

Building the World: Opportunities in Infrastructure

We estimate that global economic growth will require investments in infrastructure totalling about \$4 trillion over the next five years, half in the BRICs economies.

Our 'BRICs dream' envisions a world in which savings, population growth and productivity gains interact with good governance, sensible policies and strong institutions to yield impressive real GDP growth for Brazil, Russia, India and China, and potentially significant growth for the 'Next 11' countries. (These are the next wave of 'BRICs-like' countries, including Bangladesh, Egypt, Indonesia, Iran, Korea, Mexico, Nigeria, Pakistan, Philippines, Turkey and Vietnam.) In the developed world, the prospects for growth are more limited, but they still produce rising per capita incomes.

Infrastructure is a key part of this story. It is vital to economic growth and plays an important role in reducing income inequality. As globalization deepens, infrastructure will arguably become even more important for countries seeking a role in the 'just-in-time' global economy. Our long-term GDP growth projections are unlikely to be realized without significant and sustained investment in infrastructure, suggesting a major opportunity for the private sector in coming years.

The State of the World's Infrastructure

The current infrastructure profile varies significantly, even among developed countries:

- **Electricity generation** is a key area for investment in the BRICs, where average per capita generation is three times lower than in the G6. The BRICs show remarkable divergence: Russia produces nearly as much electric power per capita as the UK and roughly 75% of the G6

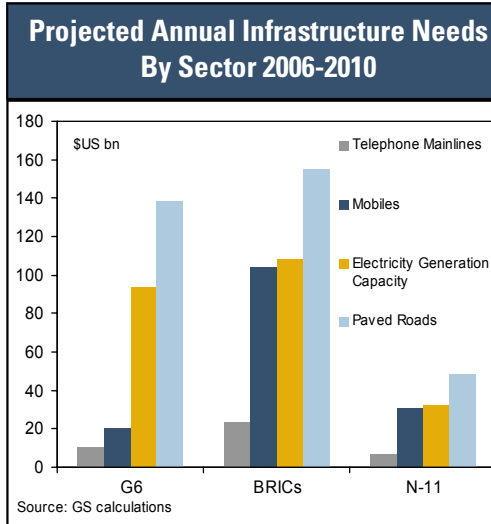
level, whereas India generates only 9% of Russia's level. Among the N-11, Korea is already at G6 levels; Iran and Mexico are close to the BRICs average.

- The most remarkable infrastructure story of the past decade is the spread of **mobile phones**, which have eclipsed **mainline phones** around the world. There are now more mobile phones than mainlines across the G6 and the BRICs, and in all but three of the N-11 (and more mobiles than people in Italy and the UK). Russia's mobile penetration rate is more than 10 times India's, while Brazil's is nearly 40% higher than China's. Korea has one of the highest mobile penetration rates in the world, but in seven of the N-11 countries penetration rates are around 10%, suggesting significant future growth if incomes rise.

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- **Road and rail** density is divergent enough, even among developed countries, to suggest that there is no one ‘appropriate’ level. Overall transport statistics may matter less than the quality of the network in key areas. In recent years the focus of transport investment has been projects such as toll roads between major cities, tunnels, bridges and airports, but internationally comparable data on these projects are not available.
- Access to ‘improved’ **water and sanitation**, the official standard, is difficult to measure. Official data show substantial improvements since 1990 in both the BRICs and the N-11. But quality and

reliability are difficult to measure, and official data probably overstate the case. Although access is not an issue in the G6, industrialization, climate change and urbanization will strain water supplies around the world.

How Much Infrastructure Investment Does the World Need?

The short answer is ‘a lot.’ Our estimates show that economic growth in the G6, BRICs and N-11 together will require infrastructure investment of nearly \$4 trillion over the next five years—or \$770 billion each year until 2010. We arrive at this figure (which includes both new projects and maintenance) by applying our own projections for growth in GDP and income per capita to a World Bank

analysis of infrastructure demand, and then using global ‘best practice prices’ to assign Dollar values.

On an annual basis to 2010, we estimate that:

- Half of global infrastructure spending will be in the **BRICs**, where aggregate annual spending could be worth nearly \$400bn, or 8.5% of current (2005) GDP. Nearly 60% of this would go to new projects, more or less evenly split among roads, electricity and mobiles. Maintenance spending would be considerably higher for roads than for either electricity or telecoms.
- Maintenance rather than new investment will be the focus in the **G6**, where annual infrastructure

Expected Annual Infrastructure Investment Needs, 2006-2010

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Infrastructure Sector	G6		BRICs		N-11	
	US\$ bn	% 2005 GDP	US\$ bn	% 2005 GDP	US\$ bn	% 2005 GDP
Telephone Mainlines						
New Investment	1.75	0.01	8.99	0.20	2.63	0.09
Maintenance	8.86	0.03	14.48	0.32	4.41	0.15
Total	10.61	0.04	23.47	0.51	7.04	0.24
Mobiles						
New Investment	8.92	0.03	67.18	1.47	20.80	0.71
Maintenance	11.60	0.04	36.46	0.80	9.73	0.33
Total	20.52	0.08	103.64	2.27	30.53	1.05
Electricity Generation Capacity						
New Investment	30.88	0.12	71.30	1.56	20.23	0.69
Maintenance	62.38	0.24	36.78	0.81	11.90	0.41
Total	93.27	0.36	108.08	2.37	32.13	1.10
Paved Roads						
New Investment	50.00	0.19	79.73	1.75	24.28	0.83
Maintenance	87.85	0.34	75.40	1.65	23.67	0.81
Total	137.85	0.53	155.13	3.40	47.95	1.64
Total of Above Categories						
New Investment	91.56	0.35	227.20	4.98	67.94	2.33
Maintenance	170.69	0.66	163.12	3.58	49.72	1.70
Total	262.26	1.01	390.33	8.56	117.65	4.03

Source: GS calculations

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spending is likely to reach \$260bn, or 1% of GDP. New projects would require roughly \$90bn, or 0.35% of GDP per year, while maintenance would be nearly twice as high, at \$170bn or 0.66% of GDP. Half of total spending would go on roads, 35% on electricity generation and just over 10% on telecoms.

- In the N-11, we project that annual spending will be about \$120bn, less than half the Dollar figure for the G6 but still a hefty 4% of the N-11's current GDP. Two factors explain why the share of spending is lower in the N-11 than in the BRICs. First, the N-11 have a lower rate of new investment, due to their slower growth in income per capita. Second, their total infrastructure stocks are lower, which means lower maintenance spending. As in the BRICs, about 60% of N-11 investment would go to new projects, with slightly more on roads than on either electricity or mobiles.

- Between 2006 and 2010, aggregate global spending on **roads** could be worth roughly \$1.7trn; **electricity** \$1.2trn; and **telecoms** close to \$1trn. The BRICs could spend more than 40% of current (2005) GDP on infrastructure, the N-11 20% and the G6 5%.

A Longer-Term View

With our 'BRICs dream' in mind, we also take a longer-term look at developing countries to see how much investment they would need to catch up to levels seen in wealthier countries. To do so, we compare stocks in the BRICs to current G6 per capita levels, and stocks in the N-11 to current BRICs per capita levels.

This exercise emphasizes the challenge ahead for the **BRICs**, which would need to spend \$10trn in aggregate—more than twice their current GDP—in order to reach current G6 infrastructure levels. 'Catch-up' would require a total of \$7.7trn (or 170% of current GDP) in

electricity generating capacity, \$325bn (7% of GDP) in mobiles and \$295bn (6.5% of GDP) in mainlines, with India and China accounting for more than 90% in each sector. Rail would require a further \$1.75trn, half in Russia. We omit roads, where our estimate is for a staggering \$25trn. The economic irrelevance and environmental undesirability of paving Siberia, the Amazon and China's western desert mean that actual spending on transport is unlikely to approach this figure.

It could take the BRICs 25 years for infrastructure to catch up with today's G6 levels, based both on our estimates of annual spending and our projection of when the BRICs' US\$ GDP will reach the level of the G6 today.

The **N-11** face a less onerous challenge in catching up to the BRICs, because they are already fairly close to BRICs levels. N-11 total spending would be in the range of \$1.7trn, or nearly 60% of current GDP, when roads are included

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alongside energy, telecoms and rail. We estimate that the N-11 could reach today's BRICs levels in 10-15 years.

Private-Sector Opportunities

The challenge of financing these substantial investments offers opportunities for the private sector and for innovation in capital markets.

Infrastructure has long been financed by the state, reflecting a variety of factors—its political status as a public good, state ownership, strict regulation and non-market pricing. This began to change during the 1990s, as governments made private investment more attractive by privatizing state assets, breaking up monopolies, disentangling regulation from ownership, allowing market-oriented pricing and demonstrating a greater appetite for public-private partnerships. The private sector now accounts for 20%-25% of total infrastructure financing in developing countries, according to World Bank and other estimates.

Our estimates of infrastructure needs in the BRICs and the N-11 over the next five years suggest that there is scope for a considerable increase in private investment. Total private-

sector commitments to energy, telecoms, transport and water in all developing countries have averaged around \$60bn a year over the past 15 years. Annual spending remains well below its pre-1997 peak and is dominated by telecoms investments.

On our estimates, new projects in the BRICs and N-11 together will require spending of \$295bn annually to 2010. If the private sector finances 20%-25% of the total, its share could be \$60-\$75bn. Annual maintenance spending could be an additional \$40bn. Thus infrastructure demand in the BRICs and N-11 could potentially support private-sector investment of \$100bn-\$125bn a year, or nearly two times historical flows.

In the near term, we would expect 50% of private inflows to go to telecoms (mostly mobiles); 35% to electricity generation; 15% to roads; and 5% to water projects. Over time, the focus would likely shift toward electricity generation and roads, though this will require further evolution in the BRICs and N-11 policy environment to make investment in these sectors more economically attractive.

The challenge of attracting increased private capital inflows is part of the broader challenge facing the BRICs

and the N-11. Private investment, like economic growth, will require macroeconomic stability, strong institutions and sensible policies. Infrastructure in particular will require appropriate and flexible regulatory regimes and a willingness to adopt market pricing for politically sensitive sectors such as electricity and water.

Ongoing capital market innovation can be helpful in pricing and allocating risk among governments, private investors and consumers; offering greater flexibility in terms of maturities, tradability and repayment structures; and attracting new investor pools. Capital markets development within the BRICs and the N-11 could provide a further basis for private-sector support.

Improving the climate for private investment in infrastructure will be politically challenging for many governments. There are only two options: increasing public spending (and in the process crowding out domestic private investment and forgoing the efficiency gains that private investment can bring)—or allowing inadequate infrastructure to be a constraint on future GDP growth.

Over the Long Term, an Enormous Catch-Up Process Ahead for the BRICs to Reach G6 Levels

Infrastructure Sector	Total Spending Needed for BRICs to Reach Current G6 Infrastructure Levels		Total Spending Needed for N-11 to Reach Current BRICs Infrastructure Levels	
	US\$bn	% GDP	US\$bn	% GDP
Telephone Mainlines	295	6.46	38	1.29
Mobiles	324	7.11	35	1.19
Electricity Generation Capacity	7,736	169.67	823	28.23
Rail	1,746	38.30	26	0.89
Paved Roads*	na	na	796	27.29

Source: GS calculations

* We did not estimate the BRICs catch-up investment needed to achieve G6 road density levels. The comparison does not seem to be valid due to great variations in the countries' surface areas and debateable levels of an 'appropriate' density.