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What Policies to Green Infrastructure Service Delivery Entail

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1. Introduction

Infrastructure reform is central to any national and global effort to improve natural resource management. Improvements are needed on both the demand and the supply side of various infrastructure subsectors to slow their excess consumption and waste since these drive air and water pollution.[2] This is not news and it has already been extensively documented. But it is easy to forget the large quantitative importance of these sectors to the greening of growth and what this size effect implies for the complexity of the interactions with other sectors.

Infrastructure accounts directly for over 40% of all emissions driving air pollution (IPCC (2007)). Power accounts for over 25%, Transport for 13% and Waste Water for 3%. However, the Power sector could just as easily be blamed for the 8% credited to Buildings and the 19% credited to Industry. A large share of the energy related emissions can indeed be traced back to the exceptionally poor record of these non-core infrastructure sectors in managing energy demand.

This means that ***over two thirds of the emission reduction challenge is strongly linked to infrastructure related activities***. The wide range of these activities implies multiple and complex interactions between the managers of the various sources of emissions. This is equally true for the production and use of energy and the production or use of transport related services. The main differences in complexity are simply anchored in the differences between the sources of complexity across sectors and the

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[2] Infrastructure activities are also linked to land pollution, although we will not deal with it here since solid waste management is not addressed .

specificities of the legal, political and social context in which policies need to be designed.

The slow nature of the changes in the energy markets illustrates quite well the complexity of the challenge of greening infrastructure. Reducing emissions in non-core infrastructure industries will have to be the outcome of improvements in policies for both core and non-core industries. In other words, energy and water specific regulations will often have to interact with policies aimed at promoting a greener growth in non-infrastructure specific activities. In practice, this means, for instance, that the energy problem will not be solved without a significant improvement in the energy demands of the construction, industrial and transport sectors as well as changes in residential use.

Managing the changes required involve many actors. There are actors across government levels, across ministries at the same government level as well as strong stakeholders such as the workers and owners of the concerned sectors. Moreover, in some cases, as for transport, the optimal design of infrastructure service markets is often a supranational matter. Indeed, the design of rail and road networks has to be thought through internationally but endorsed by national governments facing local and national pressure groups.

For water pollution and management, changes in policies are just as important but also just as complex--even if this is less well covered by the media and hence less well recognized by the non-specialized population. Recent estimates suggest that about 4 out of every 5 individuals on our planet face a very significant risk to be exposed to the consequences of poor water management and/or to water shocks related to climate change (Vörösmarty et (2010)). The interaction between climate change and groundwater extraction, agricultural and irrigation practice are indeed potentially very serious--depending on the emission scenarios. Water regulation and in particular property rights definition and pricing are instrumental in the management of these interactions. They matter to both the quantity and quality (e.g. nutrients, heavy metal, pesticides, …) of water even if the effects are obviously more localized. This importance requires a strategic vision of the sector that involves all the stakeholders relying on a common water source, maybe at the basin level for inland water and sometimes at a

supranational level. In an increasingly decentralized but interconnected world, this adds significantly to the difficulty of conducting environmentally effective policy.

In sum, the control of water pollution will depend on many countries, many sectors and many institutions, for some water uses maybe even more so than the control of air pollution. Each actor has its own preferences or constraints in terms of environmental strategies and policy options and each faces its own pressure groups to protect local interests. More importantly, the winners and the losers of policy successes and failures are more likely to face each other than in the case of air pollution. This is why water conflicts are a lot more likely and this is why it is so crucial not to underestimate the importance of water management.

Where do we go from here? *There is a need to recognize conceptually and not just politically the complexity of the greening of infrastructure and to internalize in the conceptual thinking the importance of pragmatism in the implementation of policies.* Any national policy diagnostic of the policy challenges imposed by the greening of a sector will have to deal with multiple sources of complexity. This means identifying and prioritizing a wide range of incentives and coordination challenges. This includes for instance the management key decisions concerning infrastructure across sub-sectors and often across countries. Helping countries set up this diagnostic to turn the dreams of change into real opportunities for the main purpose of this paper.

More specifically, the paper:

(i) synthesizes the key dimensions of infrastructure, emphasizing the differences between those that will make the changes in the sector easier and those that are likely to slow or block them, and

(ii) discusses the infrastructure policy, regulatory and institutional dimensions of efforts to improve resource efficiency while helping manage shocks and other sources of uncertainty impacting infrastructure.

It explores the various ways in which the current organization of the infrastructure sub-sectors has to adjust to minimize the trade-offs between efforts to meet the growing demand for services and efforts to cut undesirable emissions and waste as well as overconsumption of natural resources associated with the supply of services by the sector. The paper also assesses the scope for changes in both supply and demand

management under a conservative and an aggressive green growth policy scenario. The discussion covers a wide range of policies, including the scope for policies aimed at cutting costs in the sector. In each case, the social and political aspects of the emerging new visions for the sector are covered since these determine the feasibility and sustainability of the changes.

The paper is organized as follows. Section 2 provides a brief overview of the state of the sector and the CC consequences of a business as usual scenario. Section 3 highlights key sector characteristics that cannot be changed easily but that will influence the sector's contribution to efforts to green growth for better or worse. Section 4 shows how uncertainty specific to CC will also constrain the design of the optimal sector specific strategies and associated policies. Section 5 discusses a way of organizing the emerging vision for each subsector and what it entails in terms of policy design.

2. The state of infrastructure

The focus of infrastructure in this paper is power, transport, and water and sanitation. Although it does not cover ICT (Information and communication technologies) in detail, it is essential to recognize that access to ICT is going to be an important input into many of the technological solutions aiming at improving the management of the three subsectors. For instance, smart grids or efficiency irrigation are ICT driven. Although ICT will only be discussed to a limited extent, it cannot be ignored by any team working on the practical solutions on the ground. This message is already becoming clear in international policy circles--see BOX 1 for a summary of the action plan proposed by the OECD.

The main purpose of this section is to show and document the extent to which: (i) infrastructure supply gaps continue to represent a massive challenge for developing countries, even in the absence of any environmental (let alone climate change) concern and (ii) infrastructure demand management is just as important, even if this is sometimes underestimated.[3]

[3] The paper only includes a very brief discussion of urban infrastructure.

Box 1: ICT and the greening of growth: The OECD recommendations to its member countries

1. **Co-ordinating ICT, Climate, Environment and Energy Policies to** extend understanding of: i) the direct effects of ICTs themselves on the environment, ii) the enabling effects of ICT applications in other sectors, and iii) the systemic effects to change social and cultural behavior through the use of ICTs.
2. **Adopting Life Cycle Perspectives in ICT and ICT-enabled applications for sustainable management of natural resources and materials in production, use and end-of-life phases.** Encourage the development of methodologies and indicators to measure and monitor impacts over the life cycles of ICT goods and services and "smart" ICT-enabled applications in buildings, transport and energy systems, including developing baseline measures of embedded and actual green-house gas emissions.
3. **Supporting Research and Innovation in resource-efficient ICTs and "smart" applications** for example through technology-neutral tax incentives or carbon offset mechanisms, encourage user-driven innovation and promote co-operation and knowledge exchange between ICT and non-ICT firms, research institutions, governments, and other stakeholders.
4. **Developing Green ICT Skills:** Promote green ICT related education, training and skill development to meet demand for environmental skills and expertise at all levels and in all industries. They should also encourage interdisciplinary co–operation in developing green ICT education and training.
5. **Increasing Public Awareness of the Role of ICTs in Improving Environmental Performance:** Promote widespread development and adoption of clear standards and eco-labels based on life cycle approaches to production, use and disposal of ICT goods and ICT-enabled applications; includes spreading awareness of the direct effects of ICTs, enabling effects of ICT applications in buildings, transport and energy, and the potential of ICTs to have systemic effects on social and cultural behavior.
6. **Encouraging Best Practices to maximize the diffusion of green ICTs and "smart" ICT-enabled applications in the public and private sector**. Exchange information and good practices on how to ensure data protection, security and privacy in "smart" ICT-enabled applications and in measuring economic and social environmental impacts of ICTs and ICT-enabled applications. Finally, use these principles to review and collect information on national policies and initiatives and exchange information on policy development.
7. **Governments Leading by Example:** Minimize the environmental impact of ICTs in public administration through green ICT approaches, applications and services. To the extent possible, maximize resource efficiency of public facilities by using "smart" ICT applications in lighting, heating and cooling, and building control, including enhancing process efficiency and organizational change in public administration through teleworking and videoconferencing to reduce commuting and travelling. Minimize ICT–related disposal through reduce, reuse, and recycle policies.
8. **Improving the Greening of Public Procurement** by taking greater account of environmental criteria in public procurement of ICT goods and services and increasing environmental innovation among suppliers, including total life cycle costs of ICT goods and services, and providing information, training and technical assistance to officials in the ICT public procurement and use chain.
9. **Encouraging Comparable Measurement of the environmental impacts of ICT goods and services and ICT-enabled applications and among similar products.** They should also increase understanding of the effects of government policies (information, incentives, regulations) on improving measurement tools and increasing public awareness.
10. **Setting Policy Targets and Increasing Evaluation to measure and improve government green ICT strategies, including ICT-enabled applications across the economy.** Monitor compliance with policies on a regular basis to set clear responsibilities and improve accountability. Encourage the adoption of appropriate national legislation that sets the ground for implementation of green ICT strategies.

Infrastructure needs are still very large. Almost all developed countries have identified infrastructure gaps in their economic programs since the crisis. For developing countries, a recent fairly conservative estimate suggests that yearly investments of $1-1.5 trillion would be needed every year for at least the next 10 years to satisfy basic needs and access the type of infrastructure needed for sustained growth.[4] The poorest countries need to allocate over 10% of their GDP annually to develop and maintain their infrastructure. Middle income countries do no escape this challenge and need, on average, to allocate up to 6% of their GDP annually to these expenditure requirements. Currently, infrastructure investments (public or private) represent perhaps half that amount and this is a strong underestimation of the needs.

The need to make infrastructure CC proof will add to the costs of meeting the needs. Accounting for the need to adapt and mitigate against the risks imposed by CC could add on average 1-2% of GDP to the expenditure requirements of the sector.[5] Considering that the poorest in most countries often spend close to 15% of their income on the consumption of infrastructure services, the added costs imposed by the needs to cover the CC related investments is likely to raise social concerns. Simply including these added costs in user fees is likely to lead to social conflicts. This has already happened in the past in the context of increases in cost recovery following privatization. But the experience so far suggests that if accounted for, it can be managed. The scope for action may be better than expected when the sources of financing of the sector are looked at in more detail.

Financing infrastructure relies a lot more on taxes than on cost recovery. With the exception of ICT and to a much lesser extent energy, most of the investment in infrastructure is currently tax financed in most developing countries and in many developed countries. Full cost recovery continues to be modest on average--see Komives et. (2006) for instance. In the poorest countries, this tends to be justified by a concern for the limited ability to pay by large shares of the population. The argument may hold to some extent for urban transport and to a lesser extent for longer distance passenger transport. It does not hold as well for utilities for which user fees and cross-

[4] Estache (2010)
[5] Fay et al. (2010)

subsidies tend to dominate direct subsidies. Energy subsidies are indeed a well-recognized source of the overconsumption problem impacting CC.

Subsidies in the sector tend to be regressive. The reliance on subsidies not only distorts demand management with CC consequences, it also often fails to reach the poor it is supposed to help. This is because in practice, in many countries, the poorest do not have access to the basic water and electricity services provided by the large scale utilities. This implies that the subsidies built into tariffs tend to benefit the rich and the upper middle class since these are the segments of the population with access to infrastructure services supplied by major utilities. The urban poor may enjoy some spillovers in the most developed countries, but the rural poor seldom do.

The current pricing weaknesses offer financing … and demand management opportunities, but maybe only potentially. The fact that current subsidies are often so regressive is to some extent good news in the context of efforts to finance the greening of growth. It gives a scope for action on the price side of climate change policies as discussed later in the paper.[6] However, it also hints at a possible resistance by politically strong classes to changes that reduce these unfair benefits of regressive subsidies. In other words, although the scope to rely on price signals to manage demand for infrastructure sectors seems to be strong conceptually, it may be more politically limited than often argued.[7]

Scope for improvement is also available on the supply side and maybe be easier to implement. The scope for improvement, with matching financial, social and environmental payoffs, can also be found on the supply side of the sector. The many studies that have looked at the cost efficiency in the various infrastructure subsectors tend to show that the scope for cost reduction is high, even when authorities impose the level of jobs in the sector when underemployment is a major political concern.[8] Another easy way of getting faster coverage increases in the regions with major access gaps is

[6] The scope of improvements in cost recovery is also true more widely. In 2011, Burundi showed that when a poor country makes a fair assessment of who benefits from the existing services and the likely immediate expansion, the case for subsidies shrinks. This is what led the government to go for a significant increase in residential tariffs.

[7] Note, that if for political and social reasons, the use of prices to manage as directly as possible the behavior of users if not feasible, the case for a much improved design of fiscal policy to manage both demand and supply of polluting activities becomes stronger as discussed later.

[8] See Estache et al. (2006) for a survey

by reducing the expenditure requirements through more efficient management to improve the value for money of investments in the sector.

What does the current state of infrastructure mean for environmental damage? The many un-served poor have to rely on alternative sources of energy or water. These are known to often have adverse environmental consequences. For instance, lack of access to modern energy sources explains the widespread use of wood to heat and cook in Sub-Saharan Africa or South Asia. There are just as powerful examples of mismanagement of scarce water resources, for instance the pollution of the Guarapiranga by illegal residential and industrial use which threatened the water source of 25% of São Paulo 18 million inhabitants in the early 1990s.

So the policy failures of the past define key opportunities for the future. The lower the access rates to basic infrastructures, and often this means the poorer the population concerned, the better the margin to jump on the GG agenda thanks to the possibility of working with greener technologies. Over-specified road infrastructure mainly meets the needs of those who can afford cars. It should be easy to reallocate resources and start focusing on the needs of the many more without cars who do not benefit from the, largely public, financing of the maintenance of secondary roads. This is important to poor farmers and other rural residents and it is good for GG. Similarly, there may be no real need to be concerned with the transitional cost of switching from the heavy reliance on non-renewable sources of energy to renewable sources. There is no need to have to deal with the long wait for large scale utilities to deliver water or energy. No need to be worried with the fact that environmental friendly sources adds financial costs--renewable sources may cost significantly more than conventional sources on a levelled cost basis. Clearly, when coverage exists, switching could impose significant opportunity costs. But when coverage does not exist, accounting for the possibility of speeding up connections matters from a strict economic and social viewpoint. Indeed, simply because renewables are often easier to put in place, the difference in economic benefits return—i.e. accounting for the rate of time preference—would be greatly higher than the difference in the financial costs of the two strategies.

Making the opportunities happen rather than focusing on the complications. The concern for a greening of growth thus often represents an opportunity for infrastructure.

Of course it is not simple, but overemphasizing the additional complication and transaction costs continues to slow down the implementation of possible short term actions. The growing evidence suggests that greening infrastructure could have significant growth impacts (through greater efficiency, reduced vulnerability to water or fuel shocks, improved public health, reduced congestion).[9]

A number of emerging countries that are accelerating renewable energy investments to improve rural access, where the gaps are the largest, have also increased employment with these investments.[10] Renewable energy sector growth has also figured prominently in some countries' overall development strategies. This is the case of China and India who are now industry leaders in wind and solar; and Brazil, the uncontested world leader for biofuels. Morocco and other North African countries are investing heavily in concentrated solar, with the hope of developing a home-grown industry around it. Every country has to find its niche and its solution. The choices will often have longer economic and social impacts as they come with long term technological and related employment commitments driven by the characteristics of the specific infrastructure solution adopted.[11] But these are increasingly well understood and this form of uncertainty should no longer be a barrier to action in the sector as discussed below.

3. Infrastructure specific challenges to deliver on green growth

The previous section argued that infrastructure gaps offered opportunities for improvements accounting for concerns associated with the greening of growth. But there are also infrastructure specific characteristics that may make the transition towards cleaner technologies for production and consumption, of power and water and sanitation somewhat harder, in particular when it comes to internalizing CC-related

[9] Some of the benefits can come easily from more basic policies such as retrofits which can be quite a cost effective solution in many cases.,

[10] The issue of how much net employment, and how much sustainable employment, increase with renewable investment is still vigorously debated. One can however argue with confidence that improved rural access has increased employment and incomes in those locations, not just quality of life measures of welfare.

[11] This impact will depend on a wide range of dimensions. Consider the long term employment effect again and add the concern for access to capital. There may be more sunk cost in a fossil fired power station than in a wind farm, but after normalizing for output capacity, I would imagine that a (huge) wind farm with a rated firm capacity of 200MW (including capacity to produce without interruption) would involve more capital than a 200MW coal plant.

uncertainty and risks.[12] Experience suggests that the main relevant characteristics are the following:

1. *The long life of large infrastructure assets:* transport and utility networks can be in service for over 100 years, over which climate change impacts and ongoing emissions mitigation efforts can affect the economic value of the investments – in addition to issues related to locking-in an emissions profile per se.

2. *The dependence of key infrastructure activities and technological choices on the weather*: The effectiveness of water sources, hydroelectric power plants or inland water transportation is very highly correlated with precipitations for instance. The quality of roads is highly sensitive to extreme weather conditions which are difficult to predict. The actual performance of infrastructure investment will thus depend considerably on how these effects are taken into account ex ante.

3. *The dependence of infrastructure costs on the technological choices imposed by concerns for CC related risks;* Davis et al (2010) or Kerr (2010) for instance show for the energy sector that the adaptations required are likely to impose significant costs on users. There are in fact many back of the envelope simulations done for country specific situations. The message is that many users could end up having to allocate well over 50% of their current share of income allocated to infrastructure once the pricing of infrastructure will have become more compatible with a greener growth.

4. *The dependence of getting the benefits of economies of scale and scope on the ability to build on supranational projects.* There is a long history of supranational water management to ensure the efficient use of this resource. The recognition of the importance of supranational markets is now also very present in debates on power pools and investments in transition lines and on investment decisions in rail and road transport. This matters for the optimal choice of policies to address CC since scale benefits may lead to national technological choices that are GG friendly (as in the case of transport or hydro generation fitting into a rational water

[12] The first three types have been discussed at some length by Shalizi and Lecocq (2009),Fay et al. (2010) and Martimort and Straub (2011)

management strategy) or GG unfriendly (as in the case of interconnected road systems or thermal generation).[13]

5. *The high dependence of the sector on public funding—i.e. subsidies.* On average, 75% of the investment in infrastructure is financed by public money. As already mentioned, consumption subsidies are still also quite common. This gives an unusually strong ability to influence strategic expansion and pricing decisions in this sector, governments enjoy in few other sectors.

6. *The acute dependence of subsector specific policies on the quality of other subsector policies in terms of design and implementation*. Energy demand will only drop significantly if housing and transport policies reinforce rather than weaken any demand management strategy built in the pricing of energy. Water demand typically depends on the quality of policies as diverse as agricultural policies and upscale tourism development policies for instance.

The long asset life dimension has different implications for old and new assets. For new assets, it implies they will have to be more robust to deal with increased probabilities of undesirable CC aspects. For older assets, the likelihood of higher overall maintenance and rehabilitation costs has to be internalized in the demand for long terms budgetary comments to the sector. For the short run, and in the transition period leading to a new vision for the sector, it is useful to consider the possibility to bet on short lived technologies temporarily to buy the time needed to reduce key sources of uncertainty before investing in long lived assets. [14]

This would be an argument for the design of energy policy betting on renewable solutions for systems expansions in any country type. However, for more mature systems, it could also be an argument to extend the life of the least polluting assets to buy time before engaging in a full restructuring of the sector. This would include assets such as nuclear power stations (seriously) certified to be safe. Similarly, for water policy, in water scarce regions, considering the high cost of diverting rivers to re-

[13] It is interesting to note here that one of the striking developments in electricity generation over the past 40-odd years has been the sharp decline in economies of scale. Even with nuclear, one could say this if future smaller-scale plant designs were demonstrably much less accident-prone. The economy of scale seems to be more in transmission and with it the coordination of power sources.
[14] There is a subtle debate to be had on how short lived renewable technologies really are.

optimize water use, it may be good to postpone high water consumption investments such as golf courses until there are clearer visions of the longer term risks of drought.[15]

The weather dependence characteristic drives the optimal market structure. For key infrastructure subsectors, the technology choices made to deal with weather shocks has to be built in the choice of the market structure.[16] It is also likely to have to impact the speed at which any change in market structure has to be implemented. For instance, when drought is a growing risk, it has to be reflected in both the organization of the supply side and the assessment of the potential demand side of energy or water markets. It has to be reflected in direct technological choices—e.g. switching to technologies that do not require as much water for instance. But it also has to be reflected in the choice and the location of complementary investments and in particular transmission or transport. For instance, dropping historical non-renewable sources of energy and replacing them with renewable sources may lead to localized rationing if the transmission capacity is not available from the new locations of energy generation. This dependence may also induce the need to be more careful about regional or industrial development policies and ensuring a match between local access to infrastructure and local economic development less dependent on long distance transmission or transport.

The need to explicitly consider differences in costs resulting from alternative sectoral visions is simply good business practice and common sense. Betting on large thermal utilities does not imply the same unit cost per kWh as betting on solar sources of energy. They tend to generate much cheaper energy. But many sources of renewable energy have the tremendous advantage of delivering service quickly thanks to a much shorter time to build. Renewable energy also often offers better opportunities for local jobs in maintenance. The same observation applies to the water sector when discussing the case for water pumps and other similar local solutions when compared to the case for large scale utilities. Long asset life and lower unit costs but slow implementation may have to be traded for shorter life, higher costs but significantly faster implementation. In that kind of trade-off, environmental concerns may be enough to tilt

[15] The most immediate example is a golf course but the argument could apply just as much to new manufacturing capacity that is water intensive, or a major expansion in suburban housing for moderate income people.
[16] Typically in the utilities or rail transport this would mean degree of vertical or horizontal integration or scope for competition versus regulation.

the balance in these two sectors. A similar arbitration arises when considering options for long distance and urban transport, although the terms of the trade-offs are a bit more complex.

The necessity of a supranational commitment to investment is increasingly driving but also limiting technological choices. Economies of scale in this industry can matter so much that it is often key to cut costs to consider multi-country investment strategies. The European experience with supranational energy and transport projects shows how important coordination is to ensure that commitments to low unit costs are respected so that infrastructure services actually deliver low costs! Africa, East Asia, Eastern Europe and Latin America have all internalized the lessons.

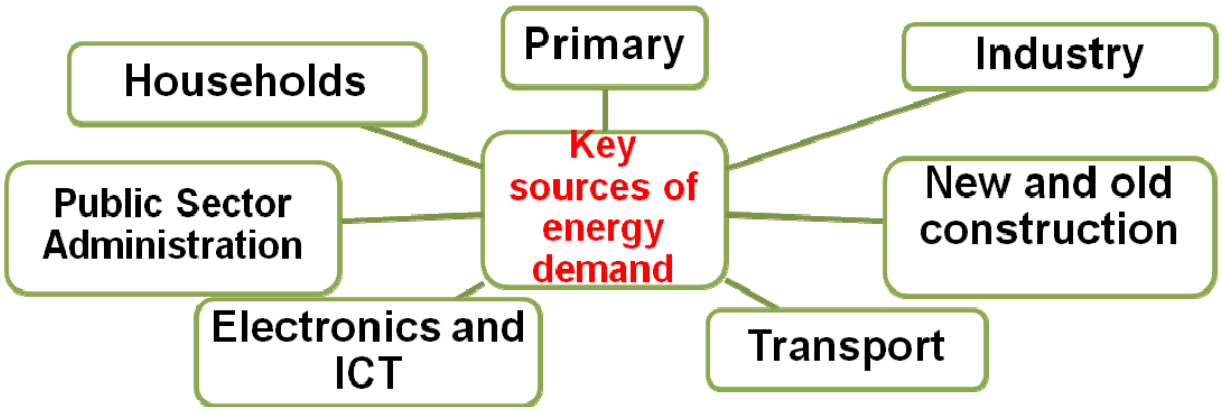
The strong reliance on subsidies leads to an underestimated policy leverage. Since this is a sector that will continue to rely on extensive subsidies, at least for the financing of systems expansions, it gives an exceptional leverage to government in negotiations for the definition of the vision and for its implementation. The concern for the expected fiscal costs makes it necessary to ensure that any significant impact of changes in sectoral strategies on the costs of investments are factored-in the assessment of the fiscal sustainability of the new visions for the sector. This is particularly important in view of the limited political and social ability to pass on a lot more than O&M expenditures onto the users for key activities such as water and passenger transport. Yet differences in total service delivery costs need to be taken into account in the design of tariff and subsidies. This is to ensure that that the incentives built-in demand and supply of these services is consistent with society's valuation of the environmental outcomes associated with this demand and supply.

It is politically attractive to maintain the lack of transparency on the consequences of preferences revealed by the consumption and production behavior. Opacity on the consequences of current common policies failures such as poor monitoring and enforcement continues to be a preferred strategy for politicians more concerned about the next election than about the well-being of the great-grandchildren of their current electorate. The link between today's energy subsidy rates and future mortality for instance is a common place among scientists and seems to be a dirty little secret among more politically sensitive audiences. Similarly, the extent to which it makes sense to

subsidize rail freight and passenger transport to offset the implicit subsidies to road transport to force road users to pay the full economic cost they impose continues to be a serious but politically largely ignored issue. In all cases, the public debates on these matters are often more emotional than informed and rational or when they are rational they are more centered on the job creation or destruction effects of the subsidies than on any views on the environment.[17] The fact that short term concerns rule time preferences is not too unexpected but it is a lot less benign because infrastructure is a sector responsible for many of the long term consequences on uninformed technological choices ruled by time preferences.

The interdependence of sectoral policies is really quite extensive in practice. Investing in R&D to reduce energy or water consumption in all these sectors is essential of course, but the political and technological readiness of these sectors to change are not comparable and hence, neither is the scope for action. This is true across sectors within countries but it is also true across countries within a sector. To give a sense of the wide range of actors involved, Figure 1 shows how much the energy demand management policies have to be related to sector specific dimensions of a wide range of sectors with a wide range of ability to adapt to the concern for green growth.

Figure 1



The high energy intensity of the construction, transport or mining industries are well known and have led to significant efforts that complement those made within the

[17] They usually also fail to take into account for instance that in many countries, the main user of the existing peak electricity generation capacity are the railways companies, no matter if the peak capacity is environmentally clean or not.

energy industry through its pricing strategies for instances. But other production activities, including government services, are also important drivers of energy demand. In many countries, the water sector is in fact also quite dependent on energy since water has to be pumped and pumping requires electricity. For all these other sectors, consumption standards have been imposed in recent years to reduce consumption. However, tolerance for lasting deviations from the new standards continue to be strong because producers in each subsector are keen on extending the asset life of their existing production technologies and politicians are uncertain about the employment consequences of forcing fast switches to greener solutions in each of these sectors.

Note that the focus on inter-industry relations is somewhat misleading. It is clearly important but it hides the fact that a big part of the drop in resource consumption does not only come from the core production hardware technology. For many sectors, efficiency gains are software driven. The coordination of railway networks for instance was once all about hardware (a track width story). It is now a software coordination and standardization exercise. The same applies to electricity smart grids where a software based system allows demand to play an active role in the optimization of system operations. This growing role for software in infrastructure is not a minor detail and it needs to be internalized in the decisions on how to target support for changes in consumption behavior. It also implies that the role of ICT in efforts to green infrastructure should not be underestimated (see Box 1).

In a nutshell, the limits of effective energy demand management are defined outside of the energy sector. In a very similar way, the limits of effective water demand management sits in the Ministries of Agriculture, Tourism or Regional development where key strategic decisions on subsidies and investment are often made with little regard to long term water concerns and often with not enough coordination with the Ministries of Public Works or Urban Development who manage the extension of services without much interaction with the other public agencies managing water use directly or indirectly.

4. How much does uncertainty matter for policies on green infrastructure?

Section 3 has already hinted at the extent to which the need to deal with uncertainty is one of the key characteristics of the infrastructure sector that could potentially be relevant to policy choices in the sector. The evidence on weather shocks of the last few years suggests that uncertainty is an important consideration in the design of effective policies and in instrument choices in any environmental problem in practice as well.[18]

The main sources of uncertainty. There is uncertainty about:

i) the level, type, timing and spatial distribution of outcomes from climate change

ii) the links between, on the one hand, the multiple consumption and production forms—i.e. technologies—and policy actions and, on the other hand these outcomes.

iii) the robustness of our understanding of the ways society's understanding and valuation of different environmental outcomes influences the demand and the supply for specific environmental outcomes

Uncertainty about CC outcomes. There is a lot we have learned in recent years but there is still a lot to learn to be able to deliver a greener infrastructure. We know with a reasonable level of confidence that the average temperature will rise from climate change and so will the sea level.[19] We also know that random weather shocks are more likely to happen in some regions than any other period on record.[20] But how much warmer temperature is going to be, how high the sea is going to rise, how much more frequent global scenarios about climate change will be and how fast this will happen is still subject to many debates. There is thus a lot we don't know on the odds of future outcomes (Vörösmarty et al., 2010). If this uncertainty is bad at the global level, it is even worse at the local level. Large countries, such as Australia, Brazil, Canada, China, Russia or the US are trying hard to get a better sense of the distribution of the risks on

[18] Weitzman (1974), Weitzman (2009) and Pindyck (2010).
[19] WDR (2010)
[20] Kunreuther and Michel-Kerjan (2009) on the large increase in the losses from natural catastrophes in recent decades and report that the impact on insurers since 1990

their land, but cannot do much to predict which region will suffer when.[21] The forecast challenge is even harder for smaller countries and the risks significantly higher since the margin for management of these risks in smaller countries is a lot narrower.

Uncertainty about policy impact and effectiveness. There is a lot we already know about uncertainty with respect to the expected outcomes of key production and policy decisions. We know, for instance, that many key environmental undesirable outcomes start with poor demand policy and operational management in infrastructure. The demand for energy and water has been growing with--and often faster than--our global ability to consume and to produce. We know for instance that century old traditions of sustainable water resource management for irrigation and human consumption purposes have disappeared with rapid increases in total demand and no effective coordinating mechanisms for the different users. Many seem to have the conviction that technology will eventually solve any problem, leading to what some view as a transitional water problem.[22] We also know, on the other hand, that technological changes have allowed infrastructure to improve its level of services at rates matching the fast growing demands of increasingly rich populations.

Yet, we still don't really know how to deal with nuclear waste and we don't know if we will ever solve that problem. In some cases, solutions have led to more problems—we have met the demand for increased mobility by expanding the menu of options to match individual preferences but ignoring the impact of this larger freedom of choice on the general interest. In many instances, the lasting and new problems are the result of an underestimation of the relevance of more institutional knowledge in comparison to the importance of technological skills in the assessment of environmentally sustainable growth as Ostrom (2007, 2008, 2010) would argue. Traditional and local contractual arrangements for water right allocation have often done a lot better to protect ecosystems than more modern national approaches to allocate water rights as in many parts of Africa or Asia.

[21] A common illustration is Piao et al. (2010). Cavallo and Noy (2010) also provide a useful number of illustrations in the context of natural disasters risks.
[22] See the debates on the competition for water use between farmers and golfers in Spain.

But institutions are not the only problem. Basic economic incentives also have to be right in the choice of support to innovation that impacts the infrastructure supply and demand. To get growth to build on the right technology, the returns to R&D have to be assessed carefully as illustrated by Acemoglu et al. (2010). Policies to support environmental innovation are easily mistargeted as discussed by Aghion et al. (2010) or Garsous (2011), supporting relatively less energy efficient innovation simply because there is no accounting for inertia in the behavior of firms' R&D efforts, including when dealing with environmental concerns. This is why for instance, the support in infrastructure related innovation is an important dimension of the modern case for industrial policy in both developed and developing countries. Many researchers are indeed arguing for targeted government intervention to redirect production and innovation towards clean technologies. Many others are pointing to the extent to which carbon pricing is an essential dimension of the incentives for the greening of innovation in the sector.

The upshot is that there is a lot we don't know on the dimensions relevant to effective policy outcomes. In particular, despite all the claims made in popular media, we don't know how far technology can really help to reduce the demand within this generation for energy, for water and for mobility on the massive scale needed to deal with the excess uses of natural resources and with the growing volume of waste associated with the production and consumption of infrastructure services. For more mature countries, in particular, we don't really have a robust knowledge of the likely consequences of the dramatic shifts in energy and transport technologies most likely to lead to the desired greener growth aimed at.

Uncertainty about how societies value the costs and benefits of policy. Uncertainty about how little we know about benefit and cost evaluations by societies is particularly relevant to infrastructure policy design. The preferences revealed by consumption and production behavior on the demand for specific environmental outcomes are at best puzzling. The number of cars on the street continues to explode. Cars and the related pollution levels seem to be an entitlement quite independent of the political speeches making the case for public transportation. It is also surprising to see that populations do not complain more about the fact that environmental policies tend to

have predominantly regressive redistributive effects in the short run.[23] Electricity and heating tend to represent a higher share of low-income household expenditures, so that any equity-blind price-based demand management energy policy aimed at reducing global emission will hurt the poor relatively more. In contrast, benefits from a cleaner environment are often more valued by high-income families. How these differences in perspective should be aggregated and how much this should drive the optimal design of policy is still up for debate as well.

The extent to which different countries around the world have different valuations of costs and benefits increases the degree of uncertainty on commitment to policies that require coordination. Carbon pricing offers a good illustration of the risks associated with an uncertain and slow commitment. In May 2011, some of Australia's biggest energy companies declared that they would keep their polluting power stations operating for at least another 20 years unless the Government committed to buy out their emissions. In other words, investment and new electricity generation capacity in Australia has stalled because it is unclear how Australia values that instrument in its menu of options to deliver on its global commitment to reduce emissions. Moreover, even if the Government establishes a carbon price, it is unclear that it will be backed by a global carbon price. Neither of these two levels of coordination seems to meet the needs of investors to make the right technological choices and time investment to meet the local and global political agenda.

*The policy complexity resulting from uncertainti*es. Considered jointly these various sources of uncertainty add up to a complex set of economic, fiscal, political, social and technological constraints that need to be considered in the design of policies specific to each subsector. Luckily, the margin for action is still quite large. But innocence or blindness with respect to the relevance of these constraints is a serious risk. One way of reducing this risk is to address these constraints explicitly in the design of the policies. Doing so will reveal often difficult trade-offs between static and dynamic efficiency and between efficiency, equity and fiscal concerns. The ultimate choice in how to deal with these transfers is of course local however its consequences will be quite

[23] Boccanfuso et al (2010) for developing countries, Fullerton (2010) for the US and to a lesser extent other OECD countries.

transparent and hence more accountable locally, and internationally , since many of the key choices made in infrastructure tend to have supranational consequences.

Uncertainty demands more efforts on information generation and stronger willingness to take policy risks in the sector. Since policymakers have at best a partial knowledge of what they need to know to make the right choices, it is essential to go as far as possible in identifying sector specific constraints that drive the limits of the effectiveness of their actions in an uncertain environment as a way of reducing the various sources of uncertainty. This effort is all the more important when the risks of irreversibility of outcomes are so high that waiting to reduce specific sources of uncertainty is not an option. This is particularly important for infrastructure since by nature, it is characterized by a much higher than average degree of inertia in the level and type of its environmental effects. Ultimately, there are so many sources of uncertainty that it is obvious that we need to be humble about our convictions on the optimal infrastructure policy design. But collectively, considering the coverage gaps on the one hand and the risks on the other hand, it is reasonable to use the need for green growth as an opportunity to act rather than an opportunity to delay decisions.

5. The main strategic options to green infrastructure and their implications

This section focuses on the policy dimensions of the GG challenge. It describes the two main broad strategies governments can consider to green infrastructure service. Whatever the strategy chosen, the explicit identification of the stepping stones of the implementation of these strategies is an essential dimension of the ex-ante assessment of their realism, credibility and consistency and of the ex-post ability to monitor compliance. This identification is the main purpose of this section.

The two main strategies for a greener infrastructure. The two strategies documented here can be viewed as the two most likely extremes since few governments are likely to do simply nothing. They can also be viewed as the two most likely de facto options around which most countries will be identified when all is said and done. Very roughly, their main difference is with respect to the depth of the change to a business-as-usual scenario. More specifically, they can be defined as follows:

i) *a change at the margin* which is unlikely to lead to a very significant contribution to the greening of growth. It boils down to a slow adjustment. On the supply side, the speed of adjustment would be driven to a large extent by the end of life of existing dirty assets. On the demand side it would improve the enforcement of the current measure often already adopted but never really fully implemented. It could also lead to the adoption and implementation of additional similar measures that do not lead to significant adjustments on demand.
ii) *a more structural change* to significantly reduce overconsumption of natural resources and excesses in waste generation. This more intensive change will often lead to a complete reorganization of the sector, of its operation, of it regulation and of its financing.

The main specific characteristics of the implementation of any of the strategies. To highlight the main differences, the section is organized around a review of each stage of the process of making energy, transport and water policies. These are the stepping stones or the checklist that needs to be put together and monitored to be able to classify the changes in a sector in a given country in one of the two broad categories just introduced. This checklist can be organized around five main characteristics of the sector.

(1) the definition of a vision for the sector
(2) the planning of the implementation of that vision
(3) the institutional support needed to implement the vision
(4) the required matching policy changes
(5) the management of transitional issues

Starting with the definition of a vision of the sector is actually quite common. In this sector, visions tend to be organized around two main dimensions: (i) the specific emission/resource use targets that make the vision concrete; (ii) the timing for the achievement of the target and (iii) the "dream" of the evolution of the sector. How aggressive the vision is and how fast the changes are expected to take place gives a sense of the degree of ambition of the policymakers. The easy part of the vision is the identification of targets and of the expected speed. The explicit targets spelled out for

Europe—initially-- are a perfect illustration of the strength of this commitment. In 2007, EU leaders committed to transforming Europe into a highly energy-efficient, low carbon economy and made a unilateral commitment that Europe would cut its emissions by at least 20% of 1990 levels by 2020. This commitment has recently been reinforced as the EU offered to increase its emissions reduction target to 30% by 2020, on condition that other major emitting countries in the developed and developing worlds commit to do their fair share under a future global climate agreement.[24] It is however quite hard to come by an exhaustive list of similar commitments for all the countries of the planet.

The really hard part of the definition of a country specific vision however is the need to be able to visualize a transformation of an economy in a dramatic way. The end of nuclear in Germany or its increasing role in South Africa, China or Brazil is relatively well accepted by local populations even if what it really means for the organization of the economy is unclear for instance, the possible resulting changes in the location of some types of production who cannot afford some of the technical and cost limitations imposed by some alternative sources of energy. The scaling up of desalinization of sea water is increasingly seen as a realistic solution in many parts of the world but few are really seriously considering a real option. In mainland Spain for instance, where drought will be part of life without a major transformation, only Catalonia has made significant progress in seriously considering the option. In many other regions, it is still viewed as futuristic without really being realistic. The transformation of transportation from a vehicle based sector (selling car, buses, ….) to a service based sector (selling transport services designed to meet needs according to time and place) as a way of reducing emissions is still far from understood.

The implementation of this vision demands strong planning. Planning in this context includes the identification of:

(i) an encompassing list of administrative and legal actions needed to ensure that the targets and their timing are realistic;

(ii) the investment needs associated with the targets, and

[24] This agreement should take effect as of 2013. This is when the Kyoto Protocol's first commitment period will have expired.

(iii) the sources of financing of that investment and the implementation of all the actions needed to ensure that the investment can actually take place.

The inventory of legal and administrative requirements needed to implement the vision is often underestimated by economists and sector scientists. Yet, environmental law, regulation and administration represent a complex field. The overlapping of sectoral specific and environmental regulation can easily lead to inconsistencies. Think of the inconsistency of the social and environmental goals of energy or water pricing. Social concerns would push tariffs down. Environmental concerns would push them up. Tariff design aimed at ensuring that the poor can increase their consumption of energy and water can thus easily become incompatible with any demand management policy aimed at achieving global emission or consumption reduction targets.

We collectively have a sound degree of experience in conducting these diagnostics even if they have not yet been seriously adopted by that many countries. So where to look for a sense of best practice? The OECD has started delivering such diagnostics for its member countries.[25] Since this includes emerging economies such as Chile or Mexico, that experience is proving to be quite useful. It forces an encompassing dialogue of the interactions between growth and the environment at the national and subnational level. It also allows policymakers to identify weaknesses or inconsistencies in the implementation of visions. In the case of Belgium for instance, it has been recently used to document serious issues with respect to the consistency of energy and environmental policies, even if these are under the responsibility of a single Minister.

The next reality check is the assessment of the total, public and private, cost of the vision. The planning of the implementation of the vision starts with the estimation of the costs of the investment and operation and maintenance needs associated with the implementation of different targets. For energy, the International Energy Agency has taken the lead and for some time now, it has been issuing such estimates at a fairly aggregate level. This raises two issues. The first is that, except for some major actors– typically the US, China and some major European countries, country specific information is not available. The second is more subtle and is driven by the assumptions

[25] See the OECD web page summarizing their country reviews: http://www.oecd.org/department/0,3355,en_2649_34307_1_1_1_1_1,00.html

built in the estimates. The assumptions underlying the transport sector are bound to lead to an upper limit. It ignores many of the changes in the way of delivering transport services which are being considered by public and private actors around the world. It is a useful benchmark, but when coming up with estimates of country specific investment and related needs, it is essential to build in the country specific dimensions. Simple extrapolations of the IEA results can be misleading and yet are too common.

The last dimension of the planning exercise is the assessment of the likely financing sources. Governments have a long list of choices to make. What will the relative part of taxes, user fees, cross-subsidies in the recovery of costs be? What will the relative part of government, commercial bank and industry specific financing of the needs be? What will the relative importance of the public and the private sector be? How much scope is there to change this over time? What are the trade-offs between jobs, growth or consumption options associated with various strategies?

These are the typical questions that need to be addressed at the planning stage at the country level. This thought process is not that common and when it is, it is not that transparent. The relative share of the public and private role in the greening of growth seems to continue to be driven by ideological considerations rather than by the very pragmatic lessons that have been learned from the PPP experiences over the last 20 years or so.[26] There is clearly a large scope for private financing matching private delivery of environmental services but as for any other type of activity, it should boil down to what is in the best interest of today's and tomorrow's consumers. It depends on variables such as the cost of capital, on the cost of public funds and the discount rate. But there are many things the private sector will not finance and the government needs to be aware of where the markets will fail and it will have to become an active source of financing to avoid the failures of efforts to green infrastructure. Figuring out all this has to be delivered by the planning of the implementation of the vision.

The ability to implement the vision depends on various institutional dimensions. These include:

i) the identification of the main stakeholders matching the new vision

[26] See Estache (2010) for a recent overview

ii) the possible redesign of the market structure for the sector

iii) the re-organization of the regulatory and supervision capacity;

iv) the distribution and coordination of responsibilities across institutions and

[v) the support to R&D to promote innovation to demand for infrastructure services—but this is dealt goes much beyond the scope of this paper.]

The identification of the main stakeholders is another necessary yet underestimated challenge of the implementation of the wide range legal and administrative requirements needed to implement the vision. Although many of the lessons of political economy have now been mainstreamed in policy circles, the associated nitty-gritty details are often underestimated by economists and sector scientists. These details are generally built in environmental law, regulation and administration. These try to deal with the needs and concerns of many actors, local, national and supranational.

Within countries, it raises issues of optimal allocation of instruments and resources across government levels--environmental federalism is indeed a booming research area. Industries are quite well organized in lobbies and have demonstrated their ability to hit on politically sensitive cords. For instance, it is hard not to talk about the changes in the transport sector without having to deal with the job related consequences of any major transformation of vehicle production raised by the local coalitions of automobile unions and producers. The heterogeneity of the transport and energy sectors drives the number of actors to take into account. The lobbies for nuclear and renewable producers can easily enter into conflicts. Similarly, in the context of transport, the difficulty of smoothing intermodal integration is largely driven by continued frictions between road and rail carriers who each have their own connections among political parties.

The water sector may appear to be simpler. However, in view of the very few global actors in infrastructure and of their political importance in their home country, in many countries, the international strategies of key actors are likely to be determinant of the greening of policies in the sector. For some countries, these strategies will be endorsed as an element of their home country industrial policy, whether this is good or bad for the global environment and for the future generations.

In sum, governance issues are likely to abound and recognizing that there is a multiplicity of agenda in view of the large number of actors. It is thus essential to identify as many of the agents to ensure as much transparency as possible and ease coordination when needed and possible within each country and, increasingly in view of the growing infrastructure interconnections of various types, across countries as well.

To a large extent, the number of key actors influencing key decisions in a given sector in a specific country is the fruit of the policy and regulatory environment defined for the sector. This is a second essential institutional dimension that needs to be analyzed in some detail to get a sense of how far the commitment to green growth can realistically go. For almost 20 years now, from the 1990s to very recently, countries around the world have considered major restructuring of infrastructure to promote competition in and for the market, and hence reduce prices. Lower prices mean higher demand which is not really consistent with the green agenda, at least in the rather long transition we will have to go through to get to a sustainable economy. To get to these lower prices, many countries restructured their sector to get private investors and users to make long term commitments to specific investments and technologies. Most of the return on toll roads built in developing and emerging economies in the last 20 years were based calculated on the basis of an expected growing car ownership and traffic. The increased reliance on renewable energies is changing the way we need to think about investment in transmission. It is also changing the way we need to think about power pools. It is forcing an unforeseen co-existence of competition and government-led support mechanisms (e.g. FITS) for certain technologies to distort relative prices in ways that favor the environment while continuing to allow meeting the demand for energy.

In a nutshell, in many countries, the desire to green the infrastructure sector is forcing policymakers to rethink the long term viability of market structures which until not too long ago, were widely believed to be a choice set for the long run and had been driving key non-infrastructure decisions. The greening of infrastructure will have to influence the current organization and regulation of infrastructure service. How much intermodal competition do we really need? How best to design the incentives for the fleet of vehicles to become cleaner? How design water property right to minimize

efficiency-equity trade-offs. How to re-design entry rules in power pools to get to a more sustainable power supply structure?

Moreover, the changes in organization and regulation are likely to lead for many actors, in the foreseeable future, to higher costs, slower demand increases or in some cases and lasting drop in demand others. This has to have financial implications which need to be considered when picking among the different possible organizational paths to a greener infrastructure supply and demand. All this will have to change if the more aggressive of the two options discussed earlier are to become realistic.

This is also going to lead to potentially dramatic changes in key policy areas, most importantly probably regulation and procurement. Taking stock of where every country stands on this front is essential as well to get a sense of the remaining opportunities. It is also fundamental to make it easier to coordinate across countries and get the most of the local benefits that supranational coordination can lead to. Increased standardization of procurement processes seems to make sense to many observers but this requires getting rid of the inertia that seems to have prevailed in the way infrastructure procurement has been organized for almost 30 years—except in telecoms where technological progress has forced procurement to evolve. But standards can also be changed for the design of infrastructure. Governments should try to switch to the use of environmentally friendly goods and services. These are defined as those with a demonstrated low impact on the environment over the life cycle of the good or service, when compared with competing alternatives.

Today's preferences for location, norms or standards are luckily no longer what they were 20 years ago—think of light bulbs for instance. But imposing, monitoring and enforcing new design standards are largely local or national decisions. How do specific country standards compare to best practice countries? How well are good standards enforced? What are the staff and budget allocated to the monitoring and enforcement? All these are key indicators of the institutional and policy commitment to the greening of infrastructure in any given country. To be able to assess this commitment fairly, transparency on all the dimensions covered here are essential.

To ensure an effective monitoring of commitments and changes in the sector, any country needs technically and financially capable, and credibly committed institutions.

Many countries have a large number of institutions responsible for at least some part of the global commitment made by their government—e.g rural vs. urban water regulation, water and sanitation vs. environmental regulation. The exact distribution of responsibilities, the degree of overlapping, the size of the major gaps in the sum of assignments, the over- or under-funding of responsibilities, the leverage, the involvement in policy decisions, in their monitoring and in their enforcement, the degree of political independence or the individual and collective accountability are the main characteristics to look at to get a sense of the degree of coordination between national actors. In many countries, other national actors and often supranational actors need to be included in the picture and each has its own set of institutions. Are the agenda of all these institutional actors consistent with the agenda of all of the other actors involved? Is there a capture problem? There are many such basic issues with the optimal assignment of responsibilities across institutional actors. The reforms demanded by the greening of infrastructure also offer an opportunity to take stock on this front

The final role of government that needs to be institutionalized is the support to R&D. Innovation is a well-known part of the global solution. Its potential role at the national or even subnational level is often underestimated. Every country needs to have a sense of how much scope for improvements in both the supply and the demand side of energy or water resources. As mentioned above, this can go as far as an innovation that applies to the whole sector in a drastic way to adjustments in processes on the supply side—ie. prohibiting the use of private cars in the cities-- at a fairly narrow level, in household behavior or within specific industries on the demand side—i.e. getting farmers to rely less on thermal energy and more on local sources of renewable energies.

Irrespective of the specific vision, changes will have to take place in most countries and these will raise transitional issues. In the context of any major reform, the management of transitions matter. In efforts to green infrastructure, this transition will cover an incredibly wide range of issues. People will have to be educated and informed of changes to come. They will need to be educated as to why business as usual in energy and water consumption is no longer likely to be realistic. Communication strategies will have to be put in place as for any reform. Consultations will have to take

place to manage emotions and to collect information on reactions and expectations. For the countries in which major economic adjustments will take place, transitional safety nets will have to be put in place to protect workers and sometime consumers when local production is replaced by foreign production or vice-versa. Transitional financing will also have to be put in place and this is likely to be a problem for any country going through hard fiscal times. Every country will have its own set of challenges. Most of the time, they boil down to financial, social and political challenges. The first challenge however is to recognize that transition matters and often takes time. Assessing the awareness of policymakers of these transition dimensions is thus an essential part of the diagnostic of the sector that any country should conduct. Checking the commitment to the management of this transition through a diagnostic of the specific actions, their costs and the budgetary commitments to the transition is just as important.

6. Concluding comments.

The main points of the paper may be summarized as follow:

- The greening of infrastructure is central to the greening of growth simply because infrastructure is part of almost all production processes somehow
- The greening of the demand side of infrastructure is just as important as the greening of it supply side
- The greening of infrastructure will add the already high cost of increasing infrastructure coverage—this increase could be as high as 20% of the current investment needs for the poorest countries of the world
- The processes associated with the greening are technically complex and much more so when infrastructure stocks are high as past national investments strategies have locked countries into network designs which are not easily fine tuned
- The processes are also financially complex and more so in countries with high coverage rates since long lived investments are still far from being amortized and many private investors have based returns assessment on an expected long term service level and quality commitments

- The processes are just as socially complex as the incidence of many of the pricing adjustments proposed for a greening of infrastructure are often regressive and is the sector associated directly with 20-30% of jobs in most economies
- The overall complexity is fueled by a high degree of uncertainty with respect to behavioral preferences and to the long term impacts of common policies
- All this explains the complexity of the political agenda for the sector
- The sum of these observations makes the case for more systematic and thorough diagnostics. Information gaps in this sector are part of the policy problem. Just like the IMF is keen on knowing the details of the macroeconomic conditions of a country to identify problems and opportunities, it is necessary to conduct full assessments of infrastructure sectors and do so keeping in mind the concern for a greening of the sector. But this has to be done at the subsector level.

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