Infrastructure to 2030 (Volume 2)

MAPPING POLICY FOR ELECTRICITY, WATER AND TRANSPORT

Infrastructure systems play a vital role in economic and social development. Increasingly interdependent, they are a means towards ensuring the delivery of goods and services that promote economic prosperity and growth and contribute to quality of life. Demand for infrastructure is set to continue to expand significantly in the decades ahead, driven by major factors of change such as global economic growth, technological progress, climate change, urbanisation and growing congestion. However, challenges abound: many parts of infrastructure systems in OECD countries are ageing rapidly, public finances are becoming increasingly tight and infrastructure financing is becoming more complex.

The looming “infrastructure gap” needs to be closed. Where will new sources of finance come from and what role will the private sector play? How can infrastructure systems be managed more effectively and efficiently? Will the financial, organisational, institutional and regulatory arrangements (the “business models”) currently in place be able to respond adequately to the complex challenges they face, and are they sustainable over the longer term? This book assesses the future viability of current “business models” in five infrastructure sectors: electricity, water, rail freight, urban mass transit and road transport. It proposes policy recommendations that aim to enhance capacity to meet future infrastructure needs, including measures that could be taken by governments both collectively and individually to create more favourable institutional, policy and regulatory frameworks.


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Infrastructure to 2030: Main Findings and Policy Recommendations

OECD Futures Project on “Global Infrastructure Needs: Prospects and Implications for Public and Private Actors”
Foreword

Following an extensive international consultation process with government departments and agencies, corporations and research institutes, the OECD International Futures Programme (IFP) launched a two-year project in the second quarter of 2005 on “Global Infrastructure Needs: Prospects and Implications for Public and Private Actors”. The purpose of the project was to take stock of the long-term opportunities and challenges facing infrastructures worldwide, and to propose a set of policy recommendations to OECD governments that aim to enhance infrastructures’ contribution to economic and social development in the years to come. The project had a time horizon out to 2020-2030 and covered energy, surface transport, water and telecommunications. The focus was on OECD countries, with the so-called BRICs (Brazil, Russia, India, China) included in some of the analysis. The purpose of this short brochure is to provide a very brief overview of the findings of the project and its principal policy recommendations.

The project was funded by voluntary contributions from governments, public agencies and corporations, who were represented on the Steering Group. The Steering Group advised the OECD Project Team on the content and direction of this project. (The reader will find a list of the Group’s members at the end of this document.) Countries represented were Canada, Denmark, France, Mexico, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. The Steering Group met four times between June 2005 and December 2006. An interim report was published in 2006 as an OECD book under the title Infrastructure to 2030: Telecom, Land Transport, Water and Electricity, reflecting the findings from the first stages of the project. The final report, together with the conclusions and policy recommendations set out in this document, will be published in the summer of 2007 as an OECD book under the title Infrastructure to 2030 (Volume 2): Mapping Policy for Electricity, Water and Transport.

The findings and policy recommendations of which a summary is presented here build on a wide range of research, discussions and exchanges of views conducted within the project. These include primarily the papers written by the OECD/IFP Secretariat and outside consultants; materials supplied by participants in the Steering Group and OECD specialists from other Directorates involved in the project; the rich discussions conducted during the Steering Group meetings; and detailed written comments provided by Steering Group members. The recommendations are addressed primarily to policy makers in OECD countries, and also to those in the larger non-OECD economies. However, many of the findings and recommendations have implications for decision-makers in the private sector.

The project was led by the OECD’s International Futures Programme, a forward-looking multidisciplinary unit which provides the OECD Secretary-General and the Organisation with early warning on emerging policy issues. It does this by identifying major developments and analyzing key long-term concerns to help governments map strategy. Its role is also to promote horizontal, cross-Directorate themes in the OECD. Hence, the work was conducted in co-operation with several OECD Directorates and Agencies, notably: the European Council of Ministers of Transport (ECMT) and the Joint Transport Research Centre (JTRC); the Environment Directorate; the Directorate for Science, Technology and Industry; the Statistics Directorate; and the International Energy Agency (IEA). The project has benefited substantially from inputs and comments from colleagues in those parts of the house.

For further information: please contact Barrie Stevens (barrie.stevens@oecd.org) or Pierre-Alain Schieb (pierre-alain.schieb@oecd.org) at the OECD International Futures Programme.

Paris, April 2007
The Principal Policy Recommendations in Brief

1. Innovative Approaches to Finance
   1. Encourage public private partnerships (PPPs) as a means of raising additional financing for infrastructure investment and diversifying business models.
   2. Encourage the investment of pension funds and other large institutional investors in infrastructures.
   3. Make greater use of user charges for funding infrastructures. They should be designed to signal prices, reflect real costs and contribute to demand management.
   4. Diversify and expand traditional revenue-raising sources.
   5. Explore the funding possibilities offered by land value capture.

2. Improving the Regulatory and Institutional Framework Conditions
   6. Examine the legal and regulatory framework conditions with a view to encouraging the emergence of fresh sources of capital and new business models for the construction, maintenance and operation of infrastructures.
   7. Encourage the emergence of new players and new business models through the creation and promotion of frameworks that stimulate the development of effective competition either in or for the market.
   8. Place greater emphasis on the issue of reliability of infrastructure functioning.
   9. Strengthen the framework for standards, as a tool both for encouraging new operational models and for improving interoperability.
  10. Explore the potential for new institutional arrangements that may provide more effective and efficient financing, funding and/or delivery of infrastructure.

3. Strengthening Governance and Strategic Planning
   11. Support the development of long-term, co-ordinated approaches to infrastructure development.
   12. Reduce the vulnerability of long-term infrastructure planning and implementation to short-term thinking and priority setting.
   13. Ensure the involvement of a broader range of stakeholders in the process of needs assessment, prioritisation, design, planning and delivery of infrastructures.
   14. Step up efforts to reduce the length and complexity of the planning-to-implementation process.
   15. Strengthen international co-operation to improve the efficiency, reliability and security of flows of goods, services and information across transborder infrastructures.

4. Developing and Integrating Technology
   16. Support the use of technologies both to improve efficiency in infrastructure and to enhance demand management.

5. Expanding and Improving the Toolkit
   17. Strengthen public capacity to inform decision-making, improve analysis, monitor performance, and develop the requisite interdisciplinary skills to address infrastructure issues.
The central message of this document is that a gap is opening up in OECD countries between the infrastructure investments required for the future, and the capacity of the public sector to meet those requirements from traditional sources. Bridging the gap will demand innovative approaches, both to finding additional finance, and to using infrastructures more efficiently and more intelligently through new technologies, demand management strategies, regulatory changes and improved planning. (The infrastructures addressed in the project cover electricity, surface transport, water and telecommunications.)

**Infrastructures are key to economic and social development.**

Infrastructures are not an end in themselves. Rather, they are a means for ensuring the delivery of goods and services that promote prosperity and growth and contribute to quality of life, including the social well-being, health and safety of citizens, and the quality of their environments. In the past, infrastructures have provided significant social and economic benefits. Looking to the future, they will continue to play a vital role in economic and social development, not least because the networked economy is becoming increasingly important, and society ever more dependent on the smooth running of a growing range of infrastructure services. Moreover, the various infrastructure systems themselves are interacting ever more closely with one another, engendering interdependencies and complementarities, as well as heightened vulnerability, and thereby posing new policy challenges such as interoperability and reliability.

**The fast pace of world economic growth will put increasing pressure on infrastructures.**

The infrastructure requirements of OECD countries and the larger non-OECD countries such as China, India and Brazil, are growing. To a large extent, this has to do with economic growth and the drive for improved economic performance and competitiveness. Central projections for the next two decades or so suggest that the world economy is set to grow on average at close to 3% per annum to 2030, with developing countries’ performance outstripping that of the developed countries by a wide margin (4% per annum versus 2.4% per annum). The two-way street — along which economic growth encourages demand for infrastructure, and infrastructure generates economic growth — is set to get much busier in the years to come. Moreover, globalisation and the emergence of new markets and new players are helping lengthen supply chains and exacerbate congestion around key ports, airports and transit corridors.
In addition, they will also be influenced by many other factors. However, infrastructure needs will also be shaped by an array of other factors. These include:

- Demographic developments — ageing populations, population growth or decline, urbanisation trends, and population movements to rural and coastal areas.
- Increasing constraints on public finances due to ageing populations, security concerns, etc.
- Environmental factors, such as climate change and rising quality standards.
- Technological progress especially, but not only, in information and communication technology.
- Trends towards decentralisation, and growing local public involvement.
- The expanding role of the private sector.
- The growing importance of maintenance, upgrading and rehabilitation of existing infrastructures.

Traditional sources of public finance alone will not suffice to meet future infrastructure needs…

At present, governments are not well placed to meet these growing, increasingly complex infrastructure needs. The traditional sources of finance, i.e. government budgets, will come under significant pressure over the coming decades in most OECD countries — due to ageing populations, growing demands for social expenditures, security, etc. — and so too will their financing through general and local taxation, as electorates become increasingly reluctant to pay higher taxes. Moreover, looking across the full range of economic, social and environmental forces affecting the infrastructure sectors addressed in this project, nowhere does the current public policy, regulatory and planning framework appear adequate to tackle the multiple challenges facing infrastructure development over the next 25 years.

Failure to make significant progress towards bridging the infrastructure gap could prove costly in terms of congestion, unreliable supply lines, blunted competitiveness, and growing environmental problems, with all the implications for living standards and quality of life.

…which are huge and growing.

What orders of magnitude of infrastructure investment are likely to be needed through to 2030? Rough estimates from the OECD Infrastructure Project suggest that annual investment requirements for telecommunications, road, rail, electricity (transmission and distribution) and water taken together are likely to total around an average of 2.5% of world GDP. If electricity generation and other energy-related infrastructure investments in oil, gas and coal are included (as the IEA does in its Investment Outlook), the annual share rises to around 3.5%. Clearly, the figure would rise further if one were to include other infrastructures not covered by this project, e.g. ports, airports and storage facilities.
OECD countries will need to invest primarily in maintenance and upgrading of existing networks…

…while the larger non-OECD countries will need to invest largely in new infrastructures.

How are these investments likely to be allocated? Globally, a large share will be used for new additional infrastructure, but much will also be accounted for by maintenance, replacement and upgrading. The shares vary across regions. In OECD countries, infrastructure networks and systems are, broadly speaking, in place, and the scope for adding new infrastructure is limited. Consequently, a larger effort will need to be directed towards maintenance and upgrading of existing infrastructures and to getting infrastructures to work more efficiently. Ways of squeezing more efficiencies out of the system include investment in new technologies, and demand management strategies to better control traffic flows through road, rail, electricity and water systems. In the BRICs and most developing countries, by contrast, the lion’s share of investment is likely to go on new construction as governments strive to expand inadequate networks.

Where will the financing come from?

Looking across the globe, a not insignificant part of infrastructure is already in private hands — this is especially true of telecommunications and, to a lesser degree, of power generation and railways – and it is to be expected that private money will continue to flow to these activities. More problematic is the area of publicly owned and operated infrastructures, because it is here that pressures on budgets and tax-raising capacity are already starting to be felt.

In OECD countries, the share of government spending on infrastructures has been falling…

Evidence suggests that in the advanced countries, public capital investment has accounted for a steadily declining proportion of total government expenditure. As Figure 1 shows, for the OECD area as a whole, government spending on gross fixed capital formation as a share of total general government outlays fell from 9.5% in 1990 through 8% in the mid-1990s, to approximately 7% in 2005.
At the same time, social expenditures have increased their share noticeably. Between 1980 and 2003, they rose on average from about 16% to 21% of GDP. Experiences differ across OECD countries, but on average public spending-to-GDP ratios increased most significantly in the early 1980s, and then again in the beginning of the millennium when average ratios rose by 1% of GDP between 2000 and 2003.

The two key drivers of increases in social spending have been expenditures on health and on the retired population. Both are expected to expand considerably in the coming decades, outpacing the growth of government budgets and that of GDP by a substantial margin. Projections suggest that for the OECD area as a whole, spending on public health and long-term care could increase from the current level of 6.7% of GDP to between 10.1% and 12.8% by 2050, while pensions could rise on average by around 3 to 4 percentage points of GDP over the same period.

Note: Weighted average using government total outlays converted to USD using 2000 purchasing power parities for GDP.

…while spending on health and the retired population has been rising.

The share of spending on pensions and health is expected to increase markedly in the future…
Table 1. Public Health and Long-Term Care Spending (in per cent of GDP)

<table>
<thead>
<tr>
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<th>Total spending on healthcare and long-term care</th>
<th>2050</th>
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<tr>
<td></td>
<td></td>
<td>Cost-pressure(^1)</td>
</tr>
<tr>
<td>Canada</td>
<td>7.3</td>
<td>13.5</td>
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<tr>
<td>France</td>
<td>8.1</td>
<td>13.4</td>
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<tr>
<td>Germany</td>
<td>8.8</td>
<td>14.3</td>
</tr>
<tr>
<td>Italy</td>
<td>6.6</td>
<td>13.2</td>
</tr>
<tr>
<td>Japan</td>
<td>6.9</td>
<td>13.4</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>6.1</td>
<td>12.7</td>
</tr>
<tr>
<td>United States</td>
<td>6.3</td>
<td>12.4</td>
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<tr>
<td><strong>OECD average</strong></td>
<td><strong>6.7</strong></td>
<td><strong>12.8</strong></td>
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1. The “cost pressure” scenario assumes no policy action.
2. The “cost-containment scenario” embodies the assumed effects of policies curbing expenditure growth.

...and is unlikely to be offset significantly by lower spending on education and family benefits.

Also, ageing populations, together with older and fewer workers, may mean falling tax receipts.

The overall result is a growing infrastructure investment gap.

These mounting pressures will probably only be offset in small part by lower spending on education for the young, and child or family benefits. Moreover, scarcer labour is expected to put pressure on governments to increase investment in all forms of education, including lifelong learning. Accordingly, the scope for public investment in infrastructure within government budgets will be increasingly constrained.

What are the options for the public sector to bridge the infrastructure gap? Despite growing pressures on public budgets, general and local taxes will continue to provide the single most important source of financing in many cases. However, in most OECD countries and some BRICs, ageing populations are likely to lead to shrinking wage bills, thereby reducing tax receipts. To some extent, the severity of the effect will depend on such factors as the evolution of labour market participation rates, immigration, productivity, and the balance between consumption-based and income-based tax revenues. Some compensation may be forthcoming in the guise of increased tax receipts from accumulated pension assets, but the offset effect is likely to be limited to generally no more than one percentage point of GDP.
Private sector finance, as noted above, has traditionally had a strong presence in some infrastructure sectors in some countries. In recent years, as the share of government investment in infrastructures has declined, that of the private sector has increased. Privatisations (i.e. the sale of state-owned assets) have been an important driver. Since the 1980s more than USD 1 trillion of assets have been privatised in OECD countries. Infrastructures have consistently been on centre stage. Averaged out over the 1990-2006 period, almost two-thirds of all privatisations in the OECD area have concerned utilities, transport, telecommunications and oil facilities.


Elsewhere, too, privatisation activity has been vigorous. Over roughly the same period, some USD 400 billion of state-owned assets were sold in non-OECD countries, of which about half were accounted for by infrastructures.

New business models with private sector participation, notably variants of public private partnership models (PPPs) that are being increasingly used particularly in OECD countries, offer further scope for unlocking private sector capital and expertise. So too do the huge pools of private sector capital managed by pension funds and insurance companies. Infrastructures, with their low-risk and steady-return profile, are of considerable potential interest to such funds. Alone in the OECD area, pension funds today amount to some USD 18 trillion, up from USD 13 trillion in 2001.
1. Pension reserve fund data are 2004 data.
2. Life insurance data are 2003 data.

Note: Unallocated pension insurance contracts are excluded from pension funds’ assets.

…but governments will also have to find new sources of public sector finance.

...Diversifying the sources of public sector finance includes making more and better use of user fees, creating mechanisms for securing long-term financing for infrastructures (e.g. long-term infrastructure funds), exploring the possibilities offered by land value capture, and promoting innovative variations on traditional financing mechanisms.
In addition to finding new sources of finance, governments will need to use infrastructures more efficiently and more intelligently…

Expanding access to additional private and public sector sources of finance will make a significant contribution to bridging the infrastructure gap. However, it will not suffice on its own. The challenges facing governments are simply too diverse and complex. In the coming years, policy makers will in addition need to:

- Improve efficiency in the construction and operation of infrastructures.
- Increase efficiency levels in the use of infrastructures through better management of demand.
- Ensure infrastructures are reliable and resilient.
- Enhance the design and capacity of infrastructures to meet future environmental and security challenges.
- Strengthen life-cycle management of infrastructure assets as the focus of investment turns increasingly to maintenance, upgrading and refurbishment of existing facilities and networks.
- Raise the effectiveness of infrastructure development both in meeting multiple objectives — economic, social, environmental, etc. — and in allocating resources to create maximum value.

…through new technologies, demand management strategies, regulatory changes and improved planning…

In rising to meet these challenges, governments will need to complement the search for fresh sources of capital with a wide array of other measures. These must include *inter alia*: regulatory changes to encourage the emergence of new business models and the development and integration of new technologies; the promotion of more competition in procurement and operation; legal and administrative changes to speed up planning, procurement and implementation; application of new technologies and new schemes to enhance efficient use of infrastructures and better manage demand; closer international co-operation; improved security; and the underpinning of infrastructure design, financing and funding with long-term strategic planning.

…and improve the basic tools for achieving efficiency improvements.

Finally, the planning, financing and management of infrastructures will need to be supported by better basic tools. Information, data collection, research and analysis need strengthening. Accounting for improved asset management should be used more widely, as should rigorous evaluation methods for stronger evidence-based policy making. Greater use can be made of on-line tools for communication and dialogue. And there is ample scope in education and training institutions for greater efforts to develop the interdisciplinary skills and knowledge that will be required to tackle the opportunities and problems raised by infrastructures in the years ahead.
The Infrastructure Project Steering Group

At the beginning of the OECD Futures Project on “Global Infrastructure Needs: Prospects and Implications for Public and Private Actors”, a Steering Group was set up to provide overall advice to the OECD Project Team. It was composed of high-ranking experts and decision makers from public and private entities in infrastructure and infrastructure-related sectors that contributed financially to the project. There were four meetings of the Steering Group over the course of the Project (June 2005, December 2005, June 2006, and December 2006).

Chairman

Michael OBORNE, Director of the OECD International Futures Programme (IFP) 
assisted by Barrie STEVENS, Deputy Director, OECD IFP, and
Pierre-Alain SCHIEB, Counsellor and Head of Futures Projects, OECD IFP

The Members

Some members of the Steering Group were replaced during the two years of the Infrastructure Project and/or assisted by other experts from their organisations. The representatives of those organisations are listed below (titles and affiliations are those held during the course of the Project).

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Endnotes


2. Surface transport (road, rail and urban public transport), telecommunications, electricity transmission and distribution, and water.

3. Total cumulative infrastructure requirements in the five sectors through to 2030 would amount to about USD 53 trillion. Adding in electricity generation would raise the figure to around USD 65 trillion, and other energy-related infrastructure investments would take it up to more than USD 70 trillion. These are estimated orders of magnitude of infrastructure needs, and may not of course necessarily translate into effective demand. The point of departure for OECD authors’ projections was the 2003 World Bank Policy Research Working Paper 3102, “Investing in Infrastructure: What is Needed from 2000 to 2010?” by Marianne Fay and Tito Yepes. The projection period is 2005-2010. The methodology for forecasting infrastructure capital stock and new construction (additions plus maintenance) is based on the elasticity between infrastructure capital stock and GDP per capita. Growth in the latter results in forecasts for capital stock, which can then be transformed into a forecast for new construction. The same model is used for all infrastructure sectors. The estimates produced by OECD authors differ from those provided by Fay and Yepes in a number of ways. First and foremost, different methodological approaches have been employed, and the projection period is much longer, namely to 2030. But even for the medium term estimates to 2010, there are considerable differences. These can, however, be explained by different assumptions about economic growth rates (i.e. the OECD estimates are based on more recent World Bank projections for the world economy than those used by Fay and Yepes), by the use of different base years for the USD values (i.e. 1995 constant USD in Fay and Yepes versus 2005 constant USD in OECD), as well as by differences in sectoral coverage (e.g. in contrast to the Fay and Yepes study, the OECD estimates cover major European rail projects such as TEN-T; electricity transmission and distribution only; and include renewal and upgrading in telecommunications). Adjusting for these differences makes the results of the World Bank and OECD studies quite consistent with one another. Where there does appear to be an irreconcilable difference between the Fay and Yepes study and OECD estimates is in water infrastructures. The authors of the OECD report on water examined a large number of recent independent studies (e.g. Ofwat in UK, EPA in US, OECD for Central and Eastern Europe) in OECD countries and middle-income countries (e.g. BRICs and Central and Eastern Europe) all of which point to considerably higher annual investment requirements — for example, equivalent to around 0.75% of GDP for high income countries as opposed to 0.03% of GDP estimated by Fay and Yepes). For details of OECD author estimates, see OECD (2006) *Infrastructure to 2030: Telecoms, Land Transport, Water and Electricity*.


7. Ibid.