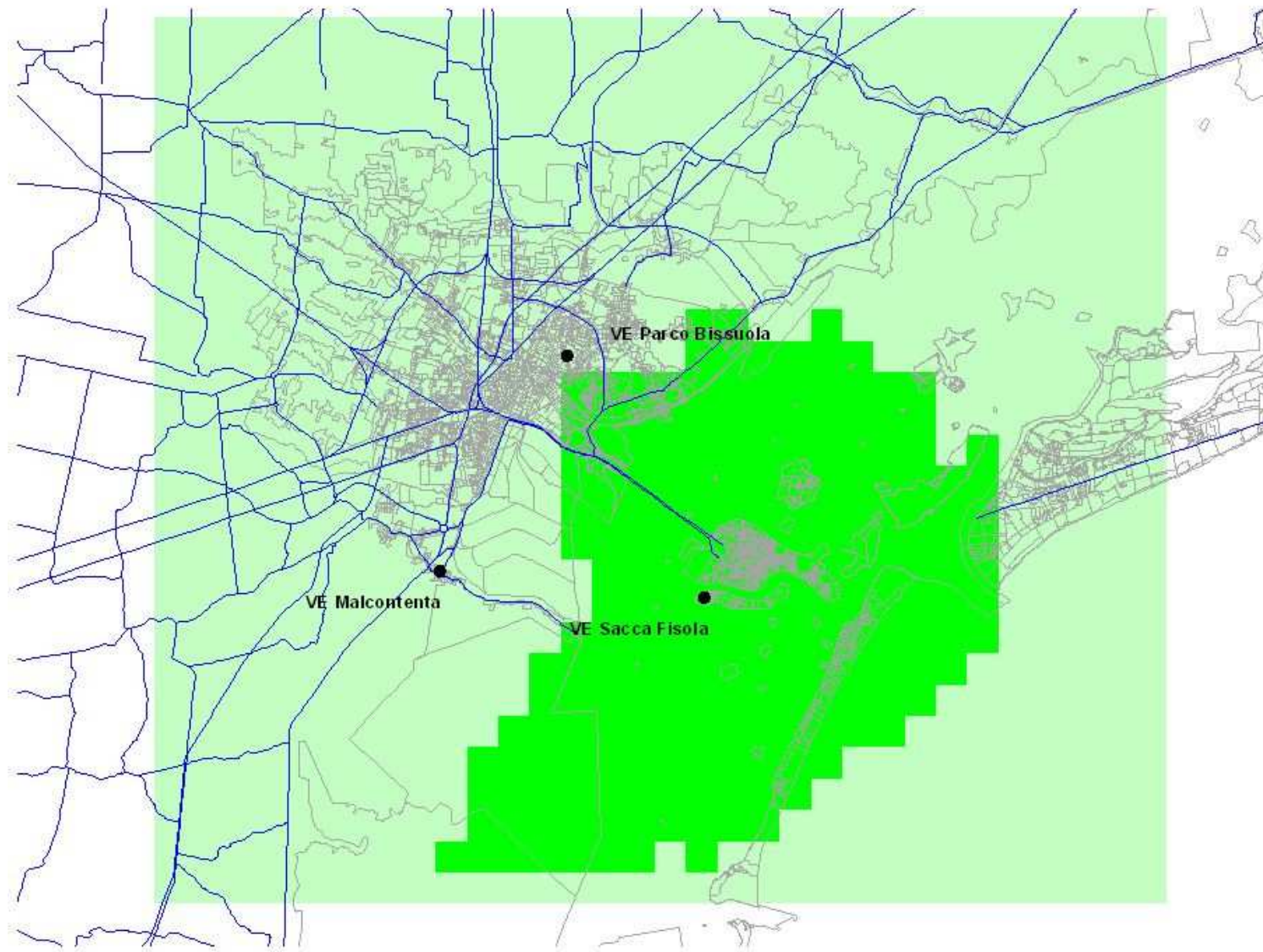


2020-scen vs 2020 Emissions - 0.1% S fuel in manoeuvring scenario

[(2020 cold ironing scenario-2020 base)/2020 base in %]



2020 mitigation scenario versus 2020 scenario



Mitigation scenario



Thank you for your attention.



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