Infrastructure in Greece

Funding the future

May 2019

pwc

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The investment gap in Greek infrastructure is about

0.7pp of GDP

1 Executive summary

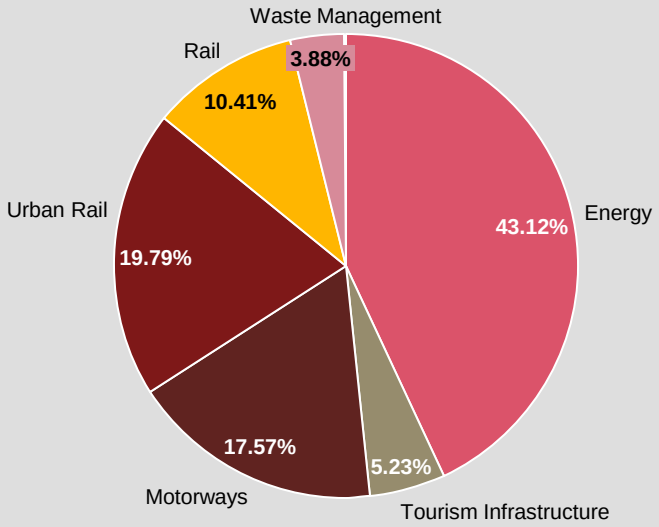
Executive Summary (1/2)

Funding the future

- Global infrastructure needs are expected to reach around $ 80trln by 2040
- Greece ranks 38th globally and 21st among the EU countries in terms of infrastructure
- There is an infrastructure investment gap between 0.7pp of GDP (against the European average) translating into an average spending shortage of € 1.4bn per year
- Infrastructure investments have an economic multiplier of 1.8x, which boosts demand across the economy
- The infrastructure pipeline, i.e. projects in progress or prepared but not yet funded, amounts to 88 projects with a budget of € 25bn
- The pipeline is higher than in the past due to the completion of lower cost projects and the addition of higher cost ones in the preparation phase
- € 10.6bn of the budget refers to Energy projects, while € 7.4bn to Railways and € 4.3bn to Motorways. Tourist infrastructure and Waste management projects account for a small part of the remaining budget taking up only about € 1.3bn and € 0.9bn respectively
- The infrastructure pipeline is concentrated (63%) on electricity interconnection and generation and urban rail
- The current project portfolio is heavy on energy and transport but short on connectivity, tourism and the environment

€ 25bn total infrastructure budget

Infrastructure work in progress and upcoming projects

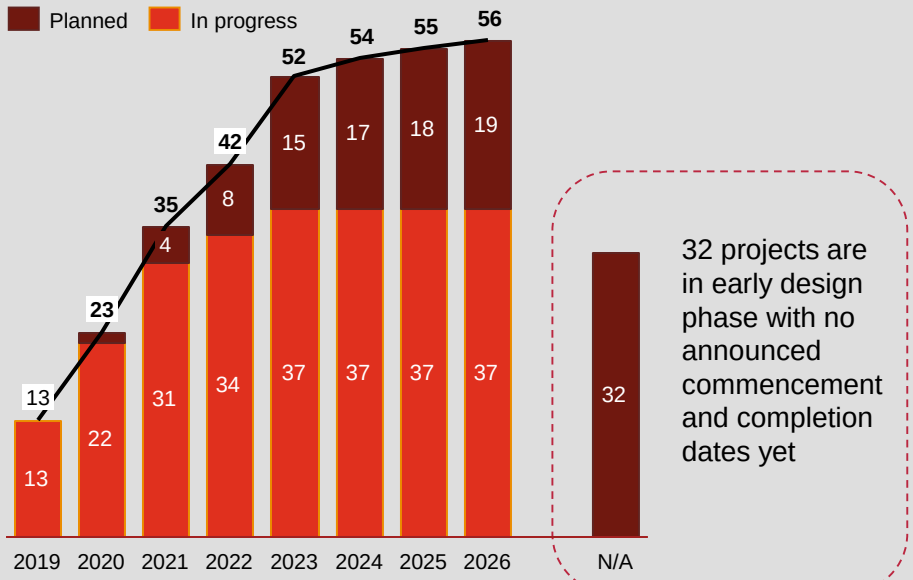


Source: Press, PwC calculations

Executive Summary (2/2)

- Infrastructure projects in Greece suffer from systematic slippage both in preparation and execution, with an average 23 months of slippage in preparation/design and 28 months of slippage in execution/construction. Possible delay factors range from government and contractor issues to general and environmental problems
- Possible delays in execution will lead to a loss of investment of around € 4bn by 2024 with a 0.8pp p.a. negative impact on GDP, which makes more imperative for the government to move the backlog of € 8.2bn, in the planning stage, forward
- There should be a single state organisation mandated with the planning, design and management of all major infrastructure projects to reduce delays and maximise private funding
- Accelerating the preparation of projects and minimizing slippage requires better coordination across the whole process and full use of concessionary and private funding
- The growing need for infrastructure spending, combined with the limited capacity of state funding and the balance sheet constraints of the Greek banks call for new sources of funding. Traditional funding sources, such as loan facilities and the Public Investment Program are limited, shifting the financing focus to the private sector

Estimated Completion year (cumulative)
Number of projects



Source: Press, PwC calculations

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Infrastructure investment

Definition of infrastructure

- ***"Infrastructure is the system of public works in a country, state or region, including roads, utility lines and public buildings"***

  OECD

- ***"Infrastructure is "the basic framework for delivering energy, transport, water & sanitation and information & communication technology (ICT) services to people affecting directly or indirectly their lives"***

  World Bank

In the study, we have included projects with regards to **transport** (airport, ports, roads & rail), **energy** (electricity, oil & gas) as well as **water & sewage**, whilst ICT and Social Infrastructure (e.g. Hospitals, Schools, Public Buildings, Sport Structures and Green Areas) have been excluded

Information & Communications Technology, according to the World Bank, refers to physical telecommunications systems and networks (cellar, broadcast, cable, satellite, postal) and the services that utilize them (internet, voice, mail, radio, and television)

Sustainable Development Goals (SDGs)

17 SDGs focusing mainly on 6 investment areas addressing poverty and universal development

In 2015, 193 UN Member States adopted the Sustainable Development Goals (SDGs) to be achieved by 2030 in order to build sustainable economic growth

Investment areas

1. Health
2. Education
3. Social Protection
4. Food Security and Sustainable Agriculture
5. **Infrastructure**
6. Ecosystem Services

In the long-term, infrastructure investment can jolt economic growth by increasing the potential supply capacity of an economy

1. Energy access and low-carbo energy infrastructure
2. Water and Sanitation
3. Transport infrastructure
4. Telecommunications infrastructure

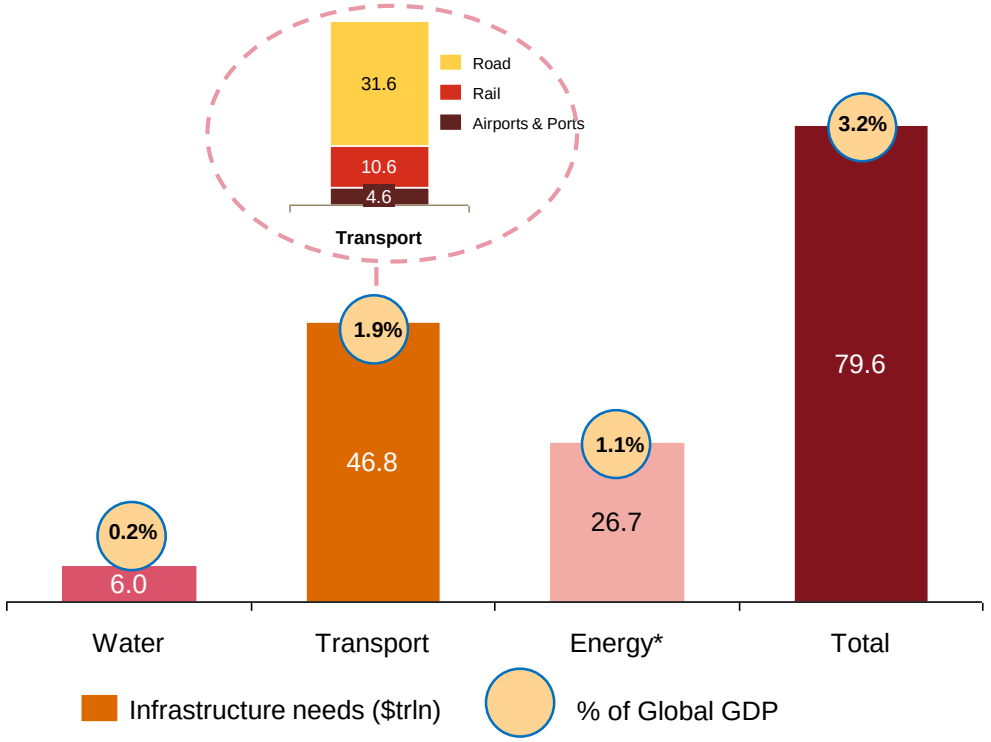
Source: Transforming our world: the 2030 Agenda for Sustainable Development, UN, 2015

Source: Investment Needs to Achieve the Sustainable Development Goals, UN, 2015

Global infrastructure could require up to $ 80trln of investment by 2040

In the period 2018-2040, **3.2% of global GDP** needs to be invested in water infrastructure, road & rail transportation, airports and ports, energy

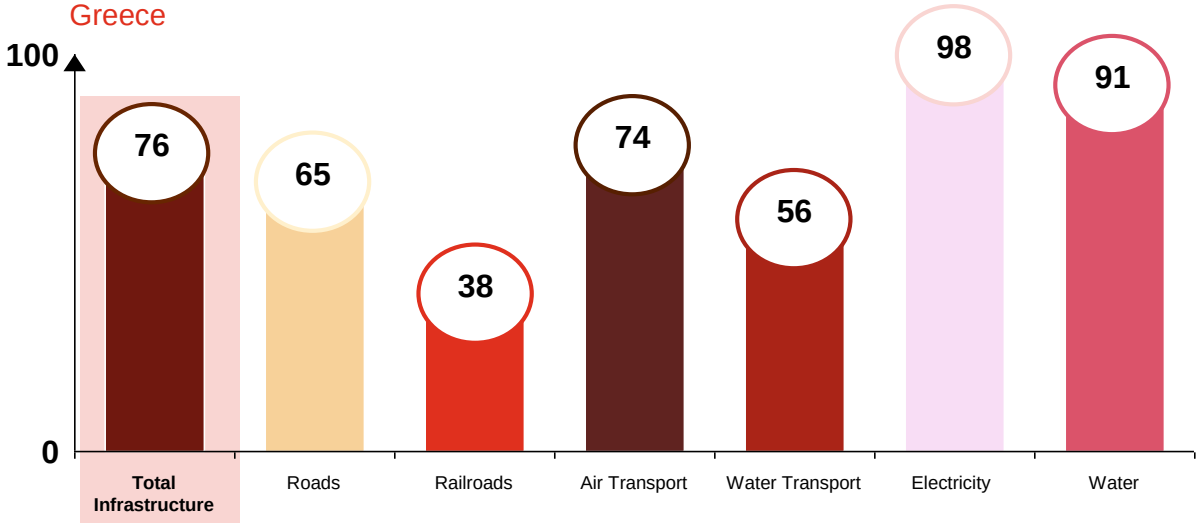
Traditional funding sources are no longer enough to cover the rapid increase in infrastructure projects, which are expected to reach $ 3.5trln p.a. until 2040



Source: Global Infrastructure Outlook, Oxford Economics

Infrastructure extent and quality index
Greece ranks low relatively to its global peers

Infrastructure index (scale:0-100*)
Greece



Source: The Global Competitiveness Report 2018

* Indices are expressed on a 0 to 100 scale and are interpreted as "progress scores", indicating how close a country is to the ideal state

Ranking in infrastructure (140 countries)

Best performer (1st)	Singapore	Singapore	Switzerland	Japan	Singapore	6 countries**	Switzerland
Greece	38th	49th	49th	26th	30th	47th	31st

**Finland, Hong Kong, Iceland, South Korea, Luxembourg, Singapore

The **infrastructure index** captures the quality and extent of transport and utility infrastructure

Transport Infrastructure

I. **Road**
- Quality of road network
- Quality of road infrastructure

II. **Rail**
- Railroad density
- Efficiency of train services

III. **Air**
- Airport connectivity
- Efficiency of transport services

IV. **Sea**
- Shipping connectivity***
- Efficiency of seaport services

Utility infrastructure

I. **Electricity**
- Electricity access
- Electricity quality

II. **Water**
- Exposure to unsafe drinking water
- Reliability of water supply

*** For landlocked countries, this indicator is not included in the computation and the Sea component score only corresponds to the score of "Efficiency of seaport services"

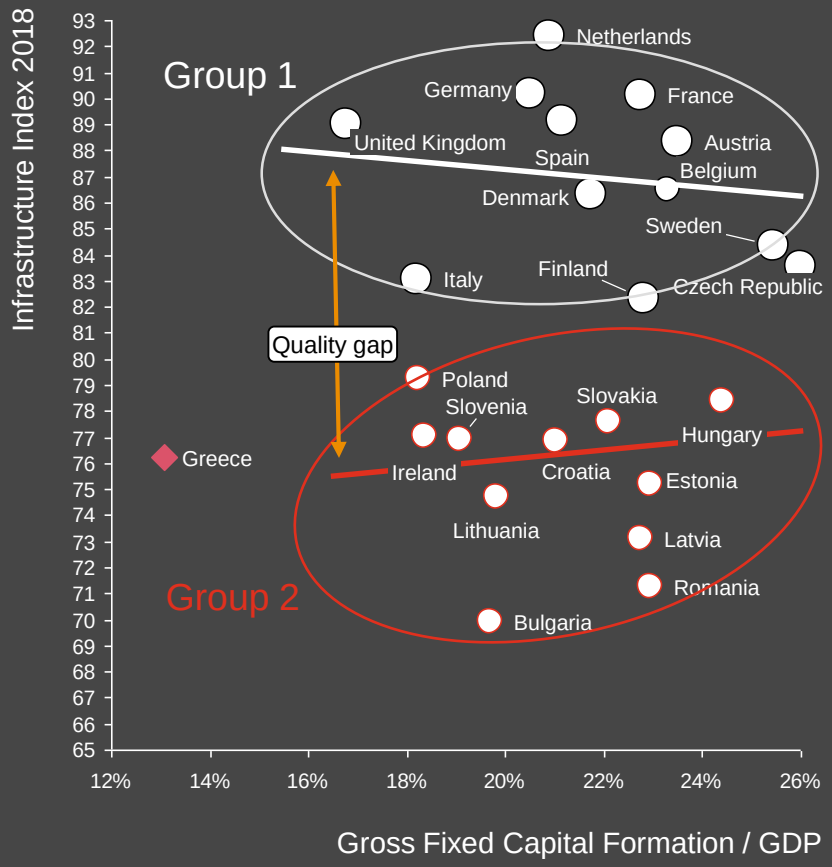
There are two statistically distinct levels of infrastructure extent and quality, whose difference cannot be explained by the level of GDP

Greece ranks 38th globally and 21st among the EU countries in terms of infrastructure, revealing also a quality gap for the current level of GDP per capita

The **differences in infrastructure extent and quality** between Western and Northern European countries, compared to the Central and Eastern European countries, cannot be explained by the level of relative investment

Infrastructure investments, measured through the Gross Fixed Capital Formation (GFCF), appear to have a **different impact on infrastructure quality in each group**

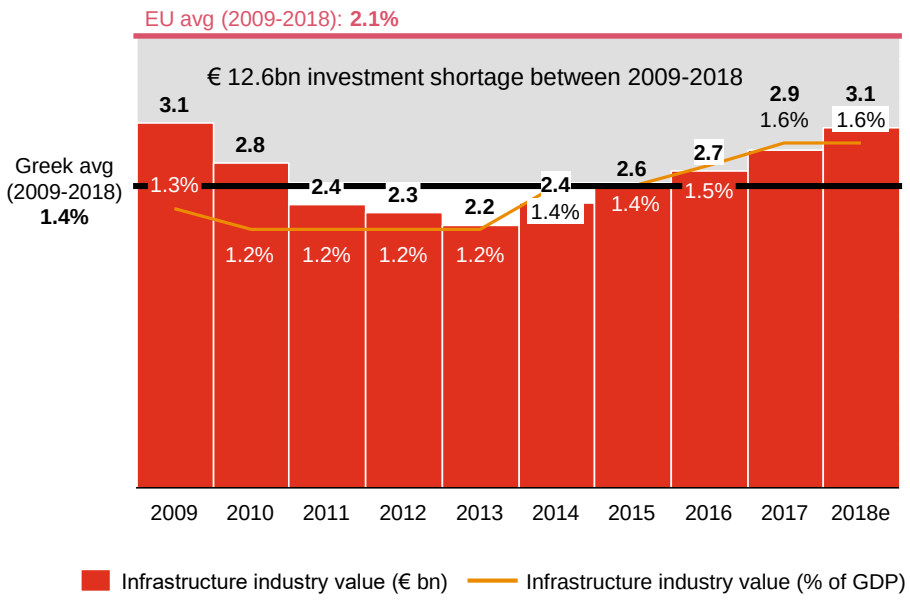
In **Greece**, the average infrastructure investment level during 2009-2018 corresponded to only 14% of GDP, **lowest among all E.U. countries**, undermining country's upcoming infrastructure quality



Source: World Economic Forum - The Global Competitiveness Report 2018, BMI

There is a systematic investment gap of 0.7pps of GDP (or ca. € 1.4bn p.a.) in Greek infrastructure over the past 10 years

Infrastructure investment*



Source: BMI International

Infrastructure in Greece has been severely affected by the deep recession. **Total value of infrastructure** projects has decreased by as much as 29% after 2009 but has rebounded since

The current **rate of infrastructure investment** is around 1.4% of GDP, falling short of the historical pre crisis average of 3.0% and the European average of 2.1% of GDP

The erosion of infrastructure investment from 2009 to 2018 resulted in a **€ 13bn permanent shortage**** against the EU average

The infrastructure investment gap is between 0.7 pp of GDP (against the European average) or 1.6 pp of GDP (against pre-crisis levels)

Infrastructure investments in Greece have an **economic multiplier of around 1.8x***** . The industry employs ca 875k people

Greece's pre-crisis rate (2000-2008): **3.0%**

Greece's historic rate (2009-2018): **1.4%**

European rate (2009-2018): **2.1%**

BMI Infrastructure Investment *incudes: Transport Infrastructure (Roads, Bridges, Railways, Airports, Ports and Waterways) and Energy & Utilities (Power Plants, Transmission Grids, Oil & Gas, Pipelines and Water infrastructure)*

*Infrastructure Investment data is derived from GDP by output figures from ELSTAT. Specifically, it measures the output of the Infrastructure industry over the reported 12-month period in nominal values. As it is derived from GDP data, it is a measure of value added within the industry , hence it does not measure the nominal value of all inputs used in the infrastructure industry

** *Infrastructure gap= (European Average-Greek Average) * Years*$_{(2009\text{-}2018)}$**Average Greek GDP*$_{(2009\text{-}2018)}$

****for every Euro spent on infrastructure, GDP is further increased by € 0.8 (IMF Working paper "The welfare multiplier of Public Infrastructure Investment, 2016)*

There is need for more investment in infrastructure

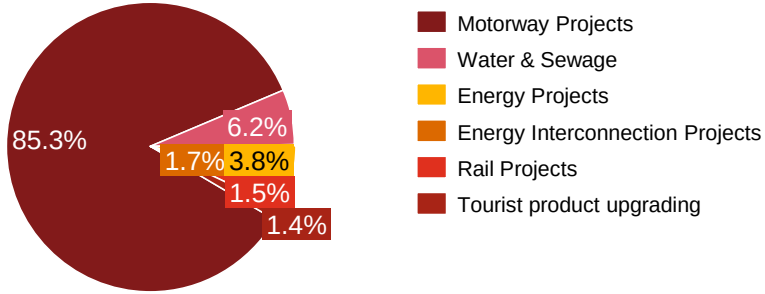
- There is a **large need for further infrastructure investment globally** over the next 22 years, estimated at $ 3.5trln per annum or 3.2% of global GDP
- The **average annual level of infrastructure investment** in Greece between 2009 and 2018 stands at € 2.6bn, 54% lower than the historical average of 2000-2008
- In Greece, there is a systematic **infrastructure investment gap of 0.7pps of GDP** (ca. € 1.4bn p.a.) or about € 12.6bn in total, over the past 10 years
- The **quality of infrastructure** in Greece is **substantially inferior** than the level of wealth would predict
- **The need for infrastructure investments in Greece in terms of both capacity expansion and quality improvement is evident**

3

Greek infrastructure projects pipeline

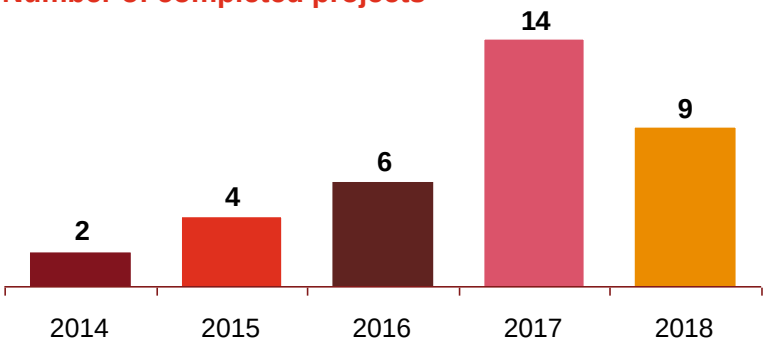
Between 2014 and 2018, 35 infrastructure projects were completed totaling € 8.3bn

Budget of completed projects
(2014-2018)



Source: Press, PwC calculations

Number of completed projects



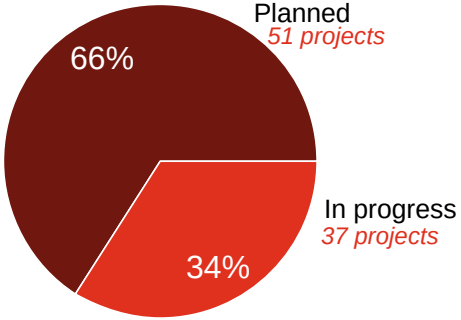
Source: Press, PwC calculations

Infrastructure projects pipeline amount to € 25bn

Most of energy and rail projects are in progress, 5 waste management projects are about to be delivered, while **tourist product projects** are still **in initial development stage**

Rail, energy and motorways require **higher investment per project,** compared to tourist infrastructure and waste management projects

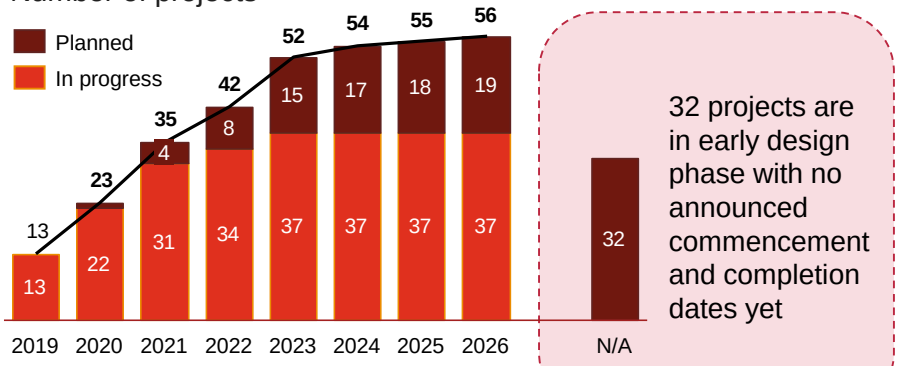
Pipeline budget* breakdown



Source: Press, PwC calculations

Estimated Completion year (cumulative)

Number of projects



32 projects are in early design phase with no announced commencement and completion dates yet

Source: Press, PwC calculations

33% of the pipeline budget represents projects that have already commenced

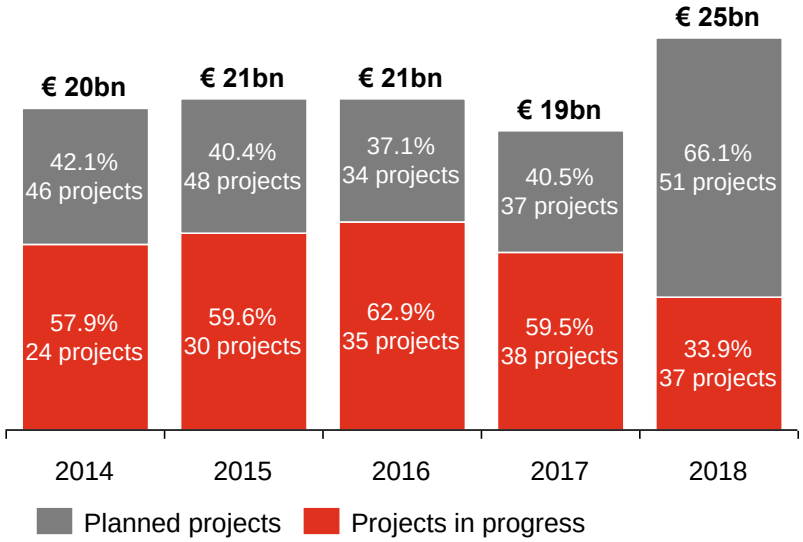
15% of the projects, with a remaining budget of around €0.5bn, are estimated to be delivered in 2019

The commencement/ completion dates of 32 projects in early planning phase, with a € 8.2bn budget, are unknown

**Infrastructure projects backlog and total budget of upcoming projects*

Higher infrastructure pipeline mainly due to completion of lower cost projects and addition of higher cost new ones in the preparation phase

Evolution of 5-year infrastructure pipeline
(2014-2018)

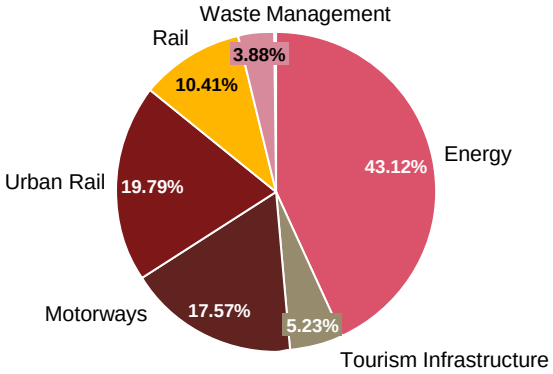


Source: PwC calculations

From 2014 to 2016 the work in progress investment remained fairly stable but in 2017 and 2018 dropped due to completion of a number of projects and no new commencements

Energy and urban rail projects account for 63% of the total budget

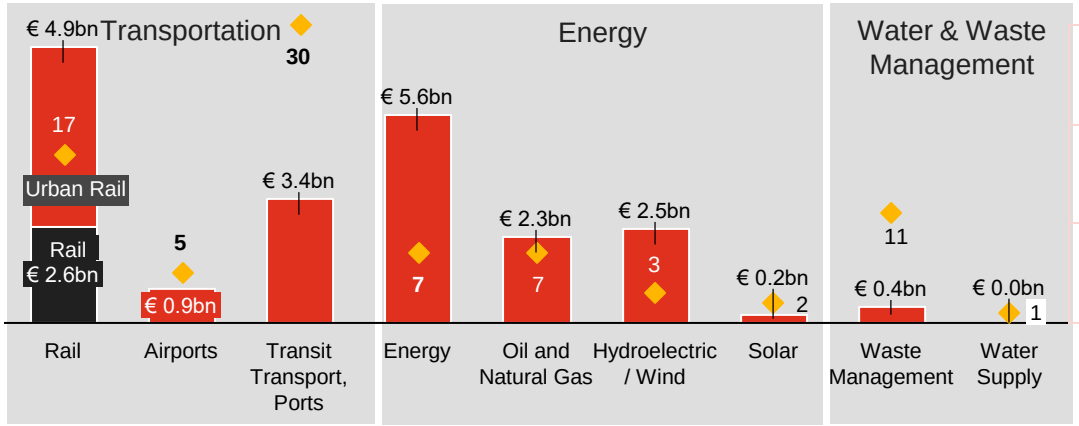
Total remaining budget*



Infrastructure backlog and total budget of upcoming projects
Source: Press, PwC calculations

- Waste management and water supply get very little attention
- Rail, given its current low economic significance, gets a disproportionate share (10.4%)

Subsector & project budget



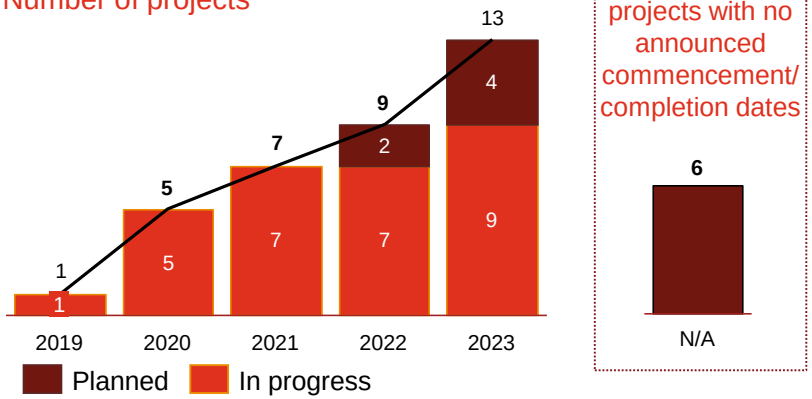
Source: Press, PwC calculations

Total Budget ◆ Number of projects

- There are 19 Energy projects (43% of total pipeline budget) mainly in oil & gas and electricity
- 30% of the remaining budget covers rail projects (17 projects), while 18% (13 projects) motorways

Energy projects amount to ca. € 10.6bn

Estimated Completion year (cumulative)
Number of projects



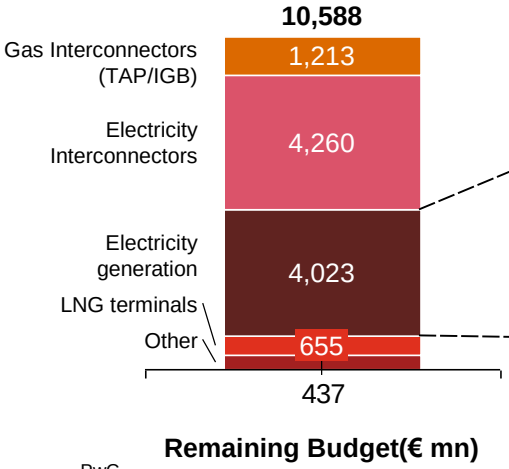
Number of projects with no announced commencement/ completion dates

Source: Press, PwC calculations

- 63% of the number of energy projects are **interconnections** (TAP, IGB, EuroAsia, Ariadne, LNGs), while the remaining 37% refers to **electricity generation** (Wind parks, Power plants)
- 62% of the remaining budget is earmarked for energy interconnections and the rest for electricity generation
- **Almost half of the total energy projects have not yet started**

Electricity interconnection projects account for 40% of the budget and generation for 38%

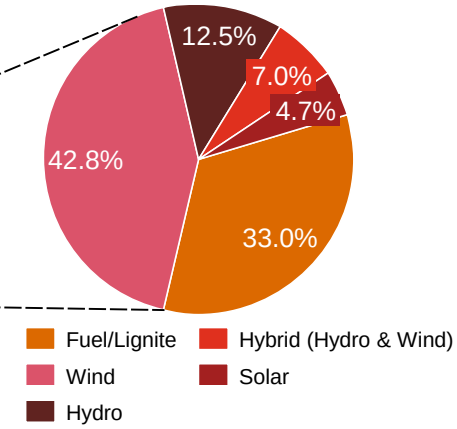
Energy projects
Remaining budget 2018 (€ bn)



Remaining Budget(€ mn)

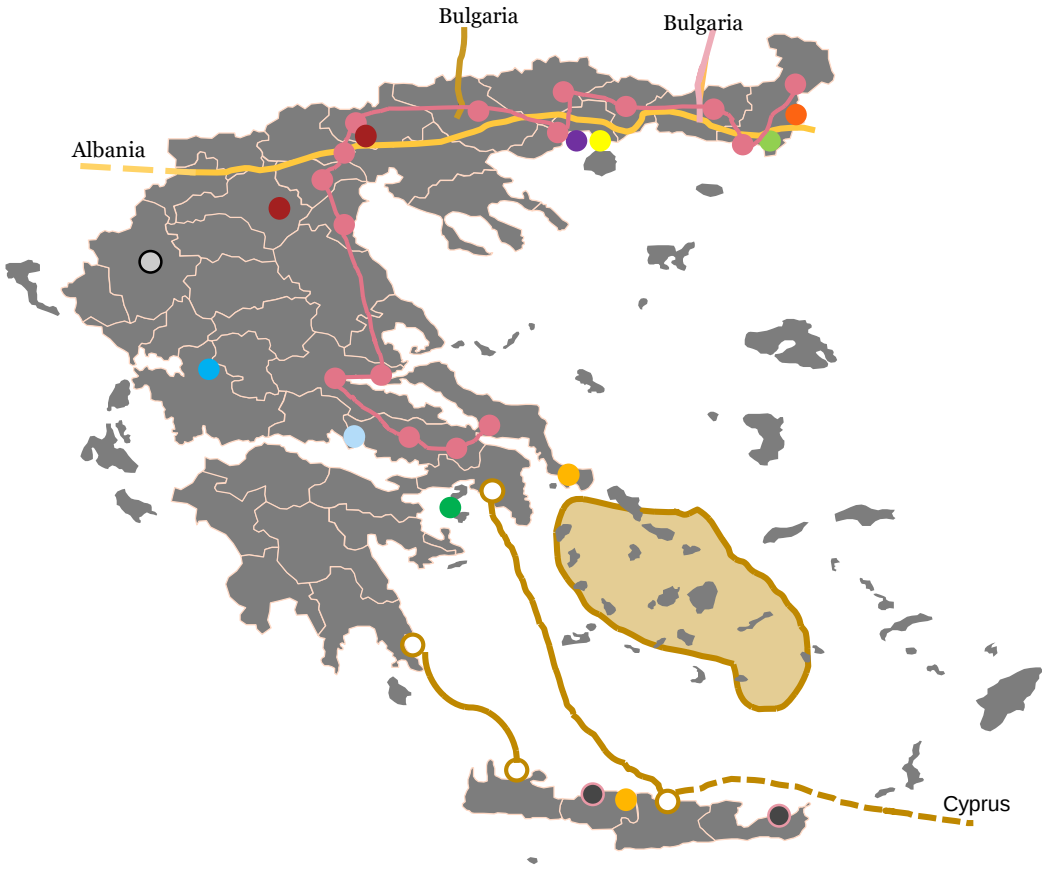
Source: Press, PwC calculations

Electricity generation sources
% of remaining budget 2018



Source: Press, PwC calculations

- The electricity interconnectors take up **about 40% of the outstanding budget**
- About 67% of the total remaining budget of scheduled electricity generation projects refers **renewable energy** and in particular wind
- The average cost per new MW installed is about € 1.1mn



TAP

Electricity Interconnectors of Cyclades

IGB

Development of distribution of natural gas network

Electricity Interconnectors

Alexandroupoli Independent Natural Gas System

Ptolemaida V Power Plant (lignite fired)

Amfilohia Hydro-pumped storage

Gas Compressor Station (Kipoi)

Kavala LNG

Wind power plants

Kavala storage facility (Underground Storage facility)

Siteia and Rethymno Hybrid Stations

Solar parks

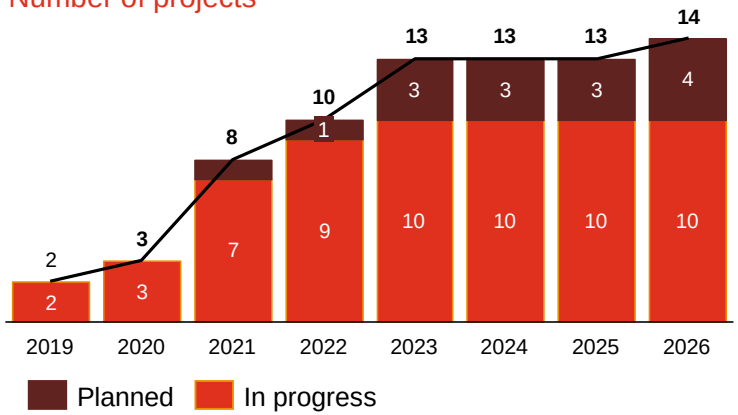
Mytilineos power plant

Energy projects geographical distribution

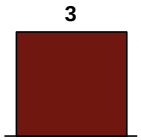
- **Trans-Adriatic Pipeline** of 878 km in total will supply Europe with natural gas from Azerbaijan through Greece, Albania and Italy, with a capacity of 20 bn m³ per annum
- **Ptolemaida V Power Plant:** New single lignite power plant of 660 MW and 140 MW for district heating (PPC)
- **Attica – Crete and Peloponnese – Crete Interconnectors:** 310 km underwater electric cable connecting Crete with mainland with a capacity of 1,000 MW and 400MW respectively
- **IGB:** Natural gas pipeline of 182km length will connect the Greek and Bulgarian existing networks, with daily transport capacity of approximately 3-5bcm per year
- **Alexandroupoli Independent Natural Gas System**: New offshore LNG with 28 km length of subsea and onshore pipeline (4 km onshore and 24 km offshore), with storage capacity of 170k m³ and pumping capacity of 6,1bcm per year
- **Kavala LNG**: Floating storage (170k m³ LNG capacity) and processing terminal (annual sent-out capacity of 3-5bcm) at Kavala Bay

Rail projects amount to € 7.4bn, with 66% on urban rail projects

Estimated Completion year (cumulative)
Number of projects



Number of projects with no announced commencement/ completion dates

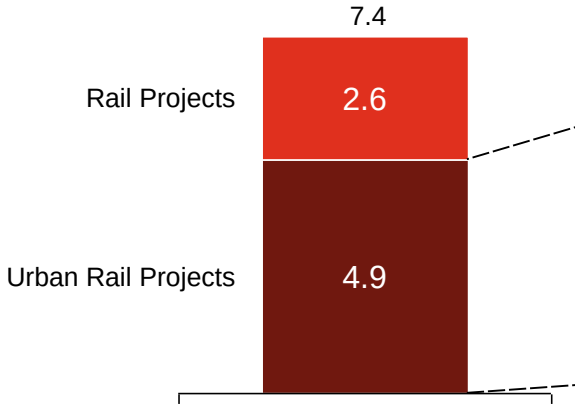


Source: Press, PwC calculations

- 35% of the rail projects account to **urban rail interconnections** (Attiko Metro, Tram, Metro Thessaloniki), while the remaining 65% to rail projects
- **More than half of the rail projects** have already started with further Attiko Metro and Thessaloniki Metro extensions and some Ergose upgrades in planning
- **2 rail projects** are expected to be delivered in **2019,** the Tithorea-Domoko rail line and the Athens Tram extension to Piraeus
- The percentage of **electrified lines in Greece is only 24%** compared to the European average of 54% (International Union of Railways, 2017). However, Greece is making progress in **rail electrification** by converting and adding **about 740km of electrified** lines to the national network

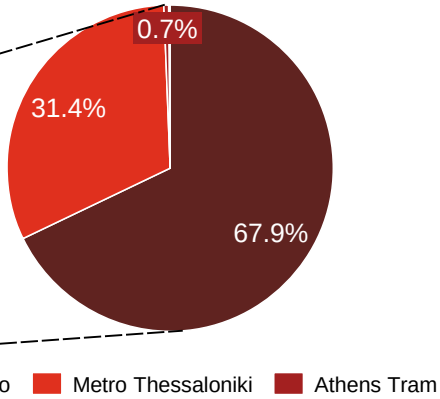
Urban rail account for the bulk of the investment expenditure in rail

Rail projects and Urban Rail projects
Remaining budget breakdown (€ bn)



Source: Press, PwC calculations

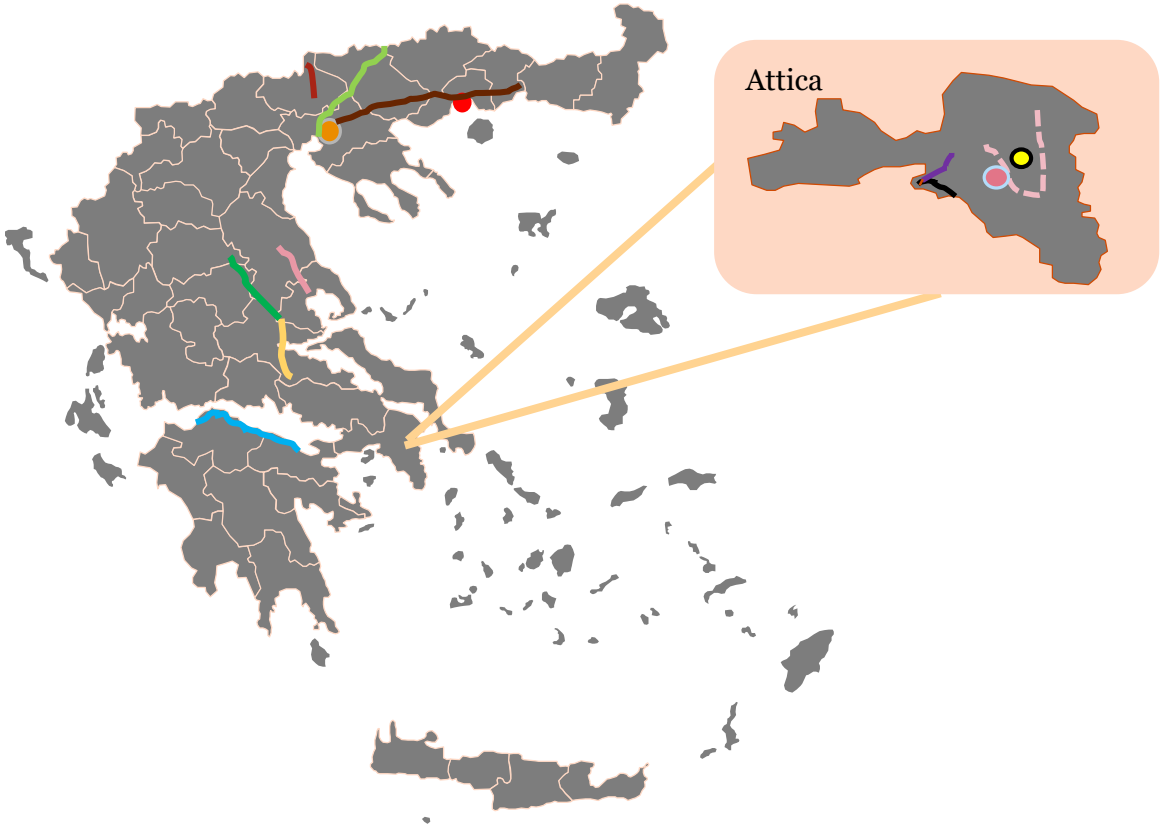
Urban Rail projects
Remaining budget breakdown (€ bn)



Source: Press, PwC calculations

- 34% of the remaining budget accounts to rail projects, while the remaining 66% to urban rail
- Attiko Metro's new lines and extensions are the largest urban rail projects, with a total budget of € 3.3bn taking up about 68% of the remaining budget of the urban rail projects
- The average investment in railway projects is estimated at € 5.9mn/km, while the respective investment in urban railways stands at €112.4mn/km

Rail projects geographical distribution

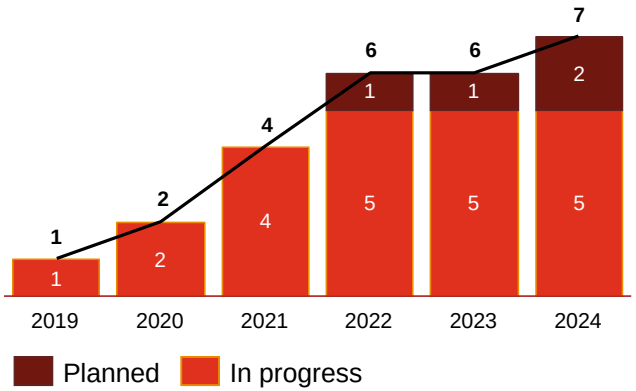


- Construction of **Metro in Thessaloniki** and extension to Kalamaria (14.3km) serving 315k passengers per day
- The new **Metro Line 4** in Athens with 33km length (31 new stations) is expected to serve around **500k passengers** daily, especially at densely populated areas (Kipseli, Pagrati, Zografou)
- Extension of **Athens metro to Piraeus** (6 new stations) **connecting the Athens International Airport with the Port of Piraeus** will increase current capacity to **123k passengers**
- **Tram extension from N. Faliro to Piraeus** (5.3km) will have a daily capacity of 100k passengers
- Construction of double rail tracks and upgrading of signaling and electrification of the main OSE network to **improve customer service** and **time of travel** rendering rail an efficient alternative for **long distance travel**
- The construction and electrification of the **Kiato to Patras** will connect Athens to Patras and Northern Peloponnese again after a long time

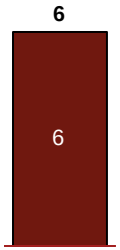
Thessaloniki Metro
ERGOSE Rhododafni
ERGOSE Upgrade of Athens Train Station
ERGOSE Palaiofarsalos
ERGOSE Polikastro
ERGOSE Volos
ERGOSE Tithorea-Domoko
Upgrade of the network in Sepolia
Attiko Metro Line 4
Athens Tram Extension N. Faliro to Piraeus
Connection of the Port of Kavala
Attiko Metro, Extension of Line 3 to Piraeus
ERGOSE Promachonas
Thessaloniki-Kavala-Xanthi

Motorways investment pipeline is about € 4.3bn

Estimated Completion year (cumulative)
Number of projects

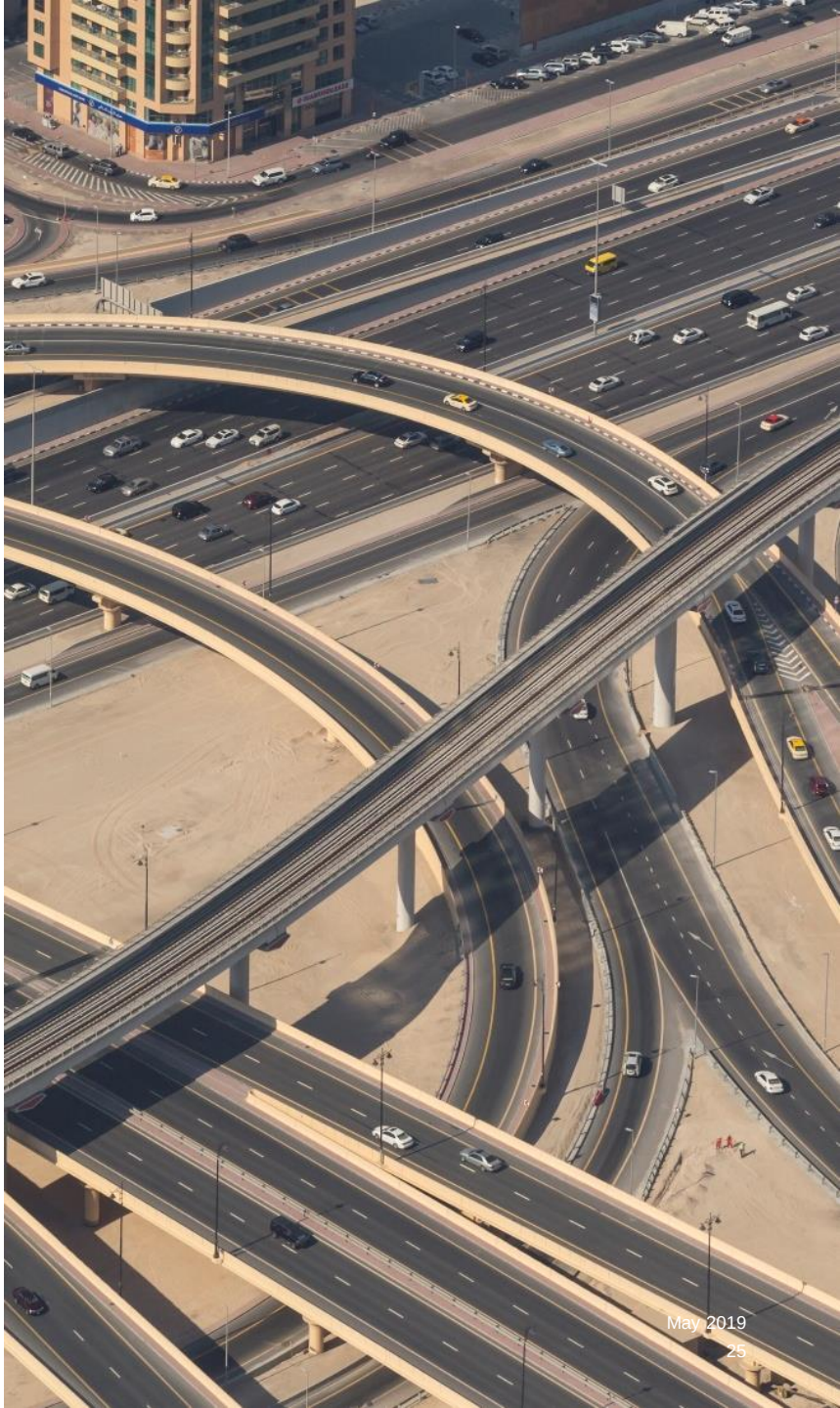


Number of projects with no announced commencement/ completion dates

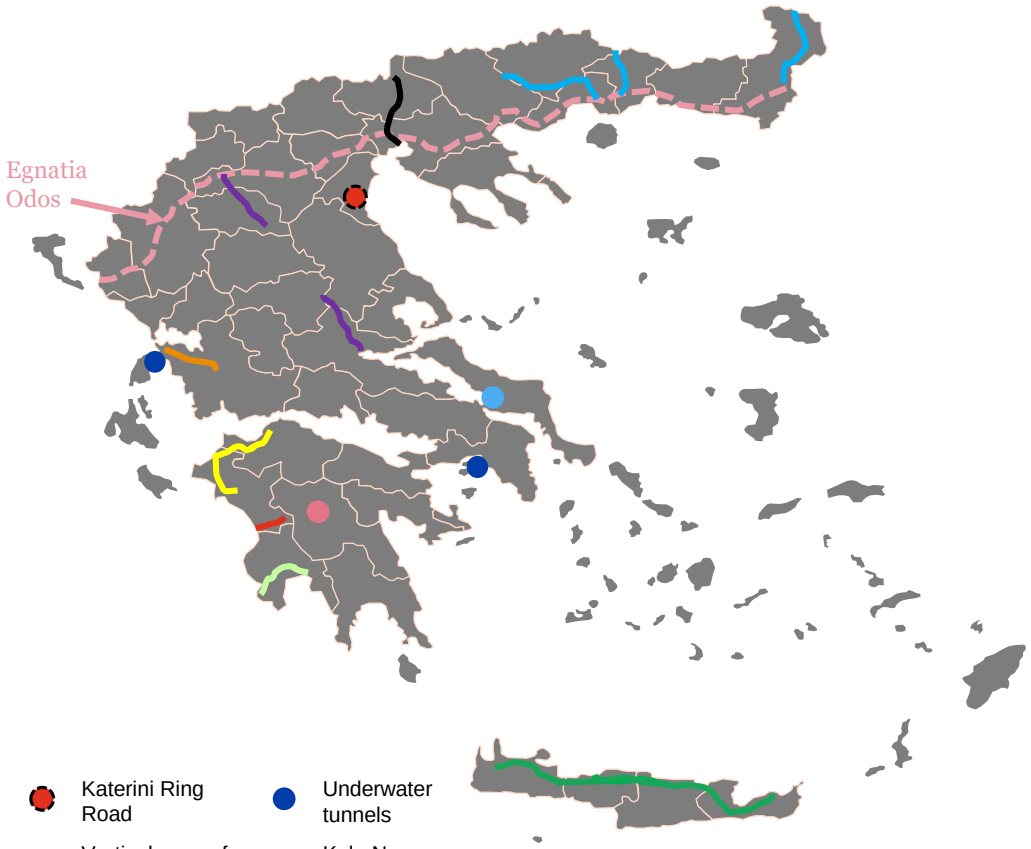


Source: Press, PwC calculations

- After the completion of many large motorway projects in 2017, the only major road projects in the pipeline are the **Crete Northern highway,** the southern and northern parts of **E65** and the **Patras-Pyrgos** link
- One of the largest projects that was announced in 2018 was the **Crete Northern highway,** with a total length of **300km** and the projected delivery date is **2024**
- The total motorway kilometers of planned and in progress projects in Greece amount to 867km, **of which only 14% has already been constructed**
- The average cost of motorway construction in Greece **is €14.6mn per km**

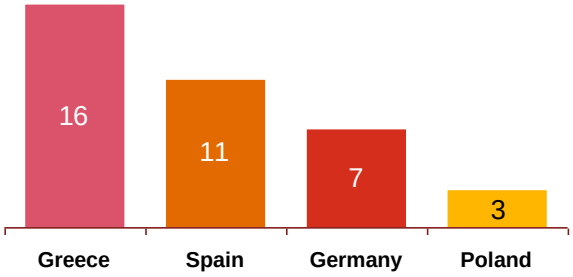


Motorway projects geographical distribution



- **Egnatia Odos vertical Axes** will connect the main part of Egnatia Odos with **Bulgaria** and **Serres with Drama and Kavala**
- **Ionia Odos side Axis,** with a length of 48.5km will connect **Aktio to Amvrakia**
- **The relative cost of construction of major motorways per km** is estimated at **€6.4mn/km**, while the respective European average stands at **€11.6mn/km** (Infrastructure Journal, 2010)
- The Northern and Southern parts of the **Central Greece Motorway** (part of E65 Motorway) are under construction with a total length of 175km and will connect **Lamia, Karditsa and Trikala with Egnatia Odos**.
- The **Patras-Pyrgos Motorway** is a physical extension of Olympia Odos with a total length of 75 km and **will establish a better connection between the two cities**
- **Crete Northern highway** is one of the largest projects that was announced in 2018, with a total length of 300km

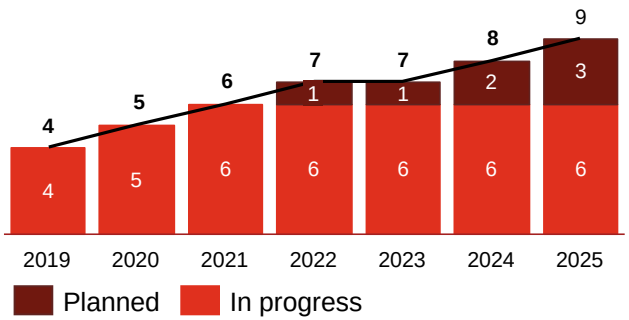
Average delays in road investment projects
Number of months from planned completion



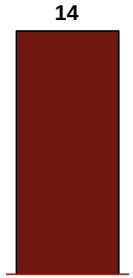
source: ECA, Are EU Cohesion Policy funds well spent on roads? (2013), PwC analysis

For the upgrading of the tourist product around € 1.3bn have been scheduled

Estimated Completion year (cumulative)
Number of projects



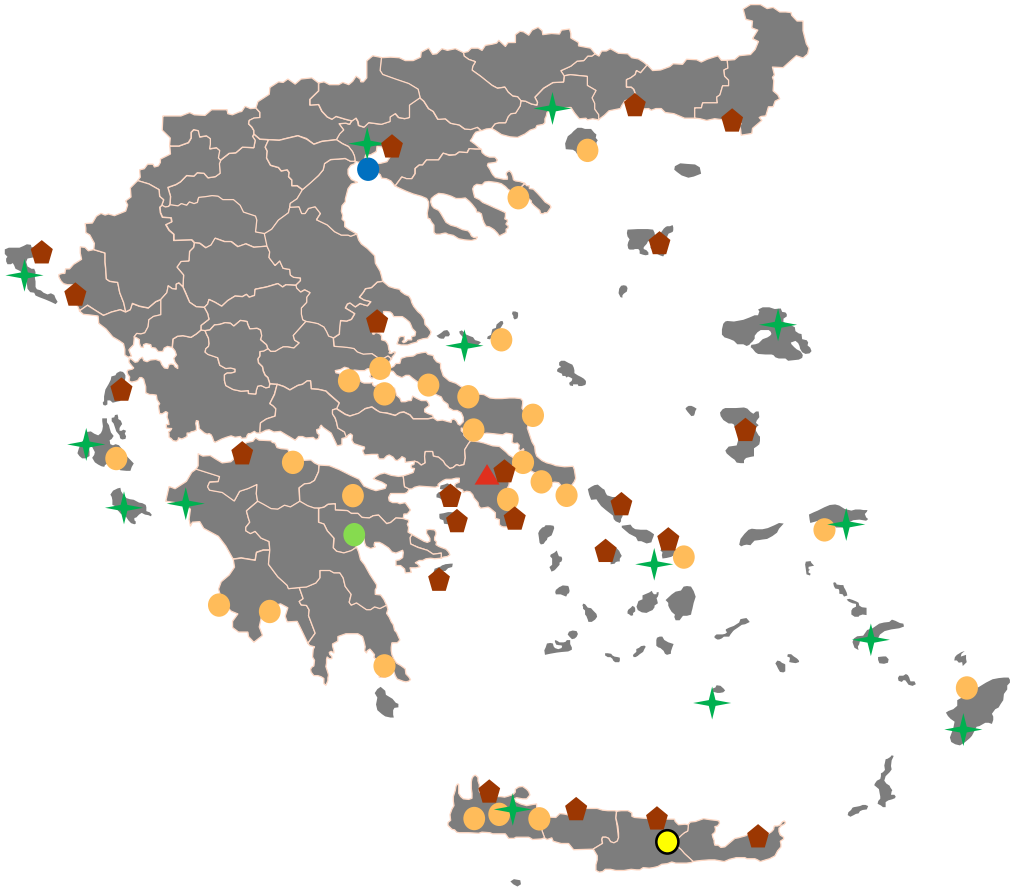
Number of projects with no announced commencement/ completion dates



Source: Press, PwC calculations

- **61% of the tourist infrastructure projects are not even fully planned** except from the new dock at the Port of Thessaloniki and Kasteli airport which are scheduled to be completed by 2022 and 2025 respectively
- There is no information on the construction of the key marinas (Katakolo & Zakynthos, Alimos hub, Glyfada hub, Patra hub, Chios hub, Crete hub, Pylos hub and Aretsou Kalamarias hub) except for the marina of Symi which was delivered in 2018
- The **average budget** for tourist infrastructure amounts to **€77.6mn per project**

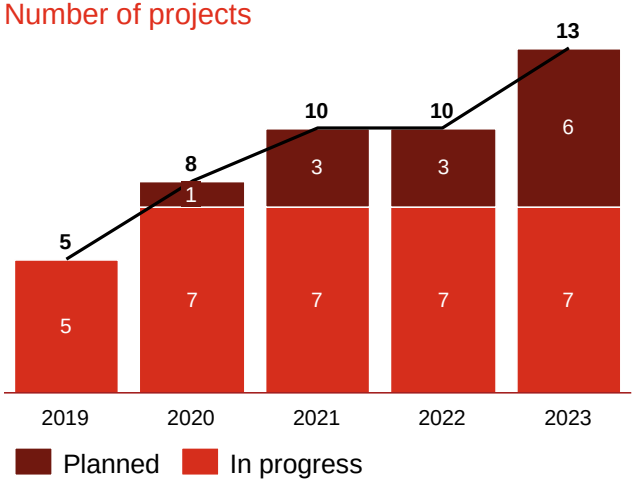
Tourist infrastructure geographical distribution



- Greece is a significant global tourist destination, attracting 30mn arrivals in 2018, and € 16bn in tourist receipts
- Despite being a global tourist attraction, the tourist infrastructure quality in Greece is of low quality
- For Greece to remain a top global tourist destination it is necessary to:
  - **complete the upgrade** of the 14 regional **airports** acquired by the Slentel-Fraport joint venture and upgrade the second wave of airport privatizations as well as the construction of the new airport in Kasteli
  - **upgrade vital ports** to serve as transit terminals and facilitate interconnection with neighbor countries
  - **modernise key marina hubs** (Alimos, Kalamaria, Chios, Crete, Glyfada, Zakynthos & Katakolo, Patra, Pylos and Rhodes & Kos) to meet the increasing demand in marine tourism

Waste management projects need about € 0.9bn

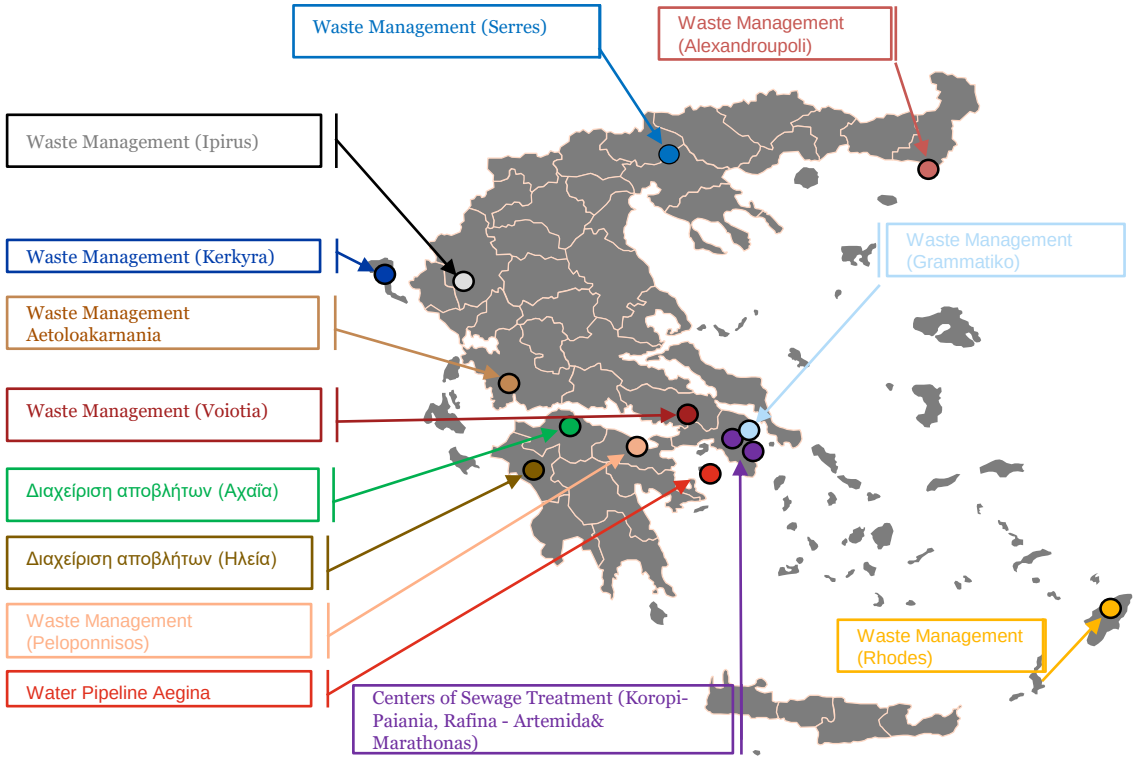
Estimated Completion year (cumulative)
Number of projects

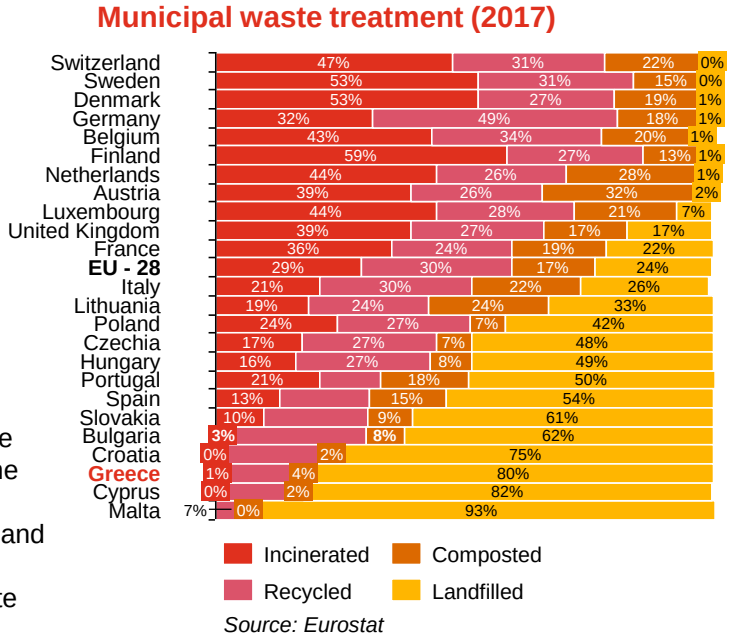


Source: Press, PwC calculations

- Within 2018, **2 PPPs were signed** for waste management projects **in Alexandroupoli and Peloponnese** and 1 more is expected to be signed in **Aitoloakarnania**
- Also, **5** waste management projects are expected to **be completed in 2019** (Grammatiko, Serres, Voiotia, Epirus and the water pipeline of Aegina)
- The **average budget** of waste management projects amounts to **€ 69mn per project**

Waste management projects geographical distribution





Source: Eurostat

- In 2015, an updated **national waste management plan was adopted** which defines the strategy, the policy and the targets of waste management on a national level and also the general obligations and appropriate measures for the treatment of waste. The National Waste Management Plan contains sufficient information on criteria for site identification and on the capacity of future disposal or major recovery installations, on the existing waste collection schemes and major disposal and recovery installations as well as for the waste prevention programmes
- **Regional Management Plans** have already been published dealing with an analysis of the current waste management situation as well as the measures to be taken, providing for an adequate and integrated network of disposal installations. The landfill sites or major waste treatment sites should be mentioned in the regional waste management plan. However, the specific future sites are not mentioned, so local conflicts arise
- The number of **illegal landfills that are still operational or in need of rehabilitation has fallen over the years**. However, according to the European Commission's 2018 'Early Warning Report', **Greece is at risk of not meeting the 2020 municipal waste recycling target of 50%**
- On **urban waste-water treatment** there have been some positive steps, such as the systematic assessment and strategic reorganisation of the country's investment needs. These efforts should lead to the necessary infrastructure being installed quickly

The current project portfolio is heavy on energy and transport and short on non electricity connectivity, tourism and the environment

- The value of **88 infrastructure projects** in progress or planned is standing at € 25bn
- **Projects in progress** account for **33%** of estimated investment
- For 39% of the projects, commencement and completion dates are not known

- The **transport and energy** sectors account for almost 91% of the pipeline of all projects and the smooth evolution of those investments will have a very positive impact in economy
- **Investments** in tourism product upgrade (5%), as well as in waste management and water supply (4%) are **important for tourism growth and the upgrade of life quality**

4

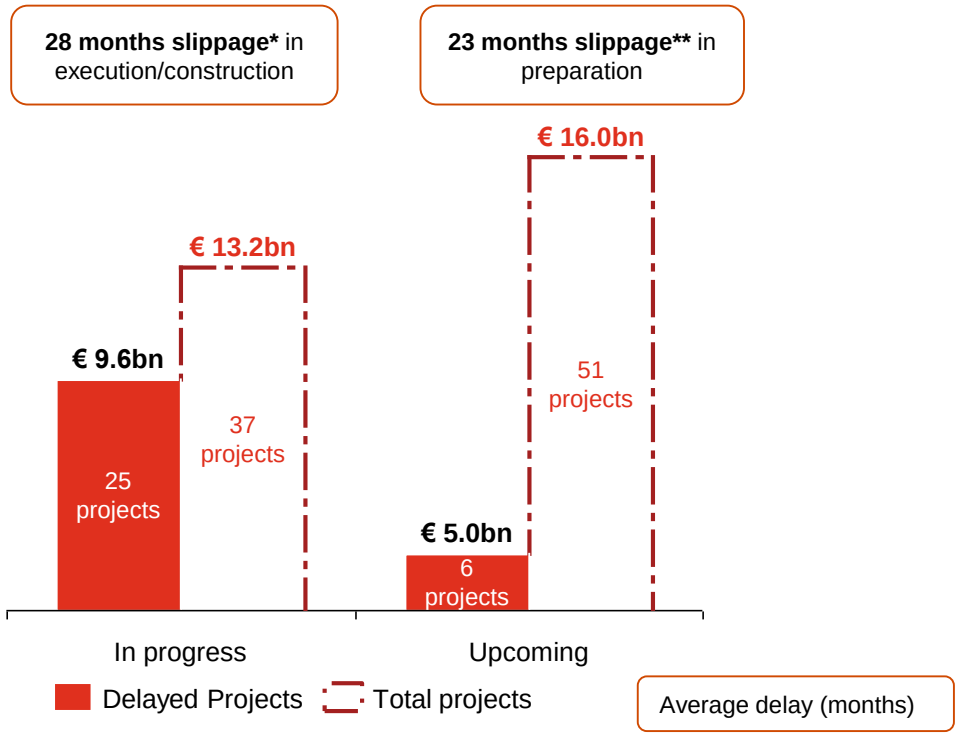
Funding Greek infrastructure

Infrastructure funding and project delays

- Projects should be assessed not only on their initial capital investment but also on the operational cost, maintenance, disposal and value-for-money across the asset lifecycle
- A poorly designed project may lead to delivery delays, higher costs and lower financial returns
- Project risk management has to be a core element of project selection, planning, and design, and it has to be continuous across the entire life cycle of the project

Infrastructure projects suffer from systematic slippage both in preparation and execution

Number and budget of delayed projects



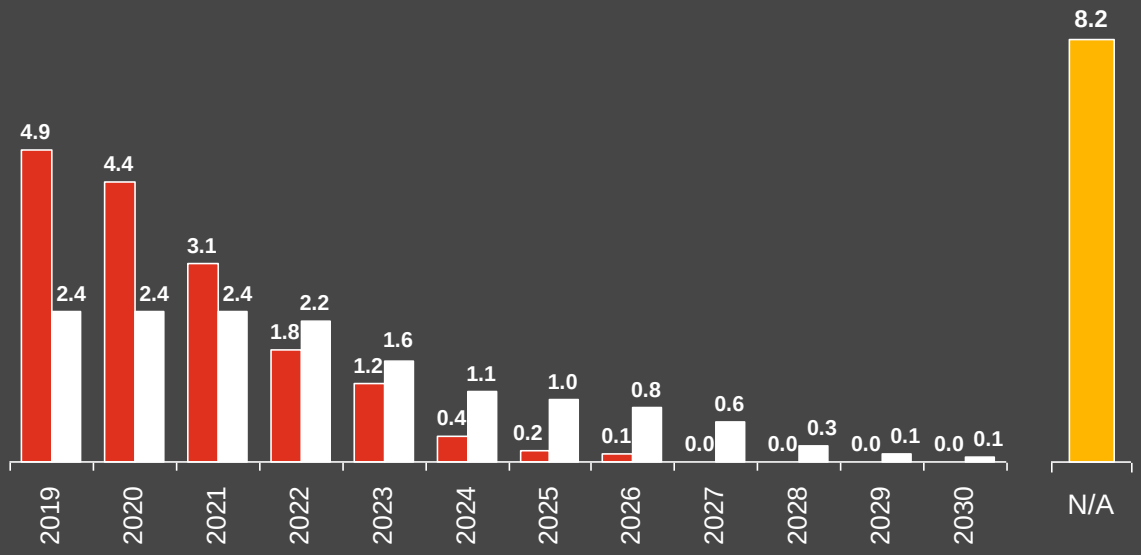
- The average delay of a from planned commencement is 23 months, while their completion date is pushed back on average by 28 months
- On average, at the outset, a project is likely to be 51 months late from its initial completion date

Projects in progress have already started construction but their completion date has been delayed
Upcoming projects are in the stage of planning or bidding and there is a commencement/completion date
Projects in early planning have not published yet a commencement/completion date

*Average delay in months from the initial completion date until the date a project in our database was officially delivered
**Average delay in months from the initial commencement date until the date a project in our database officially commenced construction
The database captures projects since 2014

Possible delays will reduce infrastructure spending by as much as € 3.8bn in the period to 2024

Remaining budget (in € bn)



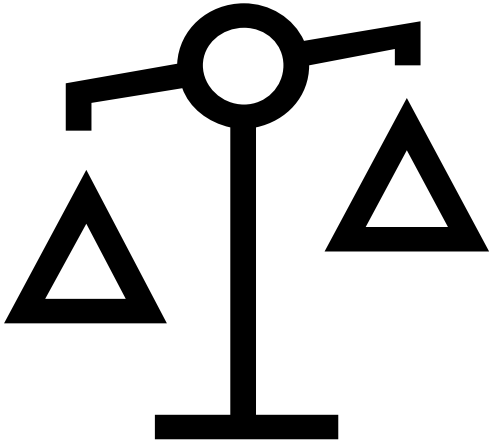
**Remaining budget with delays was calculated by applying the delays to each project and then recalculating each project's remaining budget*

- The delays will reduce for the first 3 years the average annual investment to 1.2% of GDP from an expected 2.2%
- € 8.2bn of pipeline are in the planning phase and need to be assigned a commencement date

The current active pipeline, with no delays, is above the historic rate of infrastructure investment by around € 4bn

€ 12.3bn

Expected historic rate of infrastructure investment for the period 2019 - 2024



€ 15.8bn

In planned and work in progress pipeline without assumed delays for the period 2019-2024

If delays are factored in, the investment over 2019-2024 drops to € 11.9bn with a lag of around € 4bn. Delays in the execution of the current pipeline may undercut GDP growth by ca. 0.8pp

Infrastructure investment slippage and slow preparation undercut economic growth and demand a different approach

Commencement and completion delays to be contained

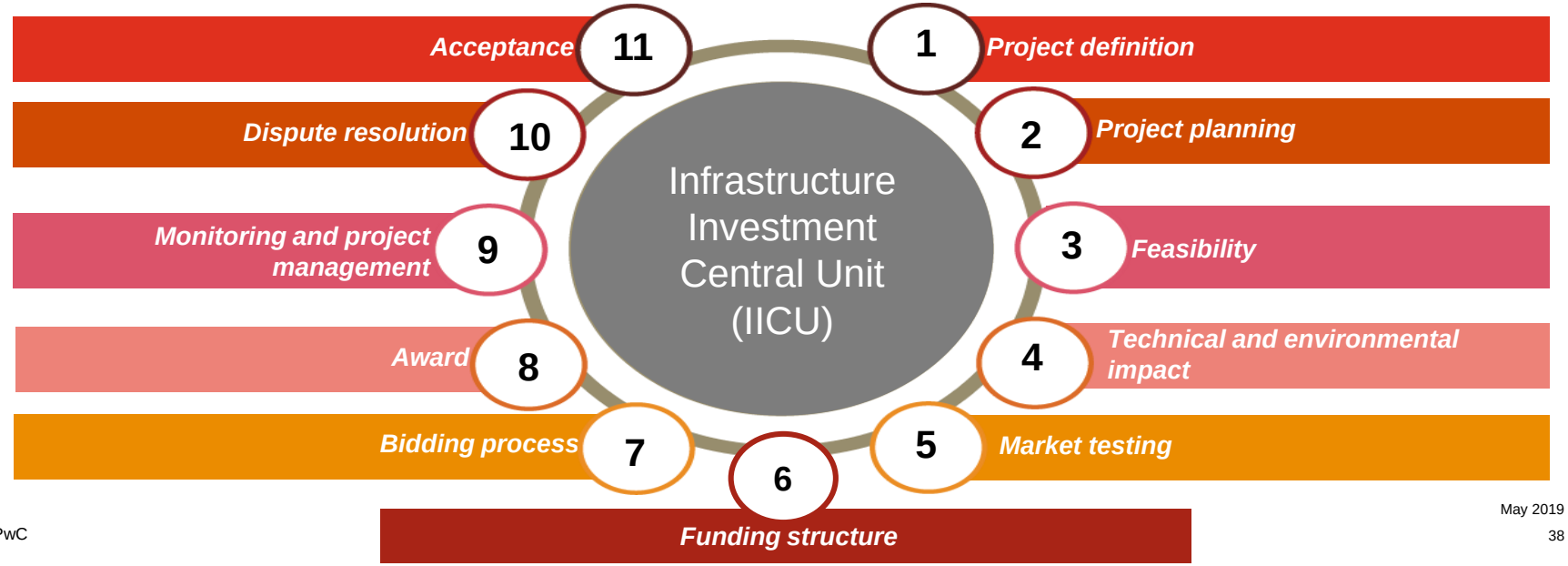
The current backlog of infrastructure projects includes €8.2bn of projects in advanced planning stages which need to move to execution mode

✓Single preparation mechanism

✓Full use of concessionary and private funding

Unified project planning will reduce delays and facilitate funding and project control

- There should be a single state organisation mandated with the planning, design and management of all major infrastructure projects (e.g.> € 20mn) to reduce delays and maximise private funding, as per Special Secretariat of PPP
- Ministries, local authorities and the private sector will submit project concepts at the pre-feasibility level to the IICU for vetting
- If accepted, the IICU will manage the preparation and the funding process



Make use of all financing options

Public-private partnerships (PPPs)

Private investment in infrastructure, in partnership with the public sector, increases accountability in the delivery, stretches public budget and helps governments deliver projects faster, cheaper and ensure that they are properly maintained

EC funding

- Projects of common interest (PCI)
- Juncker plan
- Other concessionary facilities

Project Bonds

Project Bonds could provide a significantly higher private sector participation in infrastructure funding adding a low risk element in institutional investors' portfolios

Tax increment financing

Tax increment financing earmarks incremental property tax revenues to service debt incurred to develop new transit infrastructure

Asset recycling

Asset recycling uses proceeds from the sale of existing assets to finance new development (e.g. Kasteli airport)

Value capture

Value capture leverages the value of property made viable by new infrastructure, such as a subway line extension, to finance that new infrastructure

Better municipal asset management

Municipalities own substantial properties that are often underutilised. With more proactive asset management, cities could extract significant value that can be invested in infrastructure

Delays are endemic in Greek infrastructure projects and curtail its positive economic impact

- It is essential infrastructure projects are assessed based on value-for-money across their asset lifecycle
- Infrastructure projects in Greece suffer from systematic slippage both in preparation and execution, with an average 23 months of slippage in preparation/design and 28 months of slippage in execution/construction
- Possible delay factors range from government and contractor issues to general and environmental problems
- Estimated delays in the execution of the current pipeline may undercut GDP growth by ca. 0.8pp per annum
- Accelerating the preparation of projects and minimizing slippage requires better coordination across the whole process and full use of concessionary and private funding
- There should be a single state organisation mandated with the planning, design and funding of all major infrastructure projects in order to reduce delays and secure private funding
- PPPs and Project Bonds could provide a significantly higher private sector participation in infrastructure funding, supported by EC funding

5

Conclusions

Conclusions

- Global infrastructure investment is expected to reach $3.5trln per annum in the period to 2040 or 3.2% of global GDP
- The quality and extent of infrastructure is below our European peers
- In Greece, there is a systematic infrastructure investment gap of 0.7pps of GDP**,** resulting in a **€ 13bn** permanent shortage over the past 10 years, created by the deep recession and consequent budgetary constraints
- Infrastructure investments are vital for the Greek economy, having a high **economic multiplier (ca. 1.8x)** which can boost consumption and investment in other sectors
- The number of planned and in progress infrastructure projects are not decreasing during the crisis. In 2018, their total cost is estimated at **€ 25bn**
- **€ 10.6bn** of the remaining budget refers to **Energy projects**, while **€ 7.4bn to Railways** and **€ 4.3bn to Motorways. Tourist infrastructure and Waste management projects** account for a small part of the remaining budget taking up only about **€ 1.3bn and € 0.9bn respectively**
- The current project portfolio is heavy on energy and transport and short on connectivity, tourism and the environment
- Infrastructure projects in Greece suffer from systematic slippage both in preparation and execution, with an average 23 months of slippage in preparation/design and 28 months of slippage in execution/construction. Possible delays in execution will lead to a loss of investment of around € 4bn by 2024 with a 0.8pp p.a. negative impact on GDP, which makes imperative to move the backlog of € 8.2bn of investment in the planning stage forward
- The main factors contributing to the systematic shortfall of infrastructure investment are **poor planning, slow process of political consensus and delays.** Delays are endemic in Greek infrastructure and curtail its positive economic impact
- Accelerating the preparation of projects and minimizing slippage requires better coordination across the whole process and full use of concessionary and private funding
- There should be a **single state organisation** mandated with the planning, design and management of all major infrastructure projects to reduce delays and maximise private funding

Appendix I– Infrastructure projects* in Greece

13	*Energy projects*
14	*Rail projects*
8	*Motorway projects*
15	*Tourist infrastructure projects*
16	*Waste management projects*

* Some projects have been grouped together and thus projects depicted at the tables do not add up to 88 projects

Energy accounts for ca. € 10.6bn of investments

No	Interconnection Projects	Capacity (MW)	Remaining Budget (€ mn)	Start Date	Completion Date*
1	**TAP** (Trans - Adriatic Pipeline)	N/A	1,068	2016	2023
2	**Electricity Interconnectors** (Euroasia Interconnector, Ariadne Interconnection, Cyclades, Maritsa East (BG) - Nea Santa (GR))	5,070	4,260	2019|N/A| 2014|2019	2023|2022| 2020|2023
3	**LNGs** (Alexandroupolis LNG, Kavala LNG)	N/A	655	N/A|2017	N/A|2019
4	Kavala storage facility (Undeground Storage facility)	N/A	240	N/A	N/A
5	**IGB** (GR-BG Natural Gas pipeline)	N/A	145	2019	2020
6	**Development of natural gas distribution network** in the regions of Eastern Macedonia-Thrace, Central Macedonia and Sterea Ellada	N/A	172	2019	2023
7	**Gas Compressor Station** (Kipoi)	N/A	25	2017	2019
	Total Budget		**6,565**		

No	Power Generation	Capacity (MW)	Remaining Budget (€ mn)	Start Date	Completion Date
1	**Ptolemaida 5 Power Plant (lignite fired)**	660	1,028	2015	2021
2	**Mytilineos power plant in Voiotia**	665	300	2019	2022
3	**Wind Parks**	1,479	1,723	2018	N/A
4	**Amfilochia Hydro-pumped storage**	680	502	2019	2023
5	**Hybrid Stations in Siteia and Rethymno**	139	280	N/A	N/A
6	**Solar Parks (Kozani, Anthofyto)**	212	190	N/A|2018	N/A|N/A
	Total Budget		**4,023**		

**Commissioning date*

Source: Press, PwC calculations

Rail projects amount to € 7.4bn, with 66% coming from urban rail projects

No	Upcoming Projects	Details	Remaining Budget (€mn)	Start Date	Completion Date
1	**Attiko Metro**	Extension of Line 3 to Piraeus , New Line 4 , Line 4 Extension to Perissos and Lykovrisi	3,300	2012|2019	2021|N/A
2	**Thessaloniki Metro**	Main line & Extensions to Kalamaria and Western suburbs	1,528	2006|2018| 2014	2020|2026| 2021
3	**Athens Tram**	Extension to Piraeus	32	2013	2019
	Grand Total		**4,860**		

No	Upcoming Projects	Details	Remaining Budget (€mn)	Start Date	Completion Date
1	**Ergose Tithorea**	Tithorea- Domoko	216	2013	2019
2	**Ergose Palaiofarsalos**	Palaiofarsalos - Kalambaka (electrification of railways)	54	2019	2022
3	**Ergose Volos**	Volos – Larissa (electrification of railways)	92	2019	2023
4	**Ergose Polikastro**	Polikastro - Idomeni	48	2007	2021
5	**Ergose Port of Kavala**	Connection of the Port of Kavala to the existing Thessaloniki-Alexandroupoli line	250	N/A	N/A
6	**Ergose Central Macedonia**	Upgrade of the network in Central Macedonia	35	2019	2021
7	**Ergose Athens**	Upgrade of Athens Train Station	41	2019	2022
8	**Ergose Promachonas**	Upgrade of existing line Thessaloniki-Promachonas	120	2021	2023
9	**Ergose Rhododafni**	Kiato-Rhododafni, Rhododafni-Psathopyrgos, Psathopyrgos-Patras and electrification of railways	642	2006	N/A
10	**Ergose Xanthi**	Thessaloniki-Kavala-Xanthi new line	1.000	N/A	N/A
11	**Ergose Sepolia**	Ergose: Upgrade of the network in Sepolia	57	2018	2023
	Grand Total		**2,556**		

Source: Press, PwC calculations

Motorways investment pipeline is about € 4.3bn

No	Upcoming Projects	Details	Total Klm	Total Budget (€ mn)	Remaining Budget (€ mn)	Start Date	Estimated Completion Date	Average investment/ km
1	**Crete Northern Highway**	Chania - Chersonissos, Chersonissos - Neapoli & Neapoli - Agios Nikolaos	300	1,315	1,315	2019	2024	4.4
2	**E65 Motorway (Lamia-Egnatia)**	Lamia - Xyniada & Trikala - Egnatia	96	1,126	594	2008	2022	11.7
3	**Egnatia Odos**	Vertical axes: Ardanio-Ormenio & Mandra-Psathades, Serres-Drama-Kavala, Xanthi-Echinos	173	920	910	2011	N/A	5.3
4	**Ionia Odos**	Aktion-Amvrakia Vertical Axis	49	150	93	2010	2021	3.1
5	**Regional roads**	Ring road of Katerini, Thessaloniki-Doirani, Circumvention of Chalkida, Circumvention of Lagkadia, Kalamata-Rizomylos-Pylos-Methoni & Kalo Nero - Tsakona	167	774	711	2013|2011|2019|N/A|N/A|N/A	2019|2020|N/A|N/A|N/A|N/A	4.6
6	**Underwater tunnel Salaminas**	Underwater connection of Salamina and Perama	5	350	350	2019	N/A	71.4
7	**Underwater tunnel Lefkada**	Underwater connection of Lefkada and Etoloakarnania	3	50	50	N/A	N/A	16.7
8	**Patras-Pyrgos Motorway**	Patras-Pyrgos	75	293	244	2019	2022	3.9
	Total		**867**	**4,978**	**4,266**			**5.7**

Source: Press, PwC calculations

For the upgrading of the tourist product around € 1.3bn have been scheduled

No	Projects	Remaining Budget (€mn)	Start Date	Completion Date
1	**Kasteli Airport in Heraklion**	480	2020	2025
2	**Regional Aiports**	332	2017	2021
3	**OLTH, new dock**	150	2018	2022
4	**Igoumenitsa Port upgrade**	42	2008	2019
5	**Macedonia Airport upgrade**	96	2005	2020
6	**Ioannina Airport upgrade and new terminal**	9	2010	2019
7	**Port of Patras upgrade**	37	2012	2019
8	**Key marinas**	42	N/A	N/A
9	**Luxury marines (Mykonos, Argostoli)**	9	N/A	N/A
10	**Upgrading/ Maintenance of Regional Ports**	13	2019	N/A
11	**Layrio Mega Yacht**	4	N/A	N/A
12	**Metropolitan Water Airport (Port of Thessaloniki)**	0.4	N/A	N/A
13	**Athens International Airport Small expansion**	12	2018	2019
14	**Construction of a new marina in Nafplio**	9	N/A	N/A
15	**Upgrading of Marina of Alimos**	50	2019	2024
	Total Budget	**1,284**		

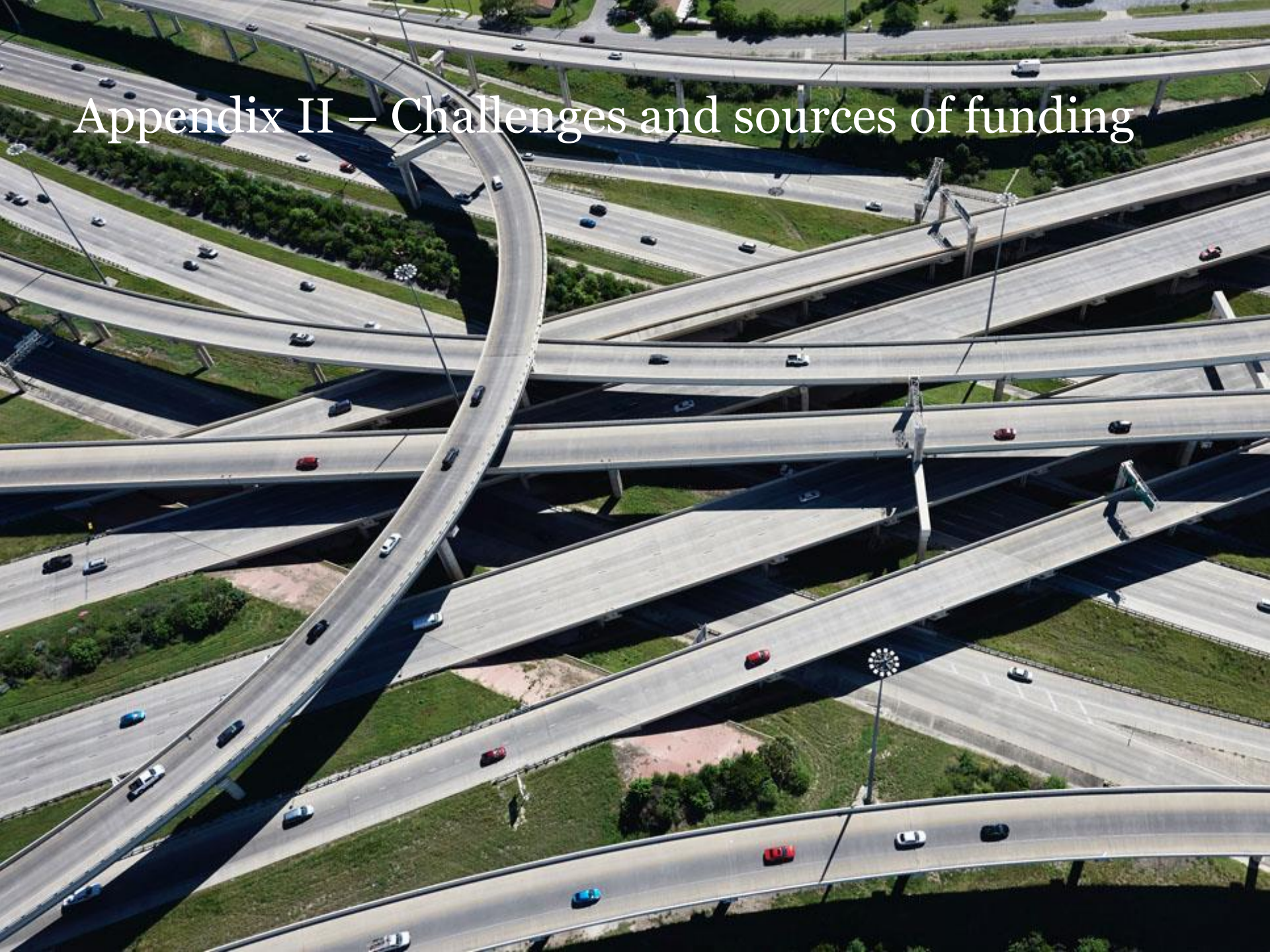
Source: Press, PwC calculations

Waste management projects need about € 0.9bn

No	Projects	Remaining Budget (€mn)	Start Date	Completion Date
1	**Center of Sewage Treatment (Koropi - Paiania)**	77	2013	2020
2	**Waste management (Aetoloakarnania)**	15	2019	N/A
3	**Waste management in Attica (Northeastern Attica - Grammatiko)**	5	2006	2019
4	**Waste management (Ilia)**	38	2019	2021
5	**Waste management (Serres)**	24	2017	2019
6	**Waste Management (Peloponissos)**	126	2018	2020
7	**Waste management (Alexandroupoli)**	58	2019	2020
8	**Water Pipeline Aegina**	20	2016	2019
9	**Waste management (Voiotia)**	11	2017	2019
10	**Connection of Pallini and Gerakas Sewage Systems to Psyttaleia**	72	2019	2023
11	**Center of Sewage Treatment (Marathonas)**	130	N/A	2023
12	**Center of Sewage Treatment (Rafina-Artemida)**	220	2019	2023
13	**Waste management (Achaia)**	50	N/A	N/A
14	**Waste management (Epirus)**	35	2017	2019
15	**Waste management (Kerkyra)**	33	2019	2021
16	**Waste management (Rhodes)**	38	N/A	N/A
	Grand Total	**952**		

Source: Press, PwC calculations

Appendix II – Challenges and sources of funding



Each infrastructure side faces different challenges that may impact the delivery and the budget of each project

Challenges		General
Government	Contractor/concessionaire	
Slow process of political consensus	Risk distribution between the state and the contractor	Projects poorly planned
Delays in work clearance/approval	Disputes between the state and the contractor	Risk distribution
Unexpected requirements	Failure to coordinate sub-contractors	Site development difficulties
Unexpected design variations	Late payment of workers during construction	
Funding problems	Poor performance/poor project management	
	Design changes	
	Inflation/Relative price changes	
	Land acquisition costs/Expropriation	
	Demand variations	

Public & Private Partnerships

5 *Signed* PPPs*

**Projects in operation or under construction*

Design, financing, construction, maintenance and operation of the facilities for the integrated waste management system in:

- Western Macedonia, € 49mn
- Serres, € 36.1mn
- Epirus, € 52.4mn
- Peloponnese, € 150mn
- Ilia, € 38mn

Total budget for these projects is € 325mn, of which 36% is state funded

9 *Approved PPPs*

5 waste management projects	2 motorway projects	1 tourist upgrading project
• Corfu, € 40mn • Achaia, € 50mn • Etoloakarnania, € 45mn • Rhodes, € 38mn • Alexandroupoli, € 58mn	• Chersonisson-Neapoli part of Crete Northern highway, € 290mn • Kalamata-Rizomylos-Pylos-Methoni road axis, € 180mn	• Marina of Nafplio, € 9mn

Total budget for these projects is € 710mn

Source: sdit.mnec.gr

Up to now, PPP projects of € 822mn have been signed since 2009, mostly schools, networks and waste management projects as well. The pipeline of approved PPPs reaches € 1.7bn

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