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Oil in Italy: Yesterday, Today and Tomorrow

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Abstract
The past, current status and future of the oil sector of Italy are considered and analyzed. The author uses methods of comparative and systematic analyses, which are implemented for assessing the Italian oil in the context of the world, Europe, and the EU. The article mainly concludes that the COVID-19 pandemic has impacted the Italian oil market more seriously than any other European countries, but its prospects are still quite good

Key words: Crude oil; Condensate; History; Production; Pipelines; Petroleum companies; ENI; Oil refining; Consumption; Foreign trade; Italy; Sicily; Russia

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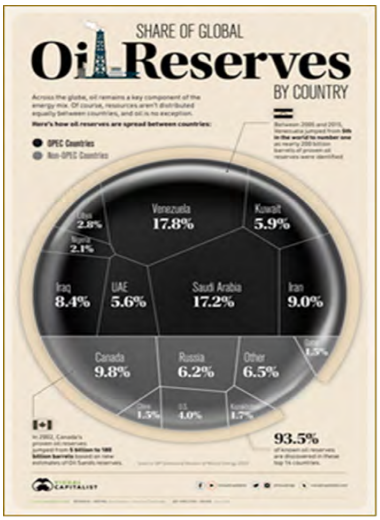
A bit of Italian oil history. Despite the historical facts that ancient Romans widely used crude oil for a long time for medical treatment of skin diseases, calling it “Sicily oil” (from the place, where it was taken from – outskirts of the small Sicilian town of Agrakos), and afterwards they found a “better” name for this oily substance “oleum petrae” (or “stone oil”, becoming “petroleum”), modern oil history in Italy is relatively short. The first oil wells in Europe were manually dug in Italy in 1860 near Ozzano (Parma) while the first commercial oil discoveries were the Ragusa (in 1954) and Gela (in 1956) fields, both in Sicily. By the mid-1950s, the first offshore seismic survey started in the Adriatic Sea. Since 2007, however, the exploration drilling has dropped to under 10 wells per year. In 2014, this negative trend was further confirmed with no exploratory wells drilled at all. The causes of this decline derive from the exploration maturity of the biogenic gas play and from the heavy bureaucratic processes involved in obtaining authorization [1].



Reserves. The most important Italian provinces for oil are the northern area of the Adriatic Sea, the Po Valley (gas and oil), the Pescara field (oil and gas), the southern area of the Adriatic (oil and gas), the Southern Apennines (oil), the Fossa Bradanica in the Puglia region (gas and oil), and the Pelagic fields (oil) (*Fig. 1*).

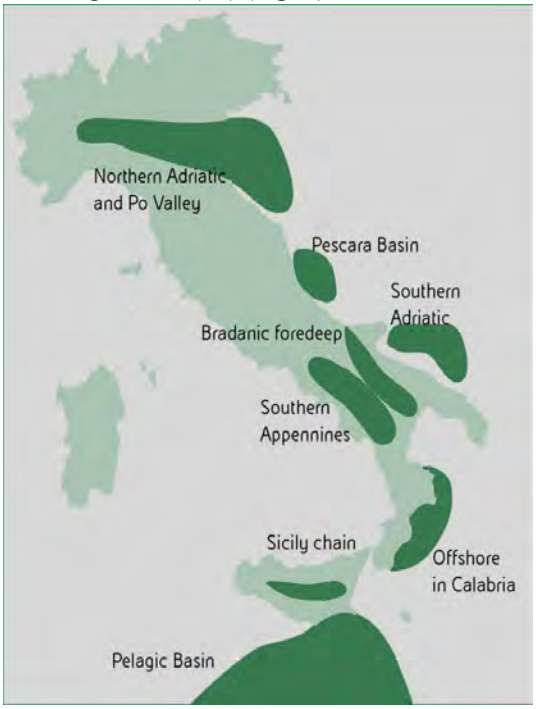


Figure 1
Main Oil Basins in and around Italy

The most important oil reserves are in Val d'Agri (Potenza) and Villafortuna-Trecate (Novara). Val d'Agri is the province with the greatest oil reserves in Italy.

ENI *(see below*) estimates Italy's proved oil (including lease NGLs) reserves at the end of 2020 – based on the national Ministry for Ecological Transition's data – at 583 mln bbl (over 3.9% of Europe's total) compared with 443 mln bbl as of 31 De-cember 2005 [2].

In its turn, BP estimates proved oil (with mixed condensate) reserves in Italy as of the end of 2020 at 0.6 bln bbl or 0.1 bln tonnes with 14.7 years of reserves-to-production ratio [3].

Production. Crude oil production in Italy peaked in 2005 at 115,000 b/d, and has since slumped below 100,000 b/d – not due to a lack of reserves (proved oil fields on the Apennines are the biggest in Europe, except for some in the North Sea) but because of a dramatic decline in local hydrocarbon exploration and development, which the government is keen to reverse.

It aimed in the autumn of 2012 to boost Italian oil production by almost 150% by 2030, and the scheduled bringing onstream the Tempa Rossa oil field (the largest Italian oil accumulation) with its 200 mln bbl of heavy, sulfurous petroleum reserves lying within the Vicino borough, often called Italy's Texas, is only about a third of the way to this goal [4].

At present, there are nearly 80 producing oil fields in Italy, including coastal waters of Sicily, (*Fig. 2*) – mainly within the Southern Apennines, Southern Adriatic and Pelagic basins – *see above*.

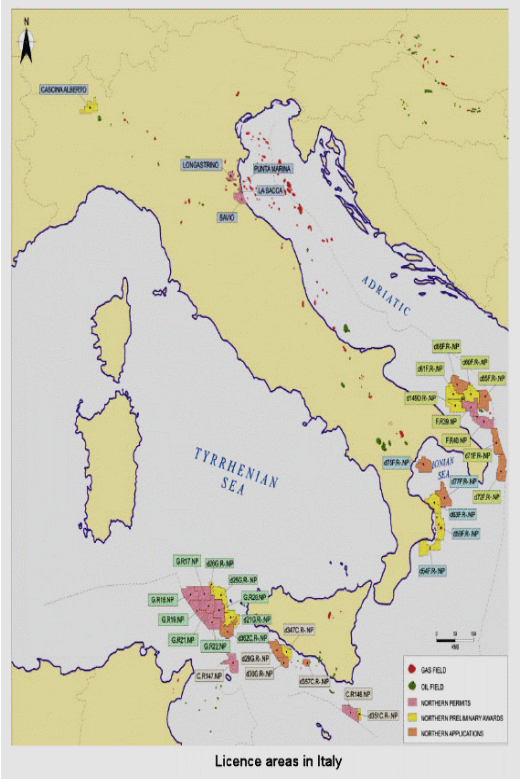
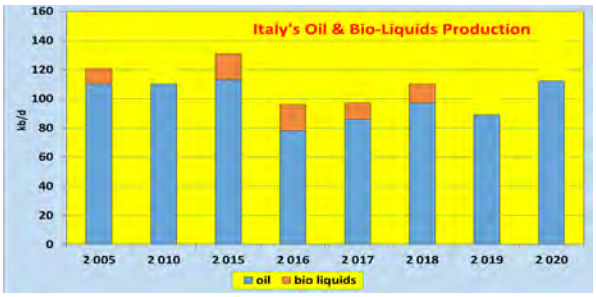


Figure 2
License Areas and Discovered Hydrocarbon Fields in Italy (as of the start of 2021)

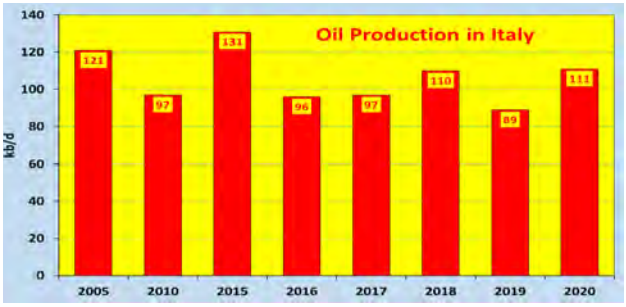
It is noteworthy that Italian statistics on national petroleum production usually include data on bio-fuels (ethanol and diesel – *see below*), which are inextricably in-built in related petroleum ("oil") numbers (and this is just the case with the statistics provided in the ENI's (*see below*) flagship *World Energy Review*) and make the Italian statistics highly misleading (for example, in 2020 ENI's data, which included bio li-quids production (of ethanol and biodiesel – *see below*), exceeded BP's oil production in Italy by 28%). Fortunately, this may be partly overcome by using related global data of BP (*Fig. 3*).



Source: drawn by the author based on https://www.bp.com/content/dam/ bp/business-sites/en/global/corporate/pdfs/ energy-economics/statistical-review/bp-stats-review-2021-full-report [3] and https://www.eni.com/assets/ documents/eng/scenari-energetici/2021/World-Energy-Review-2021 [2]

Figure 3
Annual Production of Oil (Crude Oil + Leased NGLs, according to BP) **and of Biofuel Liquids** (based on ENI's data) **in Italy in 2005-2020**, in kb/d

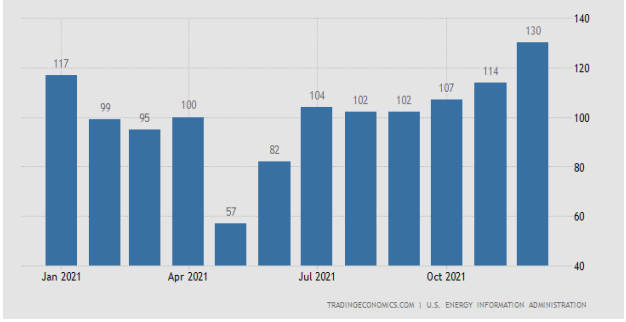
According to ENI statistics, Italian petroleum production mainly declines – from an average 131 kb/d in 2015 to 111 kb/d in 2020 – mostly due to natural dep-letion of operating fields and the lack of new oil discoveries (Fig. 4).



Source: Oil - Supply and Demand Production https://www.eni.com/assets/ documents/eng/scenari-energetici/2021/World-Energy-Review-2021 [2]

Figure 4
Annual Production of Oil (Crude + Lease NGLs + Biofuel Liquids) in Italy in 2015-2020 (according to ENI), in kb/d

Monthly crude oil production in Italy is fairly unstable. Thus, the omnipresent Energy Information Administration of the US Department of Energy (EIA/DoE) estimates that in December 2021 Crude Oil Production in Italy increased to 130 kb/d compared with only 57 kb/d in May 2021 (Fig. 5).



Source: https://tradingeconomics.com [5]

Figure 5
Monthly Crude Oil Production in Italy in 2021, in kb/d

Geographically, Italian crude is mainly produced in Basilicata region (south of Italy; nearly 69% of the total in 2018) and Sicily (almost 8%).

On the average, Italian produced crude oil is quite light (around 38.5°API) and pretty "sour" – with sulfur content of typical Italian crudes varying from 0.3 to 4% by weight. Thus, according to ENI (*see below*), in 2019 a share of light and sour crudes, produced in Italy, amounted to more than 82% while a share of heavy and sour crudes – to 17.5% [2].

Pipelines. In 2013 total length of pipelines in Italy was 23.19 thousand km, including 1,393 th. km of crude oil pipelines and 1,574 km of pipelines for refined oil products [6] (Figs. 6 and 7). The length of oil pipelines, which were laid mainly in northern Italy, changed from 4,346 kms at the beginning of 2000 to 4,016 kms as of 1/1/2017 [7].

Figure 6
Main Objects of Italy's Oil Infrastructure (as of the start of 2017)

Figure 7
Pipelines of Italy (as of the start of 2022): oil pipelines marked green, oil-product pipelines - blue

Northern oil pipelines in Italy include Northern Italy Pipeline System (NIPS), which was built during the Cold War to supply NATO forces with fuel and it continues to satisfy fuel requirements with the top military flexibility. Though located on the Italian territory, the system was and is supervised not by Italy's authorities but by NATO officers during the construction and since its start.

The NIPS pipelines stretch some 900 kms (559 mi) from La Spezia on Italy's Ligurian coast to the NATO air force bases at Ghedi, Villafranca, Aviano, Rivolto, and Cervia.

Anyway, no less important was the cross-border crude Rhône Pipeline, running some 340 km (210 mi) from a marine terminal in the port of Genoa through the Alps mountains and the Great St Bernard Tunnel to the Rhône Valley in the Swiss canton of Valais, where it supplied the Tamoil oil refinery at Collombey-Muraz. [FYI: Since 2015, the oil transportation has stopped due to Tamoil's decision to idle the oil refi-nery at Collombey-Muraz]. Commissioned in 1959 and operated by ENI's Société de l'oléoduc du Rhône, the now non-functioning trunkline with its inner diameters of 12-18 inches (300-460 mm) was capable to transport up to approximately 1.1 mln bbl of crude oil per year [8].

Also important are operating oil pipelines from Italy to Germany: the Central European Pipeline (CEP), running 753 kms from Genoa to Ingolstadt, having inner diameters of 18, 26, 32 in. and capable to pipe up to 1,100 kb/d, and the 26-40-inch Transalpine Pipeline, running 757 kms from Trieste to Jockgrim and technically capable to transport up to 900 kb/d of crude [9].

Companies. At present (2022) there are nearly 40 foreign and local oil-related companies, including such world-famous giants like ExxonMobil, Shell (RDS), BP, Total, ENI, and MOL, as well as over 20 local companies operating in upstream and downstream sectors of Italy.

Italy has its own national petroleum company – ENI S.p.A. (*Ente Nazionale Idrocarburi*), a multinational oil and gas company (or rather a petrochemical concern) headquartered in a multi-story building in the capital city of Rome. It is usually considered one of the seven "supermajor" petroleum companies in the world, operates in 69 countries (including Kazakhstan, Russia, and Turkmenistan) and has a market capitalization of US$54.08 billion, as of 11 April 2022. In 2021 the concern employed a staff of nearly 31,890 working in many subsidiaries – such as Eni Gas & Power, Saipem, Eni Rewind, EniProgetti, and Eni gas e luce [10].

The company was established on the 10th of February 1953 on a base of an existing company, Agip, which was created in 1926 with the aim to explore for oil fields, acquire and commercialize oil and its derivatives. In March 1953, the legendary Enrico Mattei, who always fought against the Inter-national Petroleum Cartel (IPC) and died on October 27, 1962, in a mysterious plane crash, was nominated Eni's chairman. The Italian government owns a 30.33% golden share in the company, 4.37% held through the Ministry of Economy and Finance and 25.96% through the state-owned Cassa Depositi e Prestiti.

Eni's logo includes Agip's symbol of the six-legged fire-spitting dog (actually, such a dog symbolizes energy, the four of its legs – four wheels of a car, and the two legs – those of a car's driver). Agip is a market brand of the ENI corporate group.

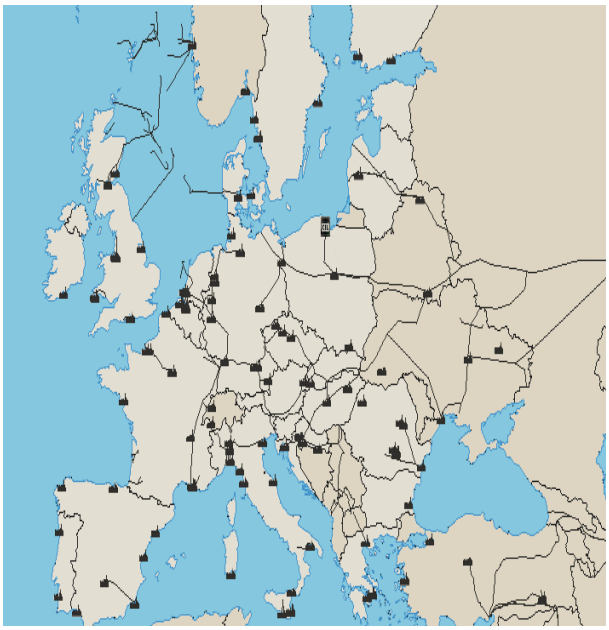
Refineries. With a total of 15 refineries (sometimes a number of 17 oil refineries in Italy now is mentio-ned but we are not sure at all about this number as we have found only 15 large, medium-sized and small oil-refining plants, out of which two in Sicily were united in 2007 into one and some of which were shut-in – mainly for being converted into bio-refineries) that can pro-cess more than 2 million barrels per day. Anyway, Italy is the second largest refiner in Europe falling just behind Germany. Out of Italy's 15 oil refineries, 11 of them are located along the coast and have terminals that are capable of receiving oil tankers. Combined design intake capacity of all the Italian existing oil-refining plants approa-ches 2.05 mln b/d (or nearly 102.4 mln t/y) while capacities of still operating 9 oil-refining plants, which are not yet converted into bio-refineries, are in total less than 1,540 kb/d (nearly 77 mln t/y) (Table 1 and Fig. 8).

During 2017, 11 Italian oil refineries processed 80.3 mln tonnes of crude oil, which represented a refinery utilization rate of 79.6%. In 2020 – because of the coronavirus decline in demand – only 1,115 kb/d (- 17.7% compared with 2019) were refined by the remaining 9 plants, and the utilization of their installed capacities has dropped to 72.4%. Generally speaking, despite its importance, the refining sector in Italy continues to contract. From mid-1980s to mid-1990s Italy suffered a reduction in refining capacity and the decom-missioning of half of its oil-refining plants (18 out of 36) – due to the structural overcapacity for distillation since the "1973 First Oil Crisis" (and the following "1979 Oil Shock" and "1980s Oil Glut"). The subsequent "2008 Financial Crisis" had a high impact on the Italian refining sector. The EU refining margin fell from above to below the average margin of their competitors (U.S., Russia, Middle East and South Korea/Singapore) mainly due to the increase in energy operating costs. This crisis has reduced the EU refining capacity by 10% and forced the shutdown of 5 Italian refineries from 2008 (from 16 to 11). All in all, available Italian refining capacity has shrunk from some 220 mln t/y in the second half of the 1970s down to just above 100 mt/y since 2015 [11].

Table 1
Oil Refineries in Italy (as of the start of 2020)

Name	Location (city, etc.)	Template intake capacity, kb/d	Start year	Owner(s)
Priolo Gargallo Isab Refinery	Priolo Gargallo, southeastern coast of Sicily	320	2007 (unifica-tion Impianti Sud and Impianti Nord Refineries)	ISAB (a wholly-owned subsidiary of LUKoil)
Sarlux Sarroch Refinery	Southwestern coast of Sardinia	300	1965	Saras SpA
Sonatrach Au-gusta Refinery	Augusta	190	1949	Sonatrach
Sannazzaro De Burgondi Refi-nery	Po Valley	180	1963	Eni SpA
Sarpom Trecate Novara Refi-nery		160	1948	ExxonMobil and ERG
Milazzo Refi-nery	Northeastern coast of Sicily	160	1961	Eni SpA and Kuwait Petroleum
Taranto Refi-nery	Taranto	110	1967	
Leghorn Livor-no Refinery (1)	Stagno (near Livorno)	105	1936	Eni SpA
Gela Refinery (1)	Southern coast of Sicily	100	1963	
Cremona Re-finery (1)	Po Valley	96	1965	Tamoil
Rome Refinery (Raffineria di Roma) (1)	Rome	86	1965	ERG SpA and Total
Falconara Ma-rittima Ancona Refinery	Falconara Marittima, Adriatic coast of Italy	78	1950	Anonima Petroli Italiana
Porto Marghera Venice Refinery (1)	Venice	70	1926	Eni SpA
Mantova Refi-nery (1)	Southeastern outskirts of Mantova	52	1946	Italiana Energia e Servizi (IES –subsidiary of MOL)
Iplom Busalla Refinery	Busalla (~ 12 mi north of Genoa)	40	2010	Iplom SpA (a subsidiary of Finoil SpA)
Total	Italy	2,047	1926-2010	Various companies

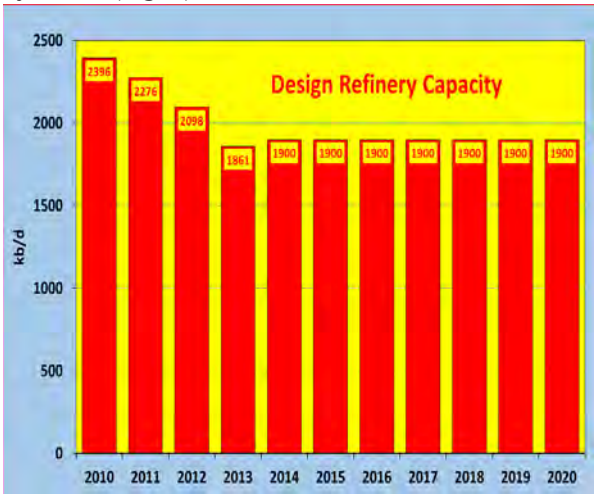
(1) Closed, including for conversion into a bio-refinery
Source: compiled by the author based on various primary sources, including [12]



Source: https://www.researchgate.net/figure [13]

Figure 8
Location of Main Existing Oil Refineries in Europe and Italy (as of the end of 2020)

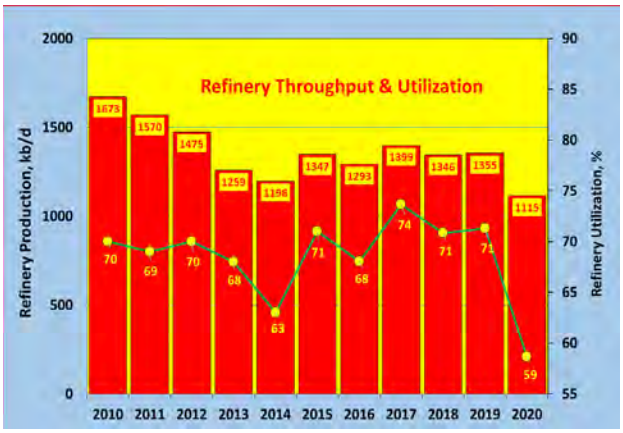
Though BP data on refining capacity in Italy are not as reliable as ENI's ones, at least BP's statistics show some dynamics (*Fig. 9*).



Source: drawn by the author based on https://www.bp.com/content/dam/ bp/business-sites/en/global/corporate/pdfs/ energy-economics/statistical-review/bp-stats-review-2021-full-report [3]

Figure 9
Combined Installed Intake Refining Capacity in Italy in 2010-2020 (at year ends; according to BP), in kb/d

Actual refinery production tends to decline during the last decade, especially under the impact of the coronavirus pandemic in 2020, when refinery throughput in Italy has decreased by nearly 18% – to only 1,115 kb/d. As a result, combined refinery utilization, which, according to BP, never exceeded in Italy 75%, has dropped to in 2020 to less than 58.7% (Fig. 10).



Source: drawn by the author based on https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/ energy-economics/statistical-review/bp-stats-review-2021-full-report [2]

Figure 10
Actual Refinery Throughput and Utilization in Italy in 2010-2020 (according to BP), in kb/d

Since October 2021 Eni (*see above*) is converting its Livor-no refinery (which suffered from a fire at the end of the year) in northwest Italy into a bio-refine-ry, as part of the company's wider strategy to make its activities more environmentally sustainable. Eni has already converted two of its Italian refineries and may speed up the conversion plan for its traditional refineries, with the aim to be producing 5 million t/y of biofuels by 2050 [14].

The acquisition of Augusta refinery in Sicily from ExxonMobil subsidiary by the Sonatrach at the end of 2018 is expec-ted to reinforce the refining system of Sonatrach with an additional refining capacity of over 9.5 mln t/y of refining and storage capacity [15].

A possible division into two parts

Bio-energy Liquids. There are in Italy a lot of organizations dealing primarily with biofuels – even the Italian Biomass Association ITABIA – and a plenty of state-run establishments and private agencies promoting such a business. Moreover, Italy has a dedicated national bioeconomy strategy.

The main implemented state measures of support include biofuel quotas (*obbligos di immissione in consume*) and premium tariffs (*biodecretos*). In particular, mandatory quota for biofuels in Italy's road transportation supplies increased from 5% in 2015 up to 9% for 2020 (*see also below*).

Over half of total primary energy supply of renewable energy sources is covered in Italy by bioenergy, with liquid biofuels meeting nearly 6% of the nation's energy consumption [16].

Biofuels (including biofuel liquids) are very developed in Italy – higher than in all other EC countries.

The world's first cellulosic bio refinery at Crescentino, Italy, (aka Biochemtex plant), co-financed (around EUR150 mln) by the Framework Programme 7 (adapted to meet the EU's needs in terms of growth and employment in 2007-2013) and by authorities of the Piedmont region, is the first commercial scale plant built to produce bioethanol (with capacity of 40 kt/y) from agricultural residues and energy crops using enzymatic conversion. Using wheat straw, rice straw and Arundo donax on marginal land, it creates economic, environmental and some social oppor-tunities. It generates ~100 direct jobs at its full capacity, and up to 400 indirect ones (e.g. local logistics of biomass collection and transport). It can also generate 13 MW of electricity entirely from lignin, enough to power the plant with extra electricity to sell back to the grid. Furthermore, the plant does not use river water; the water require-ment is satisfied by the biomass, and wastewater is treated and recycled onsite. Like other flagship projects, this one requires high initial capital expenditure and present very high risks to potential investors. Some constraints still need to be overcome: a supply of biomass that is sustainable and perceived to be so by key stakeholders; access to credit/loan guarantees, in addition to or even as an alternative to grants; and, above all, a clear, stable and positive policy framework. At the moment such condi-tions are better met in the USA, Brazil and China than in the EU, although the provision of loan guarantees is now possible in Europe too.

The Biochemtex plant of BetaRenewables (an Italian-US-Dutch JV) ran across financial problems and had to be frozen in October 2017. It came to life only in 2020 after it was acquired from the joint-venture by ENI/Versalis in November 2018, which has converted the plant into a green refinery, and upgraded the refinery afterwards with an investment of more than 15€ mln [17-18].

Besides, in the 2nd half of 2005, Wärtsilä Oyj Abp, Finland's major public engineering corporation, has extended recently a liquid biofuel-fired plant in Monopoli, on the southeast coast of Italy [19].

Wärtsilä has a market share of more than 95% for power generation from li-quid biofuels in Italy.

On this project, which is the fourth one of such a kind in Italy, Wärtsilä worked in cooperation with ItalGreen Energy, part of the Casa Olearia Italiana Group (COI), a major Italian food oil producer. As the energy company of the COI group, Ital-Green Energy focuses on renewables and biomass-fired power systems.

Also, the Italian government will evaluate several proposals to increase produc-tion of renewable fuels to accelerate energy transition, as part of its recovery plan for which the country will receive a generous financial support from the EU.

The projects include conversion of integrated Eni's 84,000 b/d Livorno refi-nery (*see above*) into a biorefinery for hydrotreated vegetable oil (HVO) production and construction of a waste-to-methanol plant (WtM) nearby. The conversion would be completed by the third quarter of 2024, and the WtM plant should be operational by the end of that year.

Eni confirmed its willingness "to carry out the appropriate assessments for the start of the conversion of the Livorno refinery into a biorefinery", but said it was too early to elaborate. The firm previously said that it could speed up domestic refinery conversions to build new HVO plants, and has said it targeted 5 mln t/y of HVO production capacity by 2050. Eni has already converted refineries at Gela and Venice, into respective 650,000 t/y and 350,000 t/y bio-refineries.

Other projects include the scaling-up of biojet production at Gela, the creation of four plants to produce

bio-oils and biomethane using up to 600,000 t/y of organic waste, the strengthening of petrochemical firm Versalis' Crescentino plant to produce ethanol and bioethanol and the creation of a plant to produce renewable plastics. All projects are subject to government approval.

At the end of September Eni has opened its second biorefinery in Italy, located in Gela, Sicily, after the first one in Venice. The plant, which began operations in August, has a processing capacity of up to 750,000 tonnes per year. It will convert used vegetable oil, animal fat, algae and by-products into high-quality biofuels. Following the closure of all petrochemical plants built in Gela since 1962, Eni has invested €294 million in converting the refineries into renewable fuel facilities. The company plans to invest an additional €73 million into further preliminary activities and for the pre-treatment of biomass, which is expected to be complete by Q3 2020. Eni began converting the refinery into a biorefinery in April 2016, and has spent over 3 million work hours on completing the project. In order to construct the Ecofining™ plant, the two existing desulphurization units were modified and a steam reforming unit was built to produce hydrogen. Hydrogen is a basic ingredient in the biodiesel hydrogenated vegetable oil (HVO) that, when added to regular diesel in a quantity of 15%, creates the premium fuel Enidiesel+. Commenting on the news, Eni's CEO Claudio Desclazi, said: "It's a very im-portant day for us. In Venice, we were the first in the world to convert a traditional refinery into a bio-refinery, and now we're opening our second, which is even more innovative. It's a fresh example of Italian excellence… This is a big step forwards on our path to decarburization, something we have been pursuing for some time but have stepped up in the last five years, investing in efficiency and in particular in green energy production, renewables and the circular economy. …" [20]. Eni employs over 1,000 staff at the site in Gela, of which 426 work at the bio-refinery.

Starting from 2012, Italy launched a series of liquid bio-refineries, which (if former ENI's oil refineries, the plants were converted since 2014 from traditional ones) (Table 2).

Table 2
Main Existing Biorefineries in Italy (as of 2022)

Name	Location (city, etc.)	Feedstock	Annual capacity, kt/y	Year started	Owner
Venice Bio-refinery	Porto Marghera, Venice	vegetable oils, animal fats, used cooking oil	300 of green diesel (HTO)	2014	ENI
Gela Bio-re-finery	Gela, south-west coast of Sicily	used vegetable oil, animal fat, algae, and by-products	750 of renewable diesel (HTO), bio-naphtha, bio-LPG and biojet	2019	ENI
Crescentino/ Versalis Plant/Bio-refinery	Crescentino, province of Vercelli, Piedmont region	cellulosic biomass from agricultural residues and energy crops	25 (20 mln gallons (76 mln l) per year) of bioethanol	2013 (1)	ENI/ Versalis
Livorno Bio-refinery	Livorno, Toscana	vegetable oils	HVO	…	ENI

The bio-refinery, managed by ENI, is active from the summer of 2020
Source: compiled by the author based on various sources

Eni plans to double its current bio-refining capacity of 1.1 million tonnes/year within the four-year (2022-2025) period and increase it to 5-6 mln t/y by 2050. The so-called biojet will play a significant role in the product mix, in line with industry scenarios and market trends, and the aim is to reach a production capacity of at least 500 thousand tonnes/year of biojet by 2030 [21].

Increasing production of renewable fuels would align with higher biofuels blending targets for 2021 and the coming years. The Italian government has set a 10-% target for biofuels in the road transport fuel mix for 2021, up from 9% in 2020 (*see above*) [22].

Biofuel liquids are represented in Italy mostly by biodiesel as well as by bio-ethanol, which is not used in vehicles purely (like in many cars, say, in Brazil) but is al-ways blended with petrol to make a gasoline-alcohol mixture – from E5 up to E85 (which means a percentage of anhydrous ethanol in a car blended fuel used now in Italy).

According to available data, at the end of the 2010s Italy's capacity biofuels to produce diesel of FAME (fatty acid methyl ester) and HVO (hydrotreated vegetable oil) types was estimated at 0.511 and 0.451 mln cubic meters respectively [23]. Between 2005 and 2017, the amount of biodiesel produced in Italy has grown almost 8-fold: from 200 thousand tonnes in 2005 up to 1,525 th. in 2017 and exceeded 28% of Italy's annual crude oil + lease NGLs production of less than 5.4 mln t [24]. The production of biofuel in Italy is expected to rise constantly up to 2025, when it is forecast to peak at 2.8 million tons of oil equivalent. In the following years through-out 2040, the value is expected to remain quite stable [25].

Potential bioethanol yields in Italy are estimated at 1,637 liters/ha (0.84 toe/ha) for wheat and 4,346 liters/ha

(2.23 toe/ha) for sugar beet. And these figures are roughly average for the EU countries [26].

Cars and Filling Stations. There were in 2019 on the roads of Italy some 40 million of passenger cars – the second place in the EU after Germany (48 mln of registered light-duty vehi-cles). With permanent population of 60.6 mln (at mid-year according to UN data) the national level of motorization per 1,000 inhabitants was 663 – the second in the EU after Luxemburg (681) [27]. This was surely higher than the world's average of over 120 units per 1,000 of persons [28], an average of nearly 470 passenger cars in the G7 countries [29], not to mention the world's highest motorization in small European countries of San Marino and Andorra (over 1,200 units per 1,000) [30].

Unsurprisingly, Italy has a plenty of car filling stations. A number of only those that refuel cars with petrol reached at the start of 2020 almost 3,550, nearly 4,185 out of which were operated by the national oil and gas company ENI (*see above*). Other large owners of Italian petrol-filling stations include Api Group, Spain's Repsol, Kuwait's Q8, France's Total, the US Esso, and the Dutch Tamoil [31].

Electric-car (or electric-vehicle, EV) market is highly developed in Italy, being the world's key market place. The market share of all-electric cars registered in Italy experienced a positive trend over recent years, passing from 0.26% in 2018 up to 2.3% (or 32,538 cars(!)) in 2020 [32]. As of December 2020, almost 100,000 plug-in passenger cars were registered in Italy. In addition, there were 6,315 light-duty commercial vehicles driving on electricity. At the end of 2020, plug-in passenger cars represented over 0.3% of all cars on Italian roads. The number of normal power charging points available in the country increased exponentially – from 1,679 units at the end of 2015 to 12,150 units in 2020 [33].

The Italian government provides some incentives for the use and circulation of EVs. These include exemption from the annual circulation (ownership) tax for a period of five years from the date the EV was first licensed and, starting from the end of that five-year period, a 75% reduction of the circulation tax.

As an additional push to the deployment of EVs, several insurance companies have started applying discounted rates on EV insurance tariffs. In some big munici-palities, EVs benefit from free parking in urban areas and from free circulation in limited circulation areas (ZTL zones) [34].

Most of the charging points are concentrated in the main urban areas and cities. The number of normal power (*i.e.* power equal or lower than 22kW) charging points available in the country increased exponentially over the last years, passing from 1,679 units in 2015 to 12,150 electric-power stations in 2020 (*Fig. 11*). The largest owner of such points/stations in Italy is ENI – especially after it had acquired in August 2021 the local Be Power company, which operated more than 5,000 charging stations. At present, ENI mostly compete in this market with the partly state Enel (*Ente nazionale per l'energia elettrica*), operating nearly 20 charging points in the city of Rome.

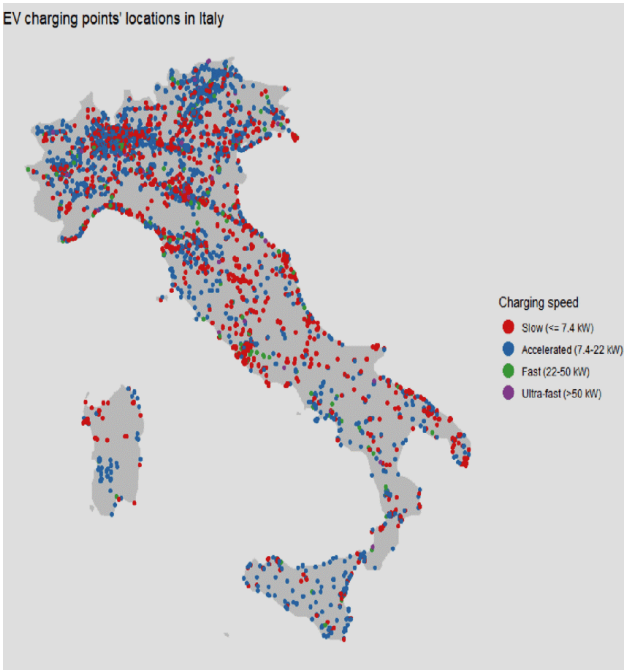
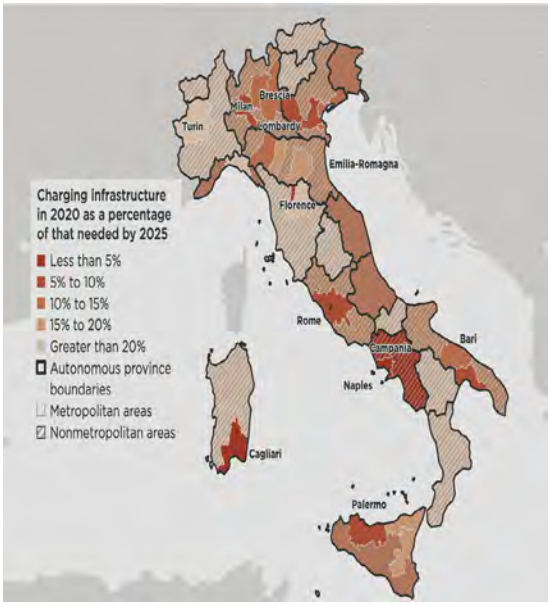


Figure 11
Location of EV charging Points in Italy (as of the start of 2021)

Surely, the Italian car-charging infrastructure is well developed but the federal authorities think that even more electric charging points in metropolitan areas should be installed in the future (Fig. 12).



Source: https://theicct.org/publication/europe-ldv-preparing-italys-charging-infrastructure-rapid-vehicle-electrification-mar22 [35]

Figure 12
Status of Electric Car-Charging Infrastructure in Italy in 2020 and Needs for 2025

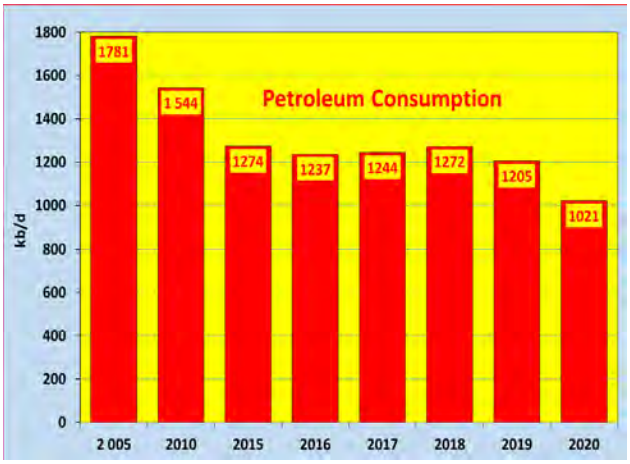
Besides, Italy is the first European market for natural gas vehicles, with more than one billion cubic meters consumed and about one million vehicles currently in circulation. The Italian Government believes in CNG as an alternative fuel for road transport and is promoting a series of initiatives to encourage the use of CNG on an even larger scale. Italy will invest around EUR 150 million over the next 5 years (2022-2026) to facilitate the development of CNG refueling plants and of CNG stations, the number of which has reached by April 2022 1,444 units, located mainly in the north [36].

Also, there are in Italy as of April 2022 nearly 5,030 LPG car-filling stations [37].

At the beginning of 2022 Eni will open the first *hydrogen* refueling station in Italy in an urban environment in Mestre (Venice), followed by the second one in San Donato Milanese (Milan). This is within the part-nership that will support the ex-pansion of hydrogen mobility in Italy and was concluded be-tween ENI and the Paris-based Air Liquide in November 2021 [38].

A bit earlier, in the beginning of June 2019, Toyota and Eni announced a collaborative agreement to speed up the expansion of fueling stations and widespread use of hydrogen cars in Italy. The first Eni hydrogen refueling station opened in San Donato Milanese (Milan). Toyota put a fleet of ten Mirai cars on the road that re-fueled at Eni's new station [39].

Consumption. Annual use of refined oil products in Italy is pretty unstable and, according to ENI's data, has declined from over 1,780 kb/d in 2005 to a bit more than 1,200 kb/d in 2019 before it has dropped afterwards – under a negative impact of the coronavirus pandemic – by almost 15.3% down to around 1,020 kb/d in 2020 (*Fig. 13*).



Source: Oil - Supply and Demand https://www.eni.com/assets/documents/eng/scenari-energetici/2021/World-Energy-Review-2021 [2]

Figure 13
Annual Liquid Petroleum Consumption (including LPG and Bio-energy Liquids) in Italy in 2010-2020 (according to ENI), in kb/d

According to BP, share of oil products in Italy's primary energy consumption mix in 2020 was over 36.3% (compared with the global average of less than 31.3%) and in 2019 – more than 39.5% [3].

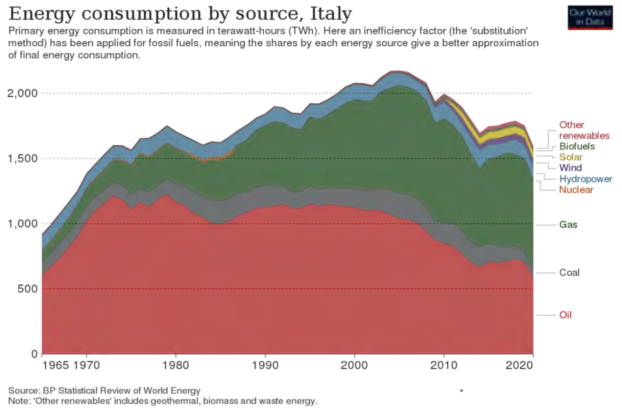
Oil product consumption in Italy, which decreased slightly (- 1.6%/year) between 2015 and 2019, fell by 15% in 2020 (*Fig. 14*) as a result of the COVID-19 crisis that deeply hit the Italian oil demand and led to severe lockdown and transport restrictions (- 20% for transport). According to preliminary statistics, oil product consumption rose by 13% in 2021 (+ 22% for gasoline and +19% for diesel). In 2020, oil consumption was 50% below its 2000 level [40].

Source: https://www.enerdata.net/estore/energy-market/italy [40]

Figure 14
Dynamics of Oil Product Consumption in Italy in 1990-2020, in mln tonnes

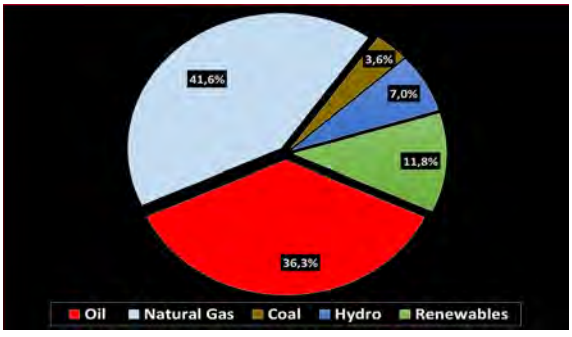
According to BP, total primary energy consumption in Italy contracted in 2020 by 9.3% – from 6.45 EJ in 2019 down to 5.86 EJ – compared with 60.74 EJ to 55.74 EJ (–8.5%) in European Union [3].

However, Italy's per capita energy consumption is nearly 20% lower than the EU average (2.3 toe in 2020). Electricity consumption per capita was 4,750 kWh in 2020, *i.e.* 11% below the EU average [40], and oil and NG still occupy overwhelming shares in the nation's energy consumption mix (*Figs. 15* and *16*).



Source: Energy Consumption by Source, Italy https://en.wikipedia.org/wiki/ Energy_in_Italy [41]

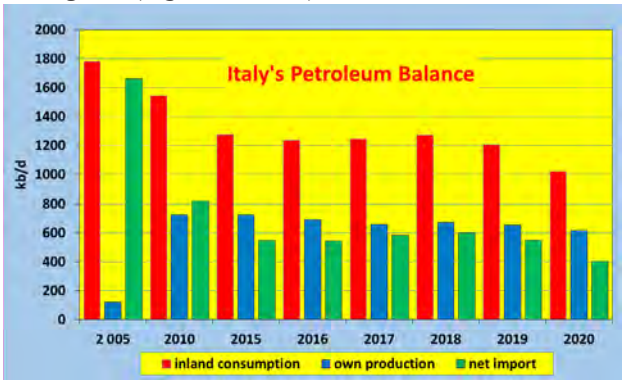
Figure 15
Evolution of Primary Consumption and its Mix by Source in Italy in 1965-2020, in TWh



Source: designed and drawn by the author based on https:/ /www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-full-report [3]

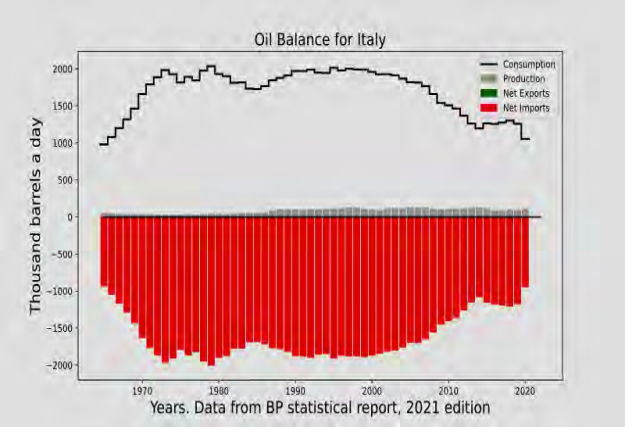
Figure 16
Structure of Italy's Primary Energy Consumption in 2020, in %%

Petroleum Balance. Italy is a typical oil-importing country, where inland oil consumption almost always dominated the country's petroleum picture while its own production of oil and biofuels (*see above*) never played a leading role (*Figs. 17* and *18*).



Source: https://www.eni.com/assets/documents/eng/scenari-energetici/2021/World-Energy-Review-2021 [2]

Figure 17
Italy's Petroleum Balance in 2005-2020 (according to ENI's data), in kb/d



Source: Oil Balance Italy https://commons.wikimedia.org/wiki [42]

Figure 18
Italy's Oil Balance in 1970-2010 (according to BP), in kb/d

The Covid-19's impact and prospects. The Covid-19 has negatively influenced the Italian petroleum sector very heavily, having caused a more than 15% reduction in petroleum consumption, a nearly 18% drop of refinery throughput, a decline in the average refinery utilization to less than 59% in 2020 (*see above*), and a general deep slump of economic activity in Italy.

Italian consumption of oil products fell by 45% on the year to 2.68 mln t in April 2020, with demand hit hard by measures to combat the Covid-19 pandemic.

Data from the Italian industry association Unione Petrolifera (UP) show a steep decline in consumption of transport fuels, with road diesel use dropping by 50% from a year earlier (April 2019), gasoline demand down by 73%, and jet fuel consumption falling by 92%.

Heating oil and agricultural diesel bucked the trend, with demand for the for-mer rising to 78,000 tonnes in

March 2020 from 47,000 t a year earlier, and demand for the latter increasing to 218,000 t from 144,000 t. UP attributed the rise to lock-down measures.

The unusual circumstances prompted UP to take the rare step of publishing a forecast for May 2019. It expected an overall year-on-year drop in oil product consumption by around 35% that month, with the rate of decline slowing as coronavirus restrictions are gradually lifted.

Italy has been among the worst hit by the virus and was the first European country to impose a nationwide lockdown in early March 2020 [43].

According to the Hyderabad-based Mordor Intelligence international consultancy, the capacity of the Italian refineries, which lost nearly 18% of their output in 2020, should remain stagnant, over the period of 2015-2018, at 1,900 kb/d in 2018. The size remained unchanged because no expansion or construction of refineries has taken place.

The Italian oil market is expected to register a CAGR of more than 3% during the forecast period of 2021-2027. The COVID-19 pandemic had a severe impact on the Italian petroleum industry due to a decline in fuel demand caused by lockdowns, particularly in the industrial and commercial sectors. It was recorded that Italy had the longest downtime in the automotive factories in Europe, which was around 41 days in 2020. The oil market in Italy is substantially driven by the extremely high energy demand, especially during long winters, and fluctuations in fuel imports, mainly from Russia. However, the market is hesitant to promise a thriving future due to the continuously increasing fuel prices in the country [44].

Foreign Trade. In 2020, Italy exported US$8.26 bln in Refined Petroleum, making it the 13th largest exporter of Refined Petroleum in the world. At the same year, Refined Petroleum was the 4th most exported product in Italy. In 2020, Italy imported US$25.5 bln of Crude Petroleum (at a value of 25.5 bln or nearly 6% of its all merchandise imports and becoming the 7th largest importer of Crude in the world) mainly from Kazakhstan (nearly 26%, $6.53B), Azerbaijan (almost 16% $4B), and Russia (nearly 15%, $3.74B). The nation has to import also refined oil products as the remaining refineries cannot meet the inland. In 2020 this import amounted to US$5.7 bln (over 1.3% of Italy's goods imports and being the 9th most imported product in Italy) – first of all, from: Russia ($1.43B, over 25%), Saudi Arabia ($931M), Spain ($438M), Greece ($430M), and Belgium ($270M) [45].

Summa summarum, the Covid-19 pandemic has impacted the Italian oil market more seriously than any other European countries, but its prospects are still quite good.

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