VENICEAGENDA

2028

Zero emission by 2028

EXTRACT

VeniceAgenda 2028 (NGO) aims to convert the entire fleet of Venice's diesel/petrol-engined motorboats (ferryboats, water-taxis, workboats and private runabouts) to zero-emission, low-wash electric and solar-electric propulsion before the year 2028

Kevin Desmond

Contents

1. The Committee 2
2. The Challenge 3
3. Some history 7
4. Available Technology 10
5. Obstacles 14
6. How much will it all cost? 16
7. Strategy 17
8. The Means 18

Media and Social Networking 18

Representatives 18

Financing 18

Event 19

9. Patronage 19
10. Postscript 19
11. Venice Agenda 2019 - 2027 : How it might work 21
12. Invitation for support 22

1. The Committee

I. Venice in Peril
II. Sir Ghillian Prance, FRS.
III. Asian Electric Vehicle Society, Osaka, Japan (Shigeyuki Minami PhD,)
IV. Prof. Massimo Guarnieri (Universita de Padova)
V. Prof. Maria Skyllas-Kazsacos AM PhD FTSE FRACI FIAust Emeritus Professor UNSW Sydney)
VI. Prof. Martin Green AM, FRS, FAAS, FTSE (UNSW Sydney
VII. John B Goodenough PhD, University of Austin, Texas
VIII. M. Stanley Whittingham, SUNY Distinguished Prof. Binghamton, NY
IX. The Electric Boat Association (President Kevin Desmond)
X. The French Electric Boat Association (President Xavier de Montgros)
XI. The Electric Boat Association of the Americas (Tom Hesselink)
XII. The Electric Boat Association of Greece (Andreas Apostolopoulos)
XIII. Zero Emission Resource Organisation (Norway)
XIV. The Electric Launch Company, USA (Charles G. Houghton, III former President)
XV. I Grandi Giardini d'Italiani (Judith Wade)
XVI. Prof. Francesco Vallerani (Università di Venezia Cà Foscari)
XVII. Dr. eng. Pierpaolo Campostrini, Managing Director, CORILA (Consortium for Managing Scientific Research on Venice Lagoon) System)
XVIII. (Huboat) Giacomo De Stefano
XIX. Lorenzo and Giovanna Quinn

2. The Challenge

This is to replace and/or retrofit all motorboats in Venice, public or private with zero-emission propulsion systems by 2028. During two decades electric propulsion, using battery couples based on lithium, has made great progress for reducing noise and vibrations in closed locations such as Venice. These systems now need to be communicated to the builders and operators and administrators concerned. Following the ongoing model of the transition of city and town bus fleets around the world from diesel to electric, this transition would also take place gradually. A similar transition is taking place in the city of Amsterdam in the Netherlands where the entire fleet of tourist, commercial and private motorboats must be 100% electric by 2025. Tourists in Amsterdam very quickly appeared to have an autonomous preference for electrically propelled boats: the sooner Venetian boat owners get their boats converted, the longer they'll benefit this advantage to their still diesel/gas propelled competitors in the market/on the canals. Alongside the all-electric Alpine lakes, moves are underway to make lakes like Como and Maggiore, all-electric.

Venice, with a dwindling population of only 56,000 Venetians, welcomes 30 million boat-paying tourists per year. Apart from the 400 human-powered gondolas in Venice, ACTV has 19 scheduled waterbus lines, transporting more than 190 million passengers and produces approximately 520,000 hours of navigation and 33 and a half million kilometres. They use 160 147kW diesel engined vaporetti waterbuses with a daily service of 16 hours consuming 520 litres of fuel (a total consumption of over 21 million litres of fuel per year. On January 18 2019, BYD, the Chinese bus manufacturer, proudly announced the production of its 50,000th pure electric bus, nine years since production began. The milestone follows the departure of a K9UB 12-meter pure electric bus for Spain from BYD's Hangzhou testing facility. The company notes that according to the U.S. Department of Transportation's research, operating 50,000 electric buses is equivalent to taking 1.35 million cars off the road and eliminating 84.5 million tons of C02 over the vehicles' 12-year lifespan.

At present, the Venice fleet with its rather aged engines uses 21 million litres of diesel - 21M x 2,68 = 56 280 000 kg CO2 costing € 6,4 M per year in healthcare, or in other words 80 000 kg PM costing € 104 M per year in healthcare. Transition of Venice's 160 waterbuses,550 water taxis and 800 workboats from diesel to electric would be so much better for the health of both Venetians and tourists.

Add to this Alilaguna, the smaller private company that services airport-city voyages. There are approximately 550 motorized five-seater water taxis. These watercrafts are all equipped with diesel engines that spew exhaust and make a racket, creating both air and noise pollution. Add to these, 800 workboats, a quite general term including: cargo (commercial), cargo (constructions), waste collection, ambulances, Venice's new ambulances provided with top technologies have just been launched … and they are diesel. Then there are 350+ private speedboats, most of them with four-stroke gasoline outboards. It is well proven that the wave effects from gasoline-engined boats, particularly when reversing or moving forward, is not good for riverbanks or for waterside buildings. Instead of the disturbing cavitation caused by their small high-revving propellers, the larger slower revving propellers used by electric boats, coupled to their lower-wash energy-efficient hulls, are far friendlier and more sustainable.

Although Venice was declared a Unesco World Heritage Site in 1987, in October 2015 experts from UNESCO/ICOMOS/RAMSAR inspected the lagoon city. They concluded that it was under threat and called for immediate improvements Their report considered adding Venice and its lagoon to the List of the 'World Heritage in Danger' if the city management had not changed drastically. Their observations included that no countermeasures had been taken to regulate the speed and the number of motorboats. The constant waves caused by motorboats, the "moto ondoso", are still a daunting problem responsible for the erosion of the foundations of the Venetian buildings. In November 2016, both the Italian Government and the City of Venice signed a "Pact for the development of the City of Venice" (allocation of 457 million euros). The Pact highlights a joint intention to resolve problems relating to navigation in the lagoon,

environmental sustainability, architectural restoration, urban maintenance and tourism. It was also presented by the Mayor of Venice during his visit to UNESCO in January 2017. The future of the status of the lagoon city is tied to a detailed plan of action on the questions of tourism and the cruise ships industry that the city town and government are due to deliver to the committee by December 1st, 2018. UNESCO has given Venice until 2019 to “clean up its act.”

In 2017 the European Commission urged Italy to take action against small particulate matter (PM10) to safeguard public health More than 66 000 people die prematurely in Italy each year as a result of particulate matter pollution, making it the most affected of all Member States in terms of PM-related mortality, according to estimates by the European Environment Agency. For the daily limit value, the 30 affected zones include the Friuli-Venezia region Small particulate matter or 'PM10' particles are present in transport emissions. In Venice this is waterborne transport.

The European Emission Agency report No 5/2015: Air quality in Europe states that although 1 litre of diesel is expected to cost €0.5, that same litre generates 32 g NOx or 3,8 g PM2.5 with healthcare costs four times that of the cost of the litre.

Fine particulates, known as PM2.5, are around 200 times smaller than a grain of sand. They are a major health worry as they can penetrate deep into your lungs, pass into your bloodstream and get embedded in your bodily organs and your brain. This can cause severe asthma and a condition called bronchiectasis. This is a long-term illness where the airways of the lungs become abnormally widened, leading to a build-up of excess mucus that can make the lungs more vulnerable to infection. It can prove fatal. A transition to electric propulsion would certainly reduce healthcare costs even in Venice.

As a land-based comparison, in November 2018 FedEx ordered 1,000 Chinese-built Chanje V8100 electric delivery vans for use in California. The company owns 100 of them and leased the other 900 to Ryder Systems. The V8100 has a range of 150 miles and a maximum

capacity of 3 tons (6,000 pounds). *Each will save 2,000 gallons of fuel every year while keeping 20 tons of carbon emissions out of the atmosphere.* Social responsibility is all well and good and should be applauded, but FedEx wouldn't be doing this if it didn't believe the total cost of ownership for these vans will be significantly lower than it is for similar vans with gasoline or diesel engines.

Venice has already taken practical measures. Protests against cruise ships are commonplace. In May 2017 nearly 20,000 Venetians voted in an unofficial referendum, with 99% backing a motion to keep cruise ships away. By the year 2021, an Italian government committee chaired by transport minister Graziano Delrio has decided, cruise ships over 55,000 tonnes will no longer be able to pass through St Mark's Basin and dock in the city. Ship operators claim they use low-emission fuel when they are near big cities, but measurements taken near the port of Venice tell a different story. The fuel they burn while at berth contains more than 100 times as much sulphur as truck diesel. As big ships sailed down the main canal, just a stone's throw from the shore, a team recorded up to 500 ultra-fine particles per cubic centimetre – 500 times higher than clean sea air. The World Health Organization places diesel particles in the same carcinogenic category as smoking and asbestos.

Venice Agenda 2028 also offers new solutions. Instead of ocean liners arriving in and polluting the Grand Canal, they might moor further out and their passengers be met by a fleet of electric shuttle boats to take them to San Marco. Those motor yachts which cannot approach using electric power would be required to be towed in by electric tugboats.

From April to October 2018, the entire ACTV fleet was powered by ENI Diesel +, a new patented ecological fuel produced by the transformation of exhausted food oil, collected by the citizens and produced in Porto Marghera, the first example in the world of conversion of a conventional refinery into a biorefinery, ie able to transform raw materials of biological origin, including used vegetable oils and animal fats, into high quality biofuels. Laboratory tests carried out by AVM / ACTV test protocol of the Ca 'Foscari University of Venice) and by the

Istituto Motori of the CNR of Naples for ENI have shown *a reduction in polluting emissions*, in particular nitrogen oxides, primary and secondary particles, and ultrafine particles, but also lower consumption, as a result of the high calorific value of the biological component. This could also be applied to cargo boats and pleasure boats. This follows a successful trial of 650 diesel buses using Eni+ biofuel in Turin. Within the year the Gela bio-refinery will be completed and from 2021 the two bio-refineries should exceed one million tonnes of ENI+ green diesel produced in Italy.

But this transition is *only a reduction, not an elimination and does not totally eliminate either engine noise or palazzo-damaging vibration*. While Venice is proud of its rich history, a refusal to adopt zero emission boats would make it appear anachronistic and out-of-step, compared to cities all over the world currently transitioning to electric land buses, trucks, automobiles and motorcycles.

3. Some history

In 1893, as part of the World's Columbian Exposition in Chicago, Illinois, a fleet of 36ft electric launches made 67 thousand trips during the six and a half months of the exposition, carrying over one million passengers, a total 320 kilometres and earning $314,000 for the World's Fair organizers. Their greatest test came on Chicago Day when fifty boats made 622 trips, each covering a trip of three miles. Six of these boats averaged over 65 kilometres, carrying about 40 people on each trip. *That day alone, there were no fewer than 25,000 passengers.*

After the World's Fair had closed, the fleet was dispersed. A syndicate of Italians purchased one and shipped it directly here to Venice. Slightly modifying her superstructure to look like a gondola, and copper-sheathing her hull to protect her from the weeds and canal water, they renamed her *Venezia.* Unique, she soon disappeared from the Lagoon and canals.

In 1988, thanks to the English Viscount's initiative of Viscount John Julius Norwich, construction began on an all-Italian 210 pax electric

vaporetto. Its hull, built in light alloy by Alutekna SpA at Marcon, measured 23 metres by 4.6 metres Beam and weighed 25T. The battery was lead-acid Magneti Marelli 1450 Ah/220–300 volt/weighing 9 tonnes. The Ansaldo motor was an air-cooled asynchronous triphase unit normally rated at 25–30 kW, but while only operating at under 10 kW, capable of a peak of 60 kW, required solely for braking. Transmission was by a variable frequency dc/ac inverter. Propulsion was by a Schottel Azimuthal propeller-rudder. In short, it was state of the art.

The sixteen hours' daily operation of the boat would be obtained by overnight battery recharging in addition to periodic opportunity charge of 15 minutes every 1 to 2hours (known in Italian as "biberonnagio") during stops of operation. The plan was to build a small fleet of ten boats for evaluation against the existing "vaporetti" It was estimated by Signor E Gasparini, Chairman of the Working Group that the charging station for 20 such would require a sizeable 2 megawatt installation. This had been designed by ENEL (Italian Electrical Agency) equivalent to the UK Electricity Council and was already nicknamed "la grande mamma"! (= the big mamma) In October, Venice's "vaporetto elettrico" waterbus *E1* was unveiled to the world.

The official launch involved speeches made by politicians from four parties, plus a baptism with holy water by Monsignor Marco Cé, then Patriarch of Venice. Sadly, E1's batteries simply did not have the required autonomy and it was not to be before another twenty years that the commercialised lithium-ion battery was to open the way for all forms of electric transport.

In 2001, the 19ft (5m80) *EcoBarca* electric water taxi went into service to take passengers from the city's railway station and the canal-side Hotel Residenzia de Epoca. Backed by Marshal Duffield of Duffy Boats, Newport Beach, the low-wake M-hull form, called MangiaOnda (Italian for "wave eater") as conceived and patented by US Venice resident, Charles W. Robinson, and William F Burns III of the MangiaOnda Co. in San Diego and was built by Duffy. The idea was that instead of making waves which were slowly eroding the palazzi along Venice's canals, this

boat would literally eat them up. Power came from a 2.5 hp Leeson permanent magnet motor, spinning a prop at 800 rpm. Energy came from six, 6-volt Sealed Gel “East Penn” batteries manufactured by DEKA.

Duffy has commented that “Italians love to speed. The Venice port authority was not impressed with our 5 mph speed. They did not pursue going forward with another boat. Venice is sinking due to boat wakes so we thought this would be something they would love.”

A feasibility project was carried out by Professor Massimo Guarnieri and other researchers of Padua University in 2015 to develop prototypes of electric water buses provided with cutting edge technologies, but it was ignored by Venice’s public transportation authority, neither similar proposals were taken into account by other private transportation companies. It seems that Venetian shipyards do not believe that they can benefit of the advanced technologies developed in the University’s laboratories and much appreciated by the international scientific community.

In 2010 Venetian shipbuilder Moreno Vizianello collaborated with Fabio Sacco of the city’s waterbus company Alilaguna, with its white and yellow livery, to produce *Energia*, a 14 meter (46 ft.), 40 pax, where an electric motor was joined in parallel to a classic internal combustion engine to charge the batteries of the boat during its journey across the lagoon between the Airport and San Marco. Energia went into operation in January 2011, and was soon joined by sister ships *Murena* and *Razza*. In the summer of 2014, Vizianello and Alilaguna launched the Siemens diesel-electric *Scossa* (= Shock) propelled by an 180 kW 3,000 rpm Siemens with 32, 19 volt Valence batteries and a 200 kW (equivalent to 272 horsepower) at 2200 rpm diesel SISU 74 CTIM and a ZF Aquadrive. Almost immediately afterwards work began on what became known as the *Hepic*. With funding from the Veneto Region, during 2015 construction of "HEPIC - Hydrogen Electric Passenger Venice Boat" was run by a joint venture called "Hydrogen Park Water Green Mobility 'The 24 pax, 15-meter (50 ft.) *Hepic* is fitted with a 200 kw triphase AC motor, alimented by 70 kWh lithium batteries in three packs; each pack has a weight of 350

kg (772 lb.), a total weight of embarked traction batteries of 1050 kg (2314 lb). For the 60 kW PEM, the hydrogen is stored on-board at a pressure of 350 bar in 4 large carbon fiber cylinders, each of 2 meters (6.5 ft.) in length and 40 centimeters (16 in.) in diameter. With its specially designed four-bladed propeller, Hepic's top speed at full load is 30 kmh (20 mph.). It has a four-bladed propeller. By October 2018, *Hepic* had still not received its permit to navigate around Venice. Undeterred, En 2017, Vizianello built *Fede* and *Coraggio*, two hybrid-diesel lagoon passenger boats so improving on the *Energia* prototype. At present their R&D in involved with two more diesel-electric boats, one for 50 passengers and the other a new water taxi design with hybrid or full electric option, both working with a sterndrive.

The California Air Resources Board (CARB) recently announced a $3 million grant to help build a hydrogen fuel cell ferry, the first of its kind in the United States, and the first commercial hydrogen fuel cell ferry in the world. The planned vessel, named *Water-Go-Round*, would carry 84 passengers and stretch 70 feet long. Construction is underway in Alameda, California, and the vessel is slated to hit the water in 2019.

4. Available Technology

The marked advantage of marine electric propulsion is in its simplicity which reduces the need and the cost of maintenance. Fuel costs far less than diesel or petrol. In addition with larger propellers turning at lower rpm, there is less cavitation, less waves and less damage to the waterside palazzi. They also offer a form of sustainable, tourist-friendly transport.

There are about one hundred thousand electric boats, inboard and outboard in operation around the world and this number is growing. At an international electric boat propulsion conference, PlugBoat, held in October 2018 on the Venetian island of la Certosa, thirty-one speakers from eleven countries as far afield as Scandinavia, across the European

Union and Japan presented subjects from propulsion types to urban integration. During this conference it was shown that the power range of inboard and outboard motors can cover the entire range of Venice's requirements.

For example, the French Electric Boat Association presented a range of 30 to 150 pax boats, already in service across France and capable of 40 to 60 sea miles range with their li-ion batteries recharged overnight. A cruising range of up to 20 nautical miles is possible without using a generator, which is always available for extended range.

The freight operator Mokum Mariteam uses the canals of Amsterdam to transport goods, waste and to deliver services. This reduces the number of small- and medium-sized trucks operated in the inner-city. The vessels or barges are fitted with silent and clean electric engines. Goods are transported through the city and delivered to their destination without noise or air pollutant emissions. Using existing transport units like rolling containers, pallets and mesh containers, the system has the potential to be implemented by other clients and partners. This makes it possible to scale up the system gradually. Returned goods including waste and residues are collected from the place of delivery in the same efficient and sustainable manner. This system of reverse logistics increases the efficiency of the distribution concept considerably. This could be done in Venice too.

Systems were presented at the Certosa conference that would be perfectly suited to the disruptive but vital transition of Venice's motorised fleet. This includes supercharging - up to one hour´s operation and recharging in ten minutes. One requirement would be for a vessel to take tourists at high speed and emission free to and from Marco Polo airport to San Marco. The cost of operations will probably be much lower than existing Vaporetti because of energy efficiency, cost of electricity and the minimum of maintenance needed. For finance, the municipality might issue a five-year guarantee to cover annual costs also covering themselves for insufficient revenues. Based on this guarantee it would become possible to find good financing. The shipyard chosen would build the vessels but engage local operators. If there are enough passengers, the municipality

will pay nothing from the guarantee. It should be possible to have a such an e-ferryboat in operation by 2020.

Other ports are already transitioning. Damen Ferries are currently building five 80-pax electric robust, steel-hulled ferries (type 2306 E3) for Denmark to be launched in Copenhagen Harbour by 2020. They will run for sixteen hours a day and ticket prices will stay the same. Arriva will operate the ferries for its client, Danish public transport agency Movia, in the country's capital city Copenhagen. This is part of Copenhagen's plans to become the first CO2-neutral city in the world by 2025. ForSea's two 100-m ferries, *Tycho Brahe* and *Aurora* have been converted from conventional diesel engine operations to battery power for regular service between Helsingborg, Sweden and Helsingør, Denmark (4 km). *Tycho Brahe* can carry 1250 passengers, 260 trucks, 240 cars and 9 passenger train coaches at one time. With installation of a 4,160-kWh battery on each vessel, they become the world's largest battery ferries, and can recharge in just 8 minutes!

The Municipality of Oslo decided a couple of years ago that public transport in the Oslo fjord should use renewable energy. Furthermore, their target is to reduce the volumes of cars entering Oslo by 20 %. Green City Ferries is discussing with some of the adjacent municipalities about having a zero emission high-speed ferry for commuting to the center of Oslo. This should be a better alternative than taking the car because of the traffic congestion. Furthermore, it is decided by the transport authority in Oslo that the larger commuter ferries in the inner Oslo fjord should be retrofitted to all electric next year. Since 2015, Norway's first all-electric ferry the 360-pax *Ampere* has reduced CO2 by 95%, operating cost by 80%, resulting in 53 further orders for shipbuilder Fjellstrand. Havyard at the Sognefjord shipyard is fulfilling 13 orders for zero-emission ferries received since 2016. Stena Line, the company that operates 38 vessels and 21 routes in Northern Europe, is electrifying one of its ferries to see whether it's viable.

Worldwide, electric and solar electric ferries have proved themselves. Since 2000, the 100-pax *Solar Sailor* has been operating in

Sydney Harbour. Four electric ferries operate in Hong Kong carrying 100 passengers each. India's first solar passenger ferry, *Aditya*, has been operating successfully for the past 20 months in the backwaters of Kerala. Based on its success, the Kerala Government has ordered three more solar ferries of 75 to 100 passenger capacity. In 2007, the keel was laid at the SSB shipyard in Oortkaten for a 100-pax hydrogen fuel-cell ferryboat to operate on Lake Alster and the River Elbe, within the port of Hamburg. The "green ferry" was part of the €5.2m *Zemship* project which involved 9 German and Czech partners and was led by Hamburg's State Ministry for Urban Development and Environment. The *FCS Alsterwasser* began its trials on inner-city waterways in Hamburg in the summer of 2008 and by 2014 had logged up 4000 operating hours and transported more than 50.000. passengers on Lake Alster. In 2018, the waterbus *Bajadera* in the city of Vukovar in Slavonia became the first wholly electric-solar boat in this part of Europe and on the whole of the Danube River. Electric waterbuses are in reliable service in La Rochelle, Bordeaux, Marseilles, Monaco and an increasing number of European city ports. The German manufacturer Torqeedo has delivered the first electric propulsion system for ferries in Thailand. The electric passenger ferry picked up operations in Bangkok as part of the city's efforts to improve air quality. The Electric Boat Association of Greece, working with both the Ministries of Energy & Environment and Maritime & Island Policy, and the national electricity supplier PPC Group & CAVOTEC SA are developing an Electric ferryboat. In the USA, in rural Alabama, the Gee's Bend Ferry operators are replacing John Deere engines with a battery-electric propulsion system, which will make it the first zero-emissions ferry of its kind in the United States. A ferry in Skagit County, Washington, may soon follow suit. Stimson Yacht Design and Naval Architecture (Auckland, New Zealand) is designing New Zealand's first all-electric 18.5 m passenger ferry. According to Stimson, the vessel will operate at 20 knots service speed, running at the rush-hour peak three back-to-back 25-minute runs with 5-minute dip charges at one side only before a 1 hour recharge is required.

In July 2018, BYD, manufacturer over 50,000 electric land buses in revenue service in 6 continents and Generate Capital announced a breakthrough leasing program to accelerate the adoption of electric buses

in the Americas. Generate Capital is investing $200 million to buy and lease the buses. The US Federal Transit Agency (FTA) announced in 2018 that it would distribute $84 million in grant funding for zero-emissions electric buses this year through its “Low or No Emission Bus Program.” Paris’s RATP plans to convert its 1,000 diesel buses to electric by 2025. What has worked on land, could work on the water.

An alphabetical and international list of 40 international suppliers of engines and propulsion systems will be available once a strategy has been finalised by those concerned.

5. Obstacles

One irrelevant excuse is that the electricity for recharging batteries would come from nuclear energy. This may be the case, except that Italy has no direct nuclear power since it was banished in 1987 by referendum. About 8% of the electricity consumed in Italy is from nuclear power – all imported from France and Switzerland. According to data published in 2017, natural gas accounts for the largest share in electricity generation in Italy (45%), followed by hydropower (14 %) with photovoltaics (9%) and wind power (6%). This could be increased by the installation of a sizeable offshore wind turbine farm which could be installed in the sunny neighbouring Adriatic.

A more relevant concern would be that Venice is just as much both the cause of and subjected to global warming as anywhere else on our Planet.

In addition, until recently the Italian auto manufacturers were lagging at the very back of their foreign competitors in taking forward hybrid and electric road vehicles, as with lorries and buses, although Florence has an excellent electric tram system. In June, the populist

government in Italy, Europe's most sluggish market for electric cars, announced a big-bang plan to put 1 million of the vehicles on the nation's roads by 2022. Getting anywhere near that target could cost the state $10 billion in incentives. Fiat Chrysler SpA Chief Executive Officer Sergio Marchionne, a one-time EV skeptic, has announced that his company will invest 9 billion euros to develop electric cars by 2022. Marchionne expects that by 2025 fewer than half the cars sold globally will be fully combustion-powered. This may be even harder to realise the Venice Agenda 2027 with internal national investment. This must be external as a gesture of gratitude from all those who have ever been enchanted by the lagoon city. Despite this, the 20ft shell-fishing boats in the lagoon, all have 200hp gasoline outboards and then 10hp petrol trolling motors. Like the water taxis, the helmsmen only have one throttle setting: full power, even in some of the speed restricted areas. Each Venice water taxi collects many, many fines every year for overspeeding in the canals –but do not pay them. At the end of the year, their federation goes to the city and offers a global sum –a small part of the total fines-, and the city accepts instead of having to recover each fine...
Venice was then the largest market in the world for 200 hp motors.

This is why the international Committee for this challenge must be as influential and transparent as possible.

And yet, in previous centuries, Venice was known for its open innovative approach. By 1450, over 3,000 Venetian merchant ships were in operation, both as supply ships for Venetian merchants and as warships for the Venetian navy. These were built at the shipyard complex known as the Arsenale, with experienced engineers such as the astronomer Galileo Galilei, who would also use the Murano glass for the lenses in his telescope which proved the Earth orbits the Sun. It is said that, at its peak, the Arsenale could build and fit out one entire ship in a single day! And Venice can show proof of her innovative nature again.

Venice, the final resting place of Saint Mark, is a Catholic City with some 139 churches including its Basilica. It has papal links through the Patriarchs of the city who have become Popes, no less than three in the

20th Century. The current Patriarch, Francesco Moraglia, was born in Genova, a naval city! His Holiness Pope Francis's encyclical "Laudato si; On care for our common home" calls all people of the world "to take swift and unified global action". On December 3rd 2018 Cardinal Pietro Parolin, Vatican secretary of state, speaking during the U.N. Climate Change Conference in Katowice, Poland, "We are standing before a challenge of civilization for the benefit of the common good. It is still possible to limit global warming, but to do so will require a clear, forward-looking and strong political will to promote as quickly as possible the process of transitioning to a model of development that is free from those technologies and behaviors that influence the over-production of greenhouse gas emissions."
This includes Venetians.

6. How much will it all cost?

Not as much as one might think. The 100-pax airport shuttle and its charging station would cost around €4M. The 113 vaporetti waterbuses, at €2.5M each would total €280M (However, it costs some €200K to refuel a vaporetto throughout the year given that 16 hours per day consuming 520 litres, a total consumption of over 21M litres per year. Electric propulsion would bring that cost down to €20K which for the whole fleet would be a saving of €21M!). The vested interest of selling and profiting from diesel sales could be replaced by the renting out and maintenance and recycling of batteries. To convert the 550 five-seater water taxis would cost €11M. The 800 electric workboats for cargo and refuse collection would cost €xxM. Finally the 350+ private speedboats and runabouts, most of them with four-stroke gasoline outboards would cost €7M for new electric outboards. This works out at a total of €400M, *grosso modo*.

This is reasonable compared to the ongoing costs of the MOSE barrier, construction of which was authorised by a "Comitatone" on 3 April

2003 and the associated construction sites opened the same year. Currently about 4000 people are employed in the construction of MOSE The MOSE project is estimated to cost €5.496 billion, up €1.3 billion from initial cost projections. VeniceAgenda would work out at one twelfth of that.

How does this compare to the costs of other vehicles? The newest US aircraft carrier, the *U.S.S. Gerald R. Ford*, to be commissioned in 2019, cost €11.2 billion. In November 2012, in a budgetary compromise, the European Space Agency (ESA) was granted € 10-10.1 *billion.* Ocean liners, often seen near Venice, cost between €1 billion and €1.2 billion. A *Rafale* fighter plane costs around €75M (flyaway cost) It would cost five fighter planes to transition Venice. As of March 2010 the average list price of one A380 airbus was about €261 M. It would cost perhaps two A380s to fully transition Venice. Solar Impulse which flew around the world, cost $170 million. In March 2010, the average price for a geared 500-TEU container ship was $10 million, while gearless ships of 6,500 and 12,000 TEU averaged prices of €65 million and €93 million respectively. It would cost about four container ships to transition Venice. On average, a 100-meter superyacht with a top speed of 25 knots and 50 crew members should cost around €240 million. Considering the 30 largest superyachts are all longer than 100 meters, they can often cost significantly more. An extreme example is *History Supreme* at €3.9 *billion.* The cost of one large superyacht would transition Venice. Once again, VeniceAgenda2028 will cost considerably less and the investment could soon be recovered with interest.

7. Strategy

As there are short distances to travel in Venice, electrifying all the vessels is a viable solution but having the technology for electrifying vessels is only the start. What is needed to really achieve the transition is:

a) Connect with EU target for reduction of CO2, PM and NOx

b) Define the means for financing charging infrastructure, retrofits and new vessels. Equity, smart long term loans, local, national and EU grants.
c) Plan for establishing charging infrastructure and connection to the grid.
d) Set target and roadmap for the transition in detail. Which vessels to be retrofitted when.

8. The Means

Media and Social Networking

- Use Media and Social Networking to expose the problem internationally: If a “change.org” poll/petition recently were to ask internauts who had visited Venice whether they would prefer quieter zero-emission boats to visit the canals, it is likely that within hours thousands would sign. In xxx hours, some yy thousand would have signed. One month later. Such statistics might influence both the Italian Government and the City of Venice to change the regulations (licensing conditions) for Venice and its surrounding islands.

Representatives

- Put together a Round table conference with representatives from industry (operators, technology providers, energy agencies), finance and politics (local and national). Set targets and formulate a transition roadmap. Use a consultant as moderator.

Financing

- Obtain world financing to begin the process towards zero emission, low cavitation motor boats, in particular by retrofitting the old petrol and diesel engines with electric units, but also by introducing new boats.

Event

- Fix a date by which the entire Venetian fleet of transport, work and pleasure boats are electric. We propose the year 2028.

9. Patronage

Inspired by the history of Venice, a consortium of major patrons (private and public) might be set up, named after Venice's ancient ***Consiglio dei Pregadi*** ("Council of the Invited"). The Number One investor would be known as the **DOGE** (Il **DO**natore **GE**nerosissimo).

The top ten investors would be select members of the traditionally named Council of **Ten** known as *Consejo de i Diexe*, while the supporting Committee of Forty (once used to elect the Doge) would give less. Inspired by the Venice Film Festival's award The Golden Lion (Italian: Leone d'Oro), a medal of either the winged Lion with its paws in the water, or of the Horses of Saint Mark (Italian: Cavalli di San Marco), known as the Triumphal Quadriga, and the letters VEP (Venice Electric Propulsion) on the reverse would be struck and presented to sponsors. Ten of these medals would be in 14 K gold, the rest in Stirling silver.

10. Postscript

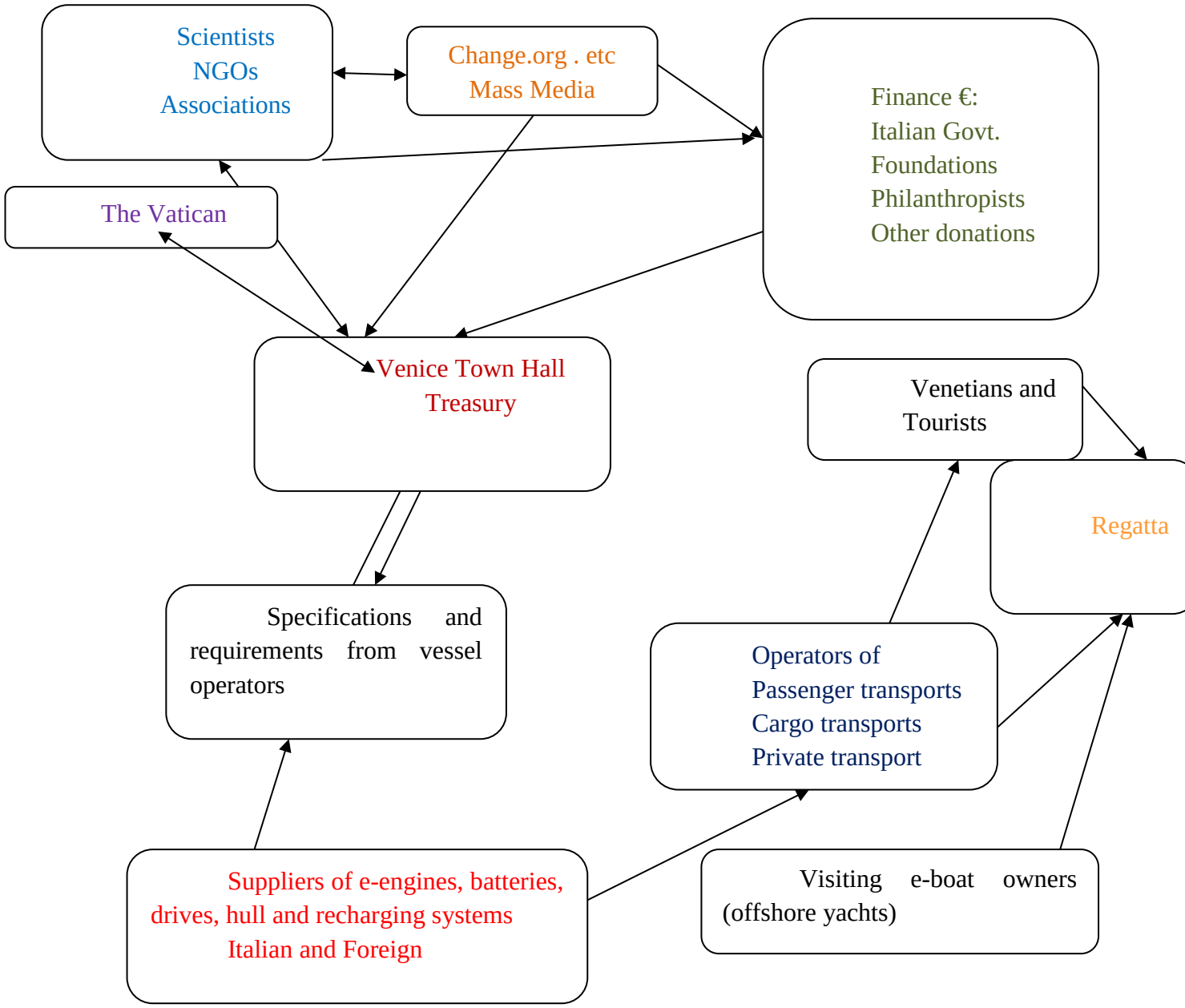
During transition, one might also organise an electric and solar electric regatta on the Grand Canal, in the centuries-old tradition for which the Venetians are renowned. In 1990, Longines, the Swiss watchmakers, decided to sponsor "A Tutto Sole" (="Sun for All"), a Solar Boat Championship, comprising nine Italian Solar Boat Races, to be held

between 1 June and 29 July: *The venues included Venice (Lagoon) and Venice (Adriatic).*

If you would like to become involved with this campaign, please sign the petition.
If, with your help, our petition reaches hundreds and thousands of signatures will have a major impact.

For more information: Kevin Desmond, coordinator phase 1 desmond.book@wanadoo.fr

11. Venice Agenda 2019 - 2027 : How it might work



12. Invitation for support

Venice, legendary lagoon city, unique in the world, is threatened by the pollution of its motor-boats, whose emissions pollute the air and whose wakes erode the palaces. Our objective is to transform Venice's motor boats into a modern fleet of non-polluting, zero-emission vessels.

So VeniceAgenda2028 invites you to sign this letter to give weight and importance to our cause:

I, the undersigned ……do hereby declare my public support for the VeniceAgenda2028 project to transition Venice's entire fleet of motorboats from diesel/petrol propulsion to eco-friendlier sustainable zero-emission propulsion before 2028.

Date ..…/……/..…..

Name & Surname Profession Signed

Please send a copy signed at desmond.book@wanadoo.fr