

Principles of Public- Private Infrastructure Delivery

Johns Hopkins, Carey Business School
February 15, 2013

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- **What is infrastructure?**
- **What is happening with infrastructure world-wide and why?**
- **What is a public-private partnership (PPP)?**
- **Why are governments increasingly turning to public-private partnership arrangements?**
- **What are PPPs being used for across the globe?**
- **What are the perceived advantages and disadvantages of this approach to infrastructure delivery?**
- **How are they financed?**
- **What next?**

What is Infrastructure?



Aerial view of a typical wastewater treatment plant





***A favorite PPP
Millau Viaduct, France***

2.46km long

7 Piers

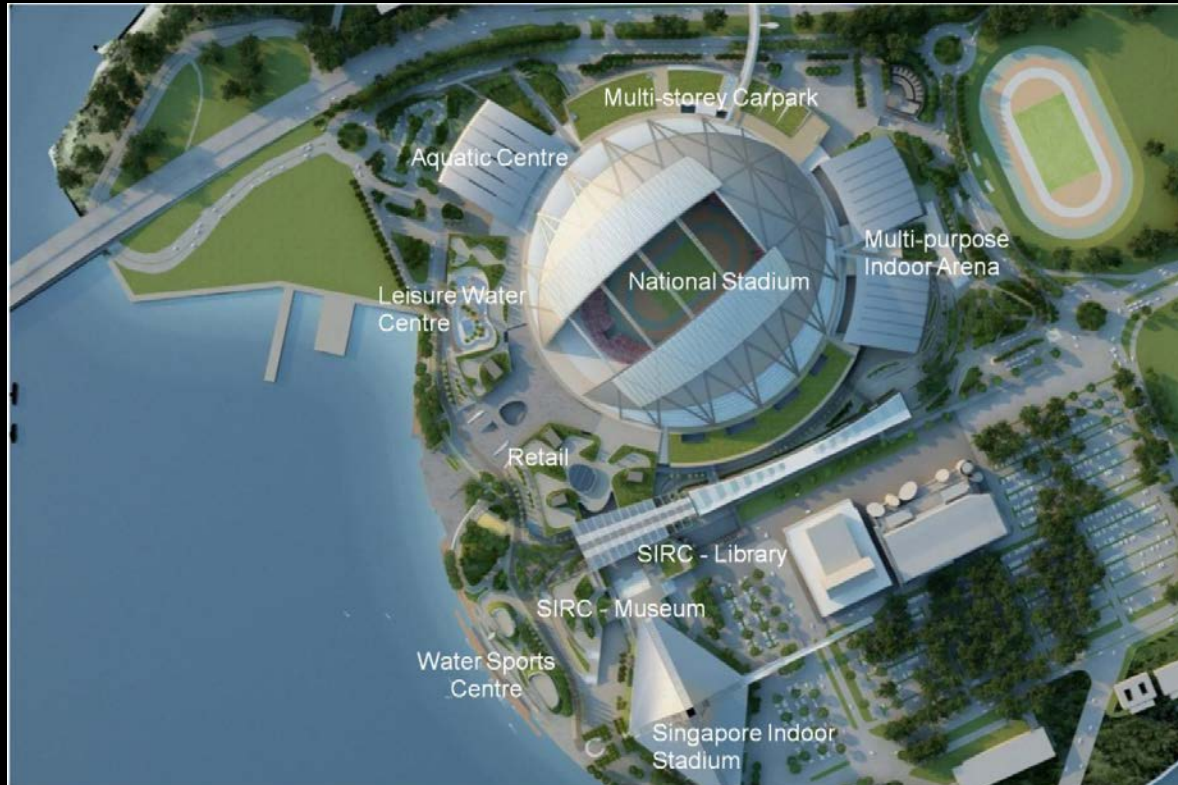
270m above Tarn River

Total height: 343m

Built in 3 years



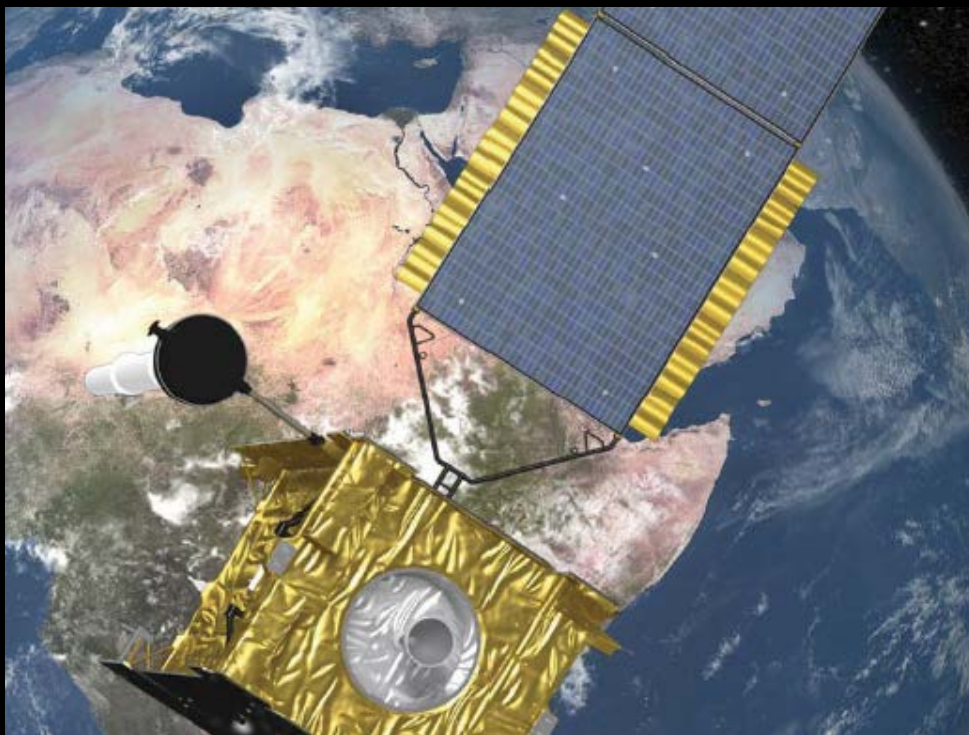
Singapore Sports Hub (Hybrid model)



- 55,000-seat national stadium
- Retractable roof
- 6,000-capacity indoor aquatic centre
- 3,000-capacity multi-purpose indoor arena
- 41,000 square metres of commercial space

- Tendered as a PPP based on design build finance and operate (DBFO)
- 25 year concession period
- Government authority make availability payment through the life of the concession
- Private sector takes availability and performance risk
- Private sector is incentivised to achieve objectives as returns based on availability payment + Third Party Revenue (TPR)

Skynet 5 –pay per use model



- Combined military high security world-wide communications with commercial satellite users
- First PPP infrastructure delivery in space
- Largest single space contract for UK MOD
- Military pays on a per use basis and non-committed time can be sold commercially

- Skynets 1 to 4 – Public Initiatives
- Skynet 1 – Failed within a year
- Skynet 2a – Launch vehicle failed
- Skynet 2b – Successfully launched
- Skynet 3 – Canceled due to budget restrictions
- Skynet 4 – Successful but past design lifespan

PPPs take a walk on the wild side

The world's first zoo PPP gives rise to some interesting questions about the nature of risk and contractual obligations



Will Vincennes be a roaring success?

Growth in a capital constrained world

In 2030, global demand for investment is expected to reach \$24 trillion.

Global investment¹ for selected years, \$ trillion



¹At constant 2005 prices and exchange rates; forecast assumes price of capital goods increases at same rate as other goods and assumes no change in inventory.

Source: Economist Intelligence Unit; Global Insight; Oxford Economics; World Development Indicators, World Bank; McKinsey Global Institute analysis

In several scenarios of economic growth, global investment demand could exceed 25% of GDP by 2030.

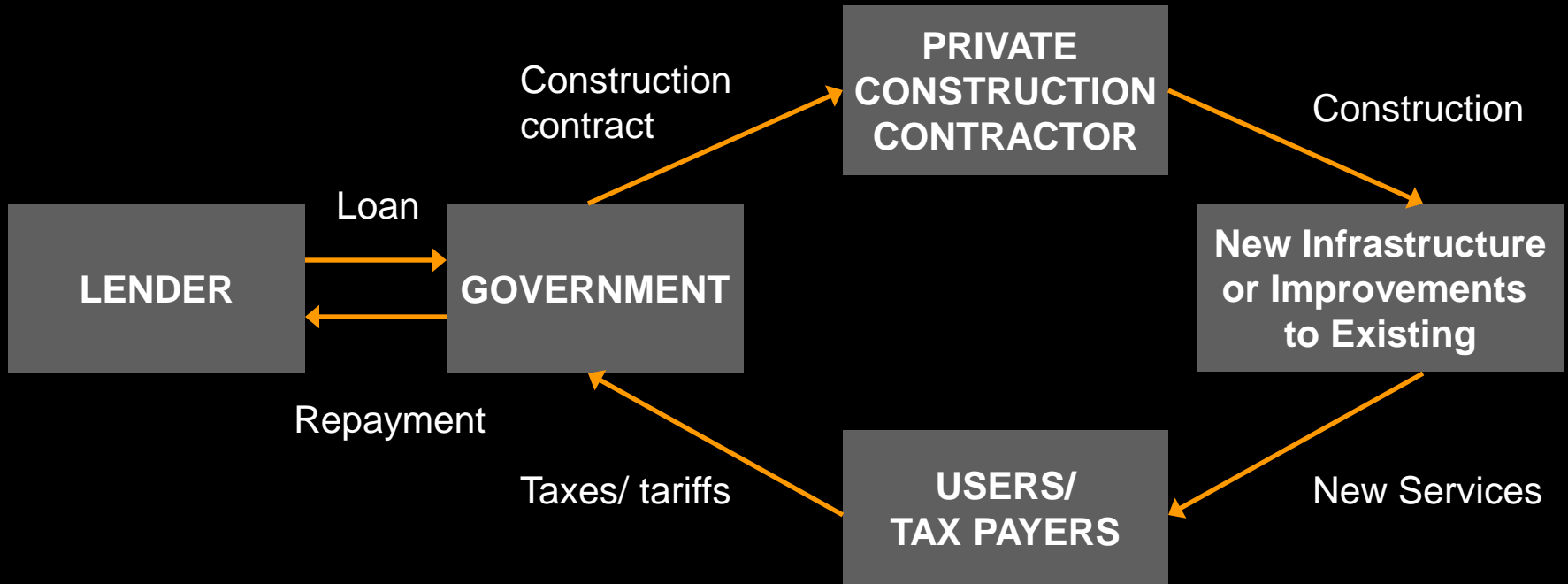
To support growth in line with forecasters' consensus, global investment will amount to \$24 trillion in 2030, compared with about \$11 trillion in 2008

Typical public financing and development of infrastructure

Public authority borrows funds and gives a sovereign guarantee to repay all funds

May contribute its own equity in addition to the borrowed funds

Lenders analyze authority's total ability to raise funds through taxation and general public enterprise revenues, including new tariff revenues from the project



Failure of traditional procurement approaches

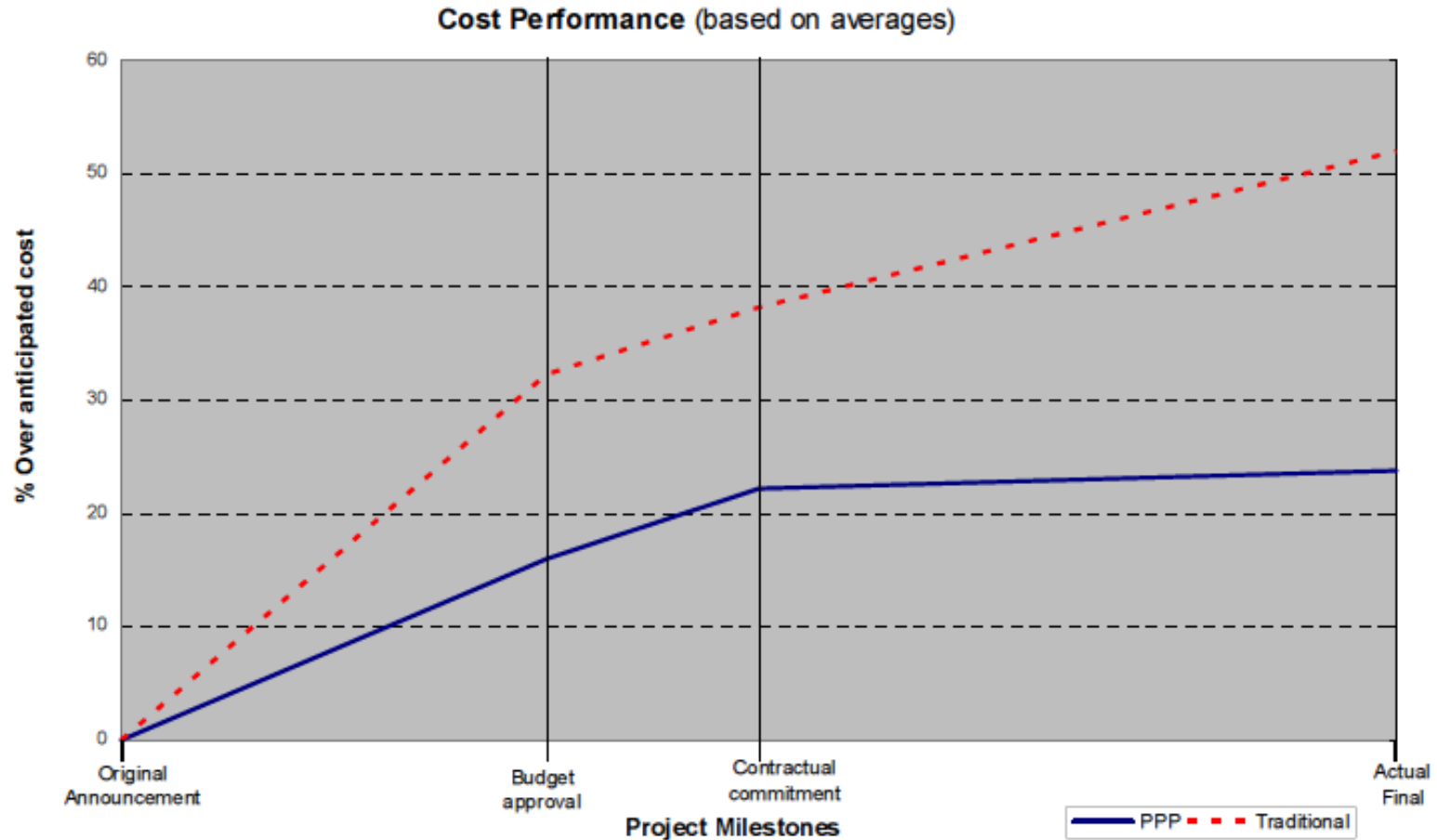
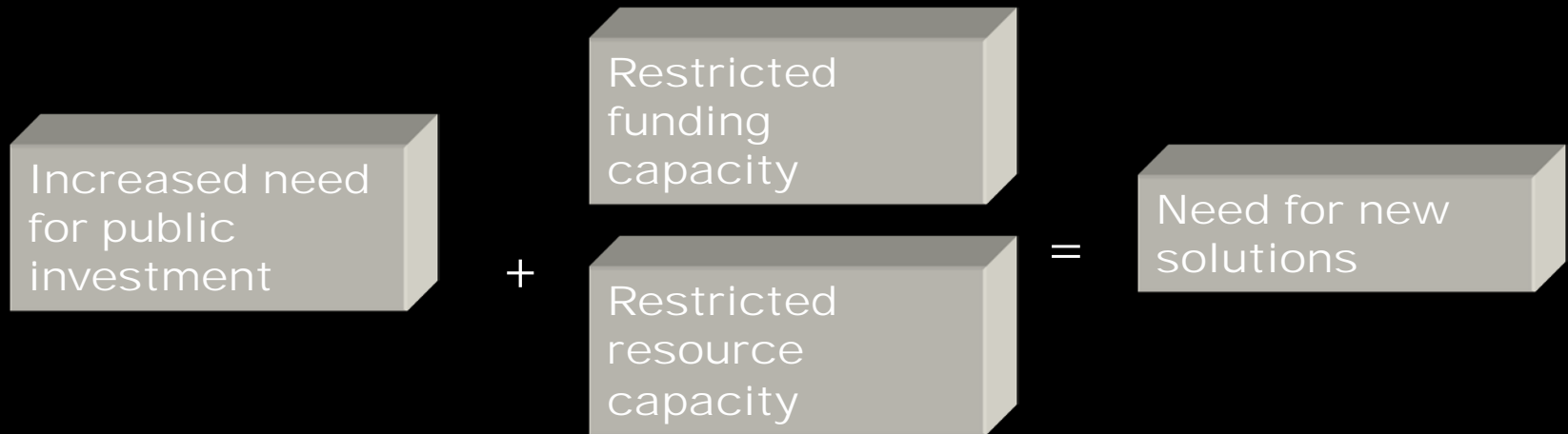


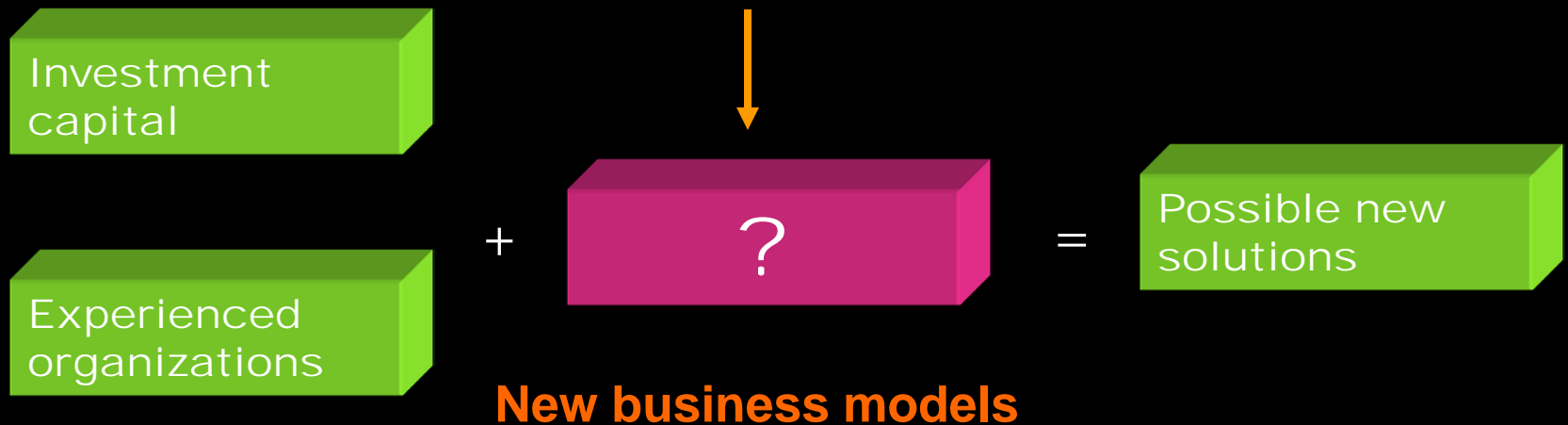
Figure S1: Cost performance over project initiation and delivery (source: Duffield 2008)

Graph highlights overestimated project costs by governments from the inception of a project, with average development costs blowing out by more 50% over the initial estimates. PPPs provided a higher level of assurance that cost increases would be minimized by project completion. When considered on a holistic basis, Australian PPPs were shown to deliver an average saving of around 16% when signing contracts, which then grows to greater than 30% on project completion.

Challenge for governments today



Strategic options



Factors driving change

- Infrastructure becoming more commercially oriented – shift from “taxpayer pays” to “user pays” – one result is increased competition (electricity supply, telecommunications)
- **Technological changes** have been challenging traditional methods of operating infrastructure and allowing a wider application of more appropriate pricing mechanisms
- Still have **inefficient pricing** of infrastructure- a wide range of infrastructure for which prices bear no relationship to consumption by end users – roads are perhaps the best example (costs financed by the general taxpayer)
- Whole host of **new technologies** that resolve some of this disparity – charging for use

Must distinguish between:

- **“Infrastructure financing”** – privatization of existing facilities
- **“Infrastructure investment”** – development, operation and ownership either by the private sector or in joining venture with public sector

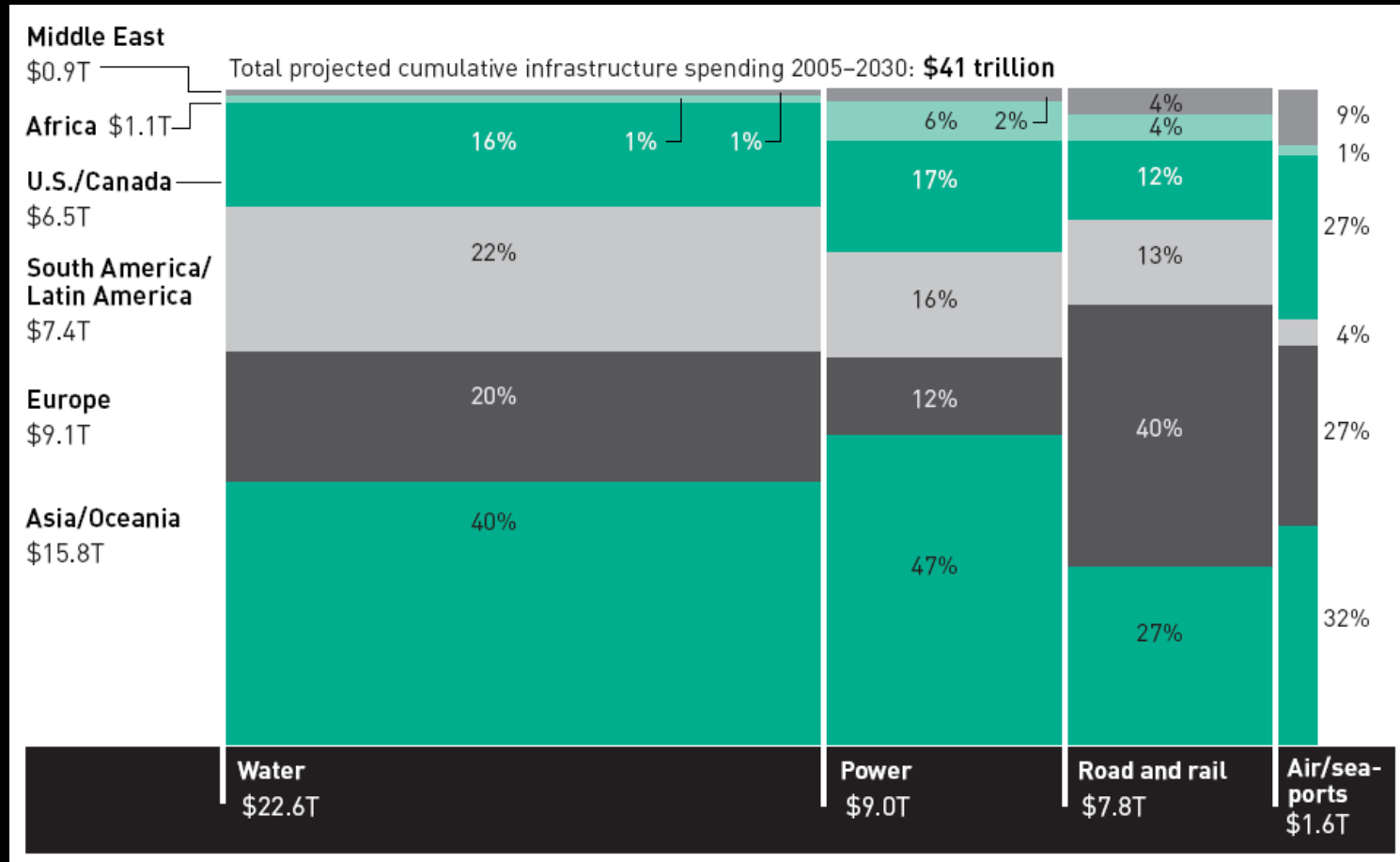
Our interest is with infrastructure investment:

- Construction of new infrastructure assets (or refurbishment of existing) that are designed, built, financed by the private sector to the procuring agencies specs, within a deadline and fixed price
- Long-term contracts (25-40 years) for the provision of infrastructure services associated with an asset
- Collection of revenues by the operator or payment by the public sector to a private organization

Distinguishing between “**economic**” and “**social**” infrastructure and between “**hard**” and “**soft**” infrastructure

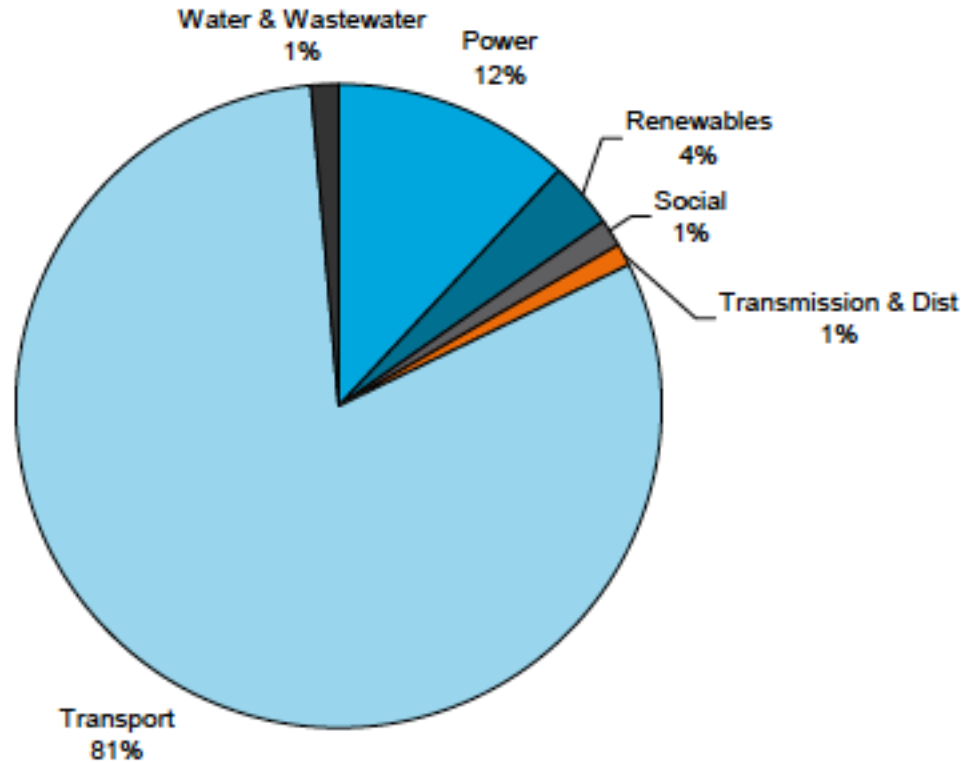
	HARD	SOFT
ECONOMIC	Roads	Vocational Training
	Motorways	Financial Institutions
	Bridges	R&D Facilities
	Ports	Technology Transfer
	Railways	Export Assistance
	Airports	
	Telecommunications	
	Power	
SOCIAL	Hospitals	Social Security
	Schools	Community Services
	Water	Environmental Agencies
	Housing	
	Sewage	
	Child Care	
	Prisons	
	Elderly Care	

Percentages of total projected cumulative infrastructure investment needed during the next 25 years to modernize obsolescent systems and meet expanding demand, broken down by region and sector



Source: Booz Allen Hamilton, Global Infrastructure Partners, World Energy Outlook, Organisation for Economic Co-operation and Development (OECD), Boeing, Drewry Shipping Consultants, U.S. Department of Transportation

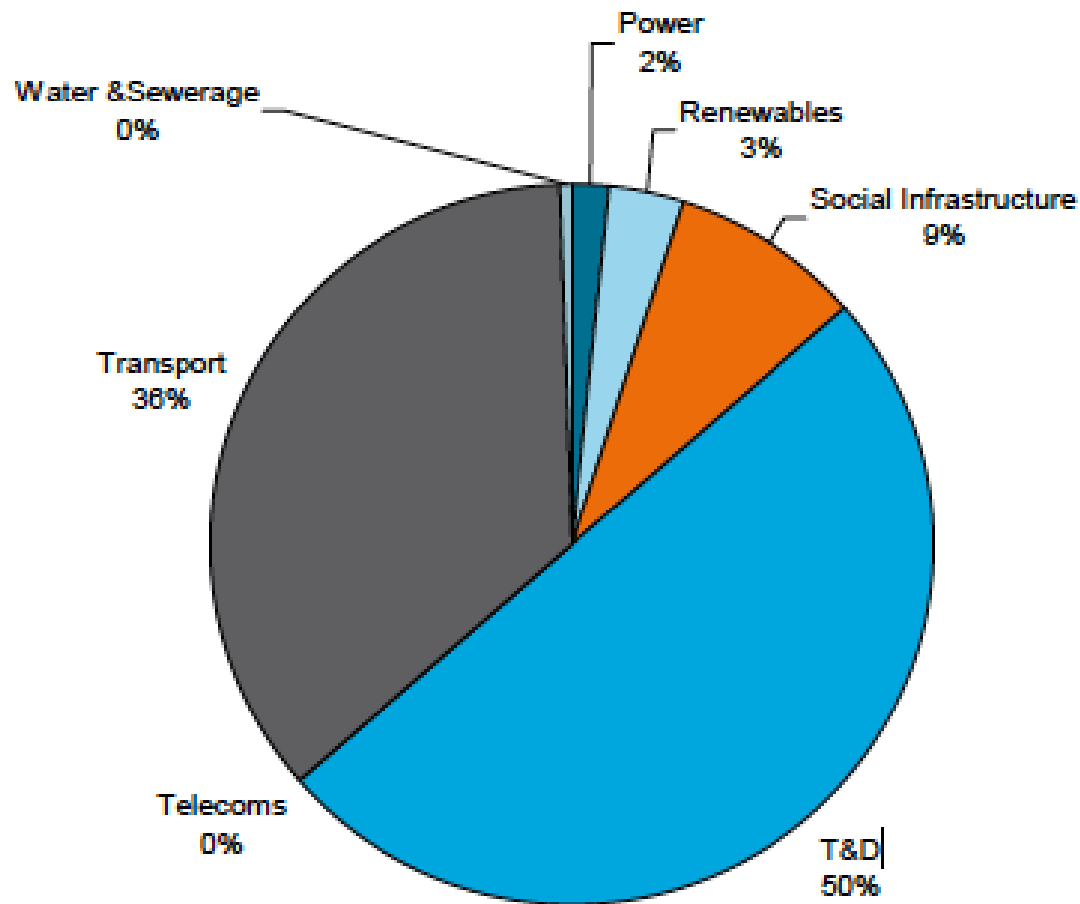
Infrastructure spending by sector - Europe January to March 2011



The Transport sector was the by far the largest spending sector in the first quarter of 2011, accounting for more than 80% of total spending, followed by the Power, Renewables and Transmission & Distribution sectors which contributed a combined 17% of total spending.

The importance of economic infrastructure proves that governments are focusing on assets which have the greatest potential to promote gross domestic product (GDP) growth.

Infrastructure spending by sector - North America January to March 2011



Source: AMP Capital, Quarterly Infrastructure Research Report, August 2011

PPP Model

PPP model has evolved in UK, Australia, Canada, Chile and to a lesser extent in the US largely driven by three factors:

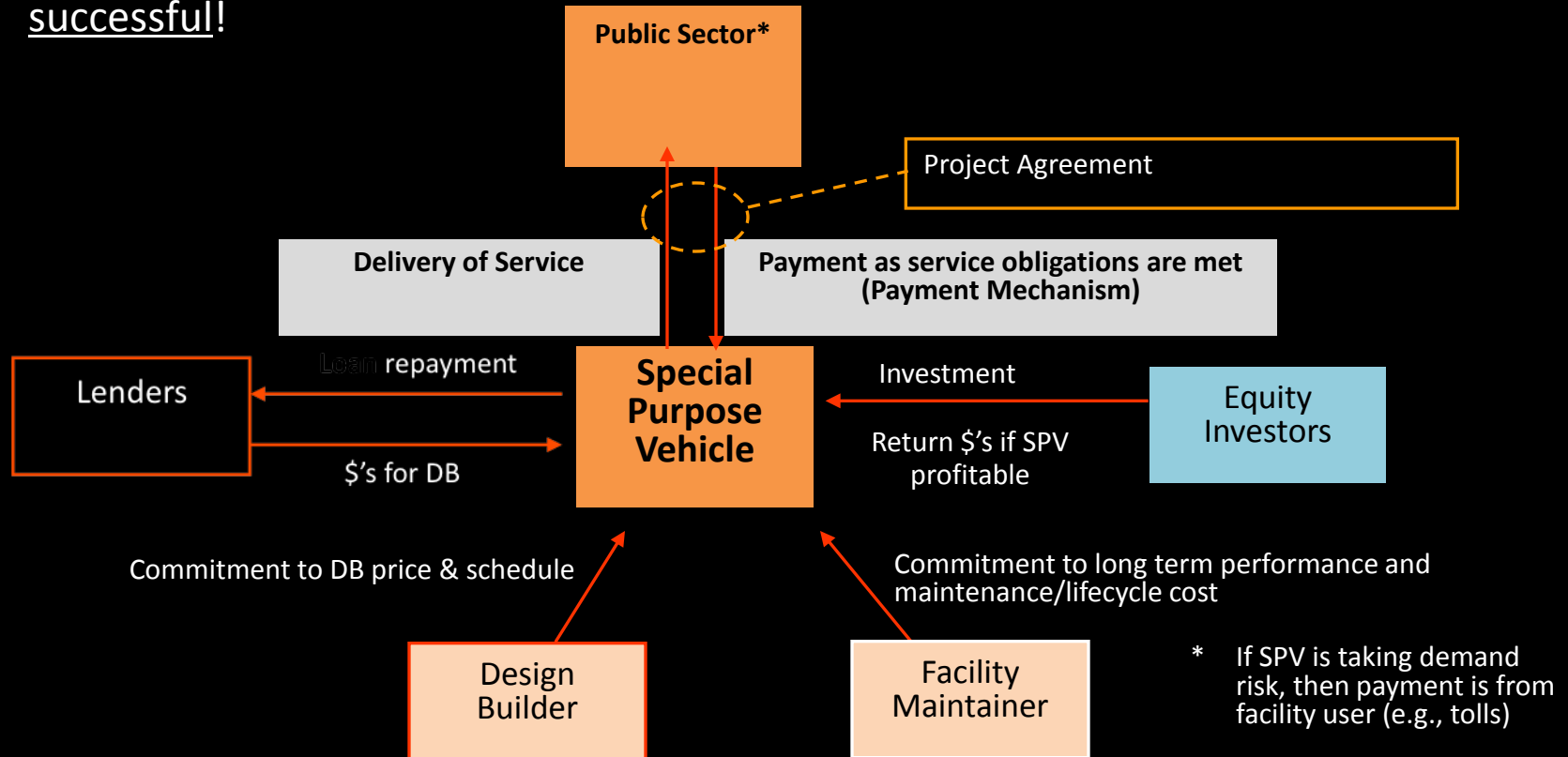
- **Changing market for public services** – reflects changing attitudes to the way public services are produced and delivered – the “new public management” or “marketization” of the public sector
- **Private finance** – refinement of the private finance model and the development of project finance techniques to suit PPP structures
- **The concept of partnering** – first developed in the engineering construction industry that lie on the border between engineering and management – partnering concept provides the intellectual backdrop to support PPPs

**How some
critics
characterize
PPPs**



PPP contract structure uses capital market discipline to confirm appropriate risk allocations

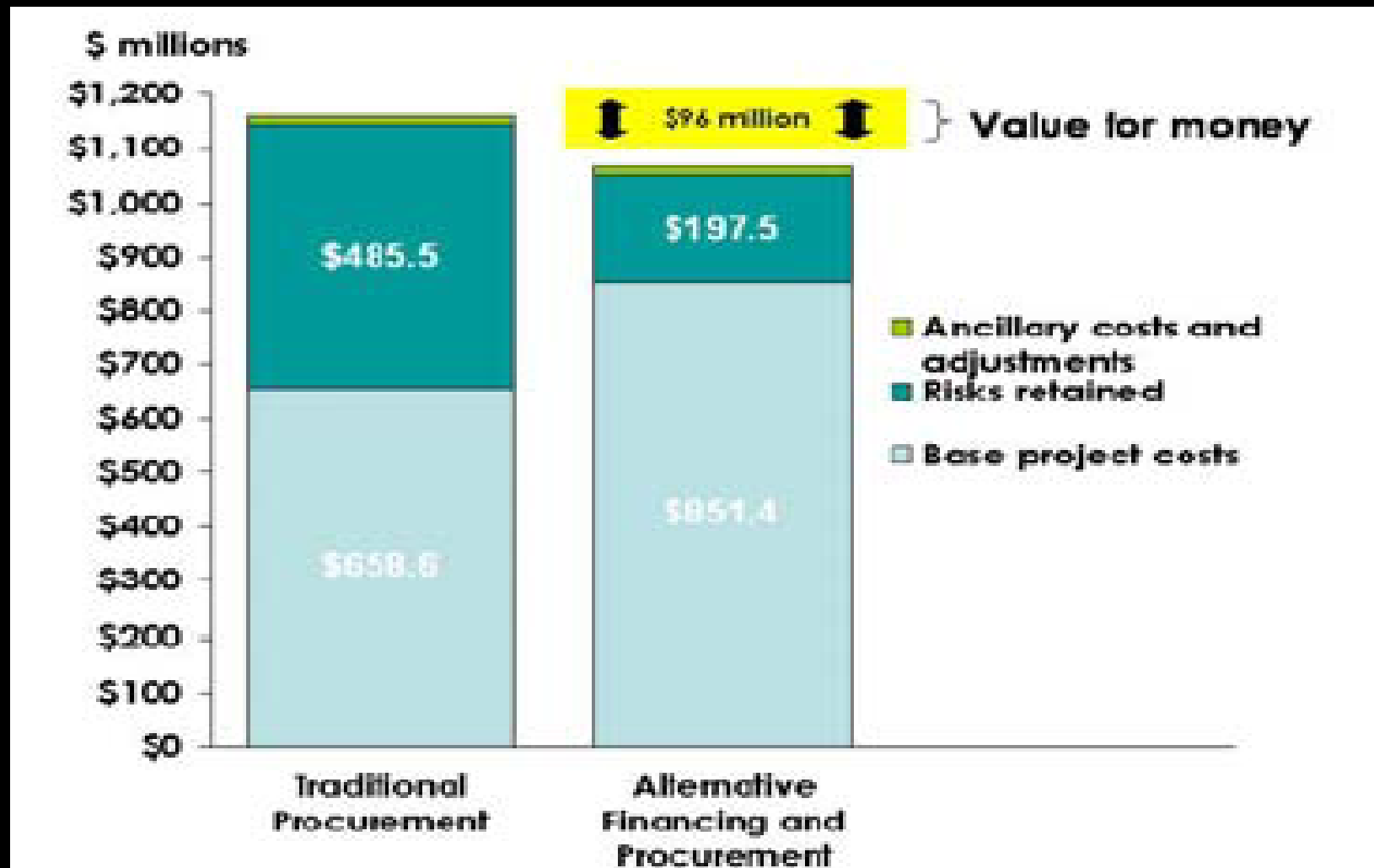
- A **Special Purpose Vehicle** is created as a focal point for costs, revenues, and risk allocations. SPV's obligations "flow down" through back-to-back subcontracts
- Private lending enforces discipline into risk pricing and capacity of all participants. Loan repayment is not "guaranteed" ... SPV can only repay debt if project is successful!



Pricing Project Risks – VFM Equation

Major infrastructure projects include significant risks.

- Value for Money (VFM) Argument for PPP:
- Risk-adjusted NPV of PPP option is lower than risk-adjusted NPV of Public Sector Comparator (PSC).



The Risk Matrix - Valuing Risks

Expected Value of Risk Transfer

$$EV = \text{cost base} \times \text{probability} \times \text{impact}$$

Probability can include a statistical distribution of the risk arisen

Risk Category	Cost Base		Design Build Finance Maintain Model					Traditional Model						
			Probability	Impact			Risk Quantified		Probability	Impact			Risk Quantified	
	Portion of DBFM	Value	%	10th part	Typical	90th part	Province	Shared	%	10th part	Typical	90th part	Province	Shared
Design Coordination /Completion	Design & Construction	\$240,000,000	90%	0.50%	1.00%	5.00%	\$0	\$0	90%	0.50%	2.00%	5.00%	\$4,320,000	\$0

In the above example, for a \$240 million infrastructure project, the Province would retain \$4.3 million of design co-ordination / completion risk under a traditional procurement model, but no such risk under a DBFM model.

Conventional public sector procurement too often assumes 0% probability of risk occurring.

Empirical evidence shows much higher probability that risks will actually occur, particularly if no measures are taken to manage and mitigate the risk.

Risk Negotiation – Windsor Essex Parkway

The Windsor-Essex Parkway will be a below-grade, 11-kilometre, six-lane highway with 11 tunnels and a four-lane service road that will connect Highway 401 to a new international crossing proposed for construction over the Detroit River to Interstate 75 in Michigan. The Windsor-Essex Parkway will be the most significant single highway investment made in Ontario to date. It represented Infrastructure Ontario's first DBFM road project.



Case Study – Windsor Essex Parkway Ontario

Transferred Risks*

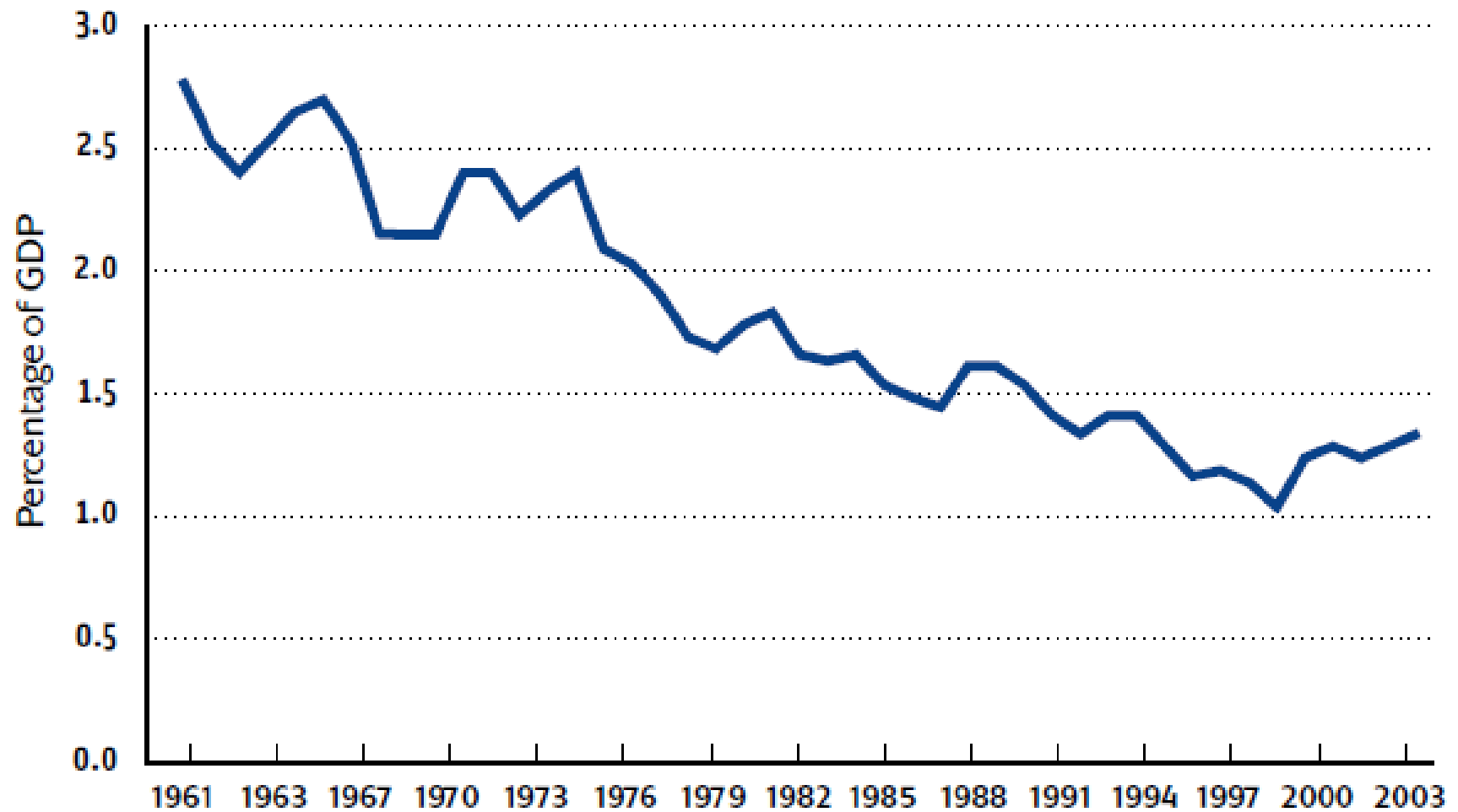
- construction price certainty
- scheduling, project completion and delays (phased completion)
- site conditions and contamination
- development approvals
- construction financing
- commissioning and road readiness
- activity protocols
- change order protocol
- lifecycle repair and renewal

Actual Risk Allocation	Allocation of Risk		
	Province	Project Co	Shared
Environmental			X
Endangered Species		X	
Protestors			X
Traffic Volume / Revenue	X		
Interaction with Tolloed DRIC Bridge			X
Change of Law – Works Change of Law			X
– Relevant Change in Law	X		
– General Change of Law		X	

* Source: Infrastructure Ontario VFM Report

TOTAL INVESTMENTS BY ALL ORDERS OF GOVERNMENT

Investment in public infrastructure has been declining as a percentage of GDP



Source: Department of Finance Canada

Governments in Canada have now adopted a common approach based on the universal PPP model that has resulted in significant investment opportunities for knowledgeable investors

Infrastructure Opportunity

Canada has a long-history of substantial under-investment in infrastructure

Approximately
30%

Percentage of Canadian infrastructure that is more than 85 years old.

Over
80%

Percentage of Canadian infrastructure having surpassed its life expectancy.

\$123 billion

Estimated amount required by Canadian municipalities to upgrade municipal infrastructure to an acceptable level.

\$115 billion

Amount of new infrastructure needed to fulfill the changing needs of communities.

Over
\$2 trillion

Amount that the Canadian infrastructure deficit could balloon to in 60 years if unchecked.

Sources: *Federation of Canadian Municipalities*
The Canadian Council for Public-Private Partnerships

Bundling into a single contract

The *bundling* of project phases into a single contract is the main characteristic of a PPP contract.

If we consider the different stages of a project as comprising the *design (D)*, the *building (B)*, the *finance (F)* and the *operation and management (O)*, PPPs basically differ in terms of which of these four stages are delegated to the private sector.

However, the term PPP is generally used to indicate a substantial involvement of the private sector in at least the building (or renovation) and operation of the infrastructure for the public-service provision.

The bundling of project phases encourages the private-sector party (typically a consortium of firms) to think about the implications of its actions on different stages of the project (from the building to the operation) and thus favours a *whole-life costing approach*.

Long-term risk assignment

PPP contracts are characterized by a relevant level of *risk transfer* to the private-sector party, although the specific risk allocation varies with the form of PPP used for the project, as different is the scope of activities delegated to the private sector.

For each type of PPP contract, risk is allocated to the private-sector party through contractual incentives and penalties incorporated within the payment mechanism, and through the activities for which the private-sector party is responsible.

PPP contracts are generally *long-term contracts* with duration increasing with the level of financial involvement of the private sector in the provision of investments.

Upon contract expiry, the public-sector party regains possession of the assets and can re-tender aspects of the service provision to other providers or take the provision in-house.

Limits of risk transfer to the private sector

Flynberg, Bruzelius, Rothengatter's research indicated that optimism bias from project proponents led to consistent underestimating of costs and an overestimation of project benefits due to aggressive promotion by politicians, political interference in public processes, and systemic failures by public service.

- In Australia, for toll and un-tolled roads 25% of forecasts incorrect by more than 40% over a 30 year period
- In Spain, on average, traffic over-estimated by 35% on 14 toll-roads in 2007
- Rail projects, 9 of 10 projects over-estimated forecasts an average of 106%
- Investment decisions depend on the accuracy of forecasts – inaccurate demand forecasts translate into significant equity risk or solvency threats
- Availability-based PPP schemes are one answer but then economic risk still resides with the public sector and this will eventually impact credit ratings

Payment mechanism

A key element in every PPP contract is the payment mechanism. The structure of the **payment mechanism is the principal means for the public-sector party to allocate risks and give incentives to the private-sector party.**

In order to provide appropriate incentives and encourage good performance, payments are generally contingent on the project's results, not on the inputs and processes needed to deliver the service. The project's results are to be defined as output specifications in the contract.

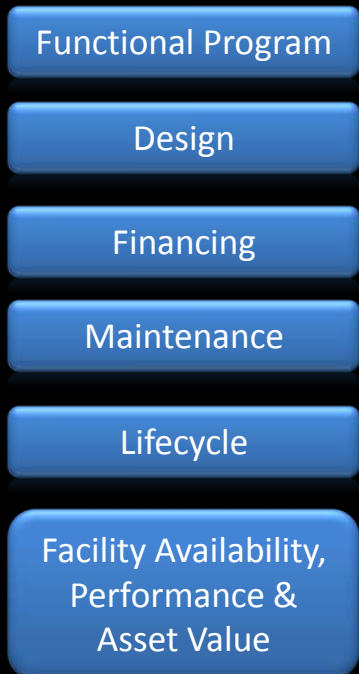
To the extent that there is consistency between output specification, payment mechanism, and risk allocation, the contract design increases the likelihood that the project delivers **value for money**. Decisions to be taken in formulating a payment mechanism will be informed by the output specification and the project's risk assessment; similarly, the payment mechanism may also lead to further refinement of the output specification and risk assessment.

Design-Build-Finance-Maintain Model

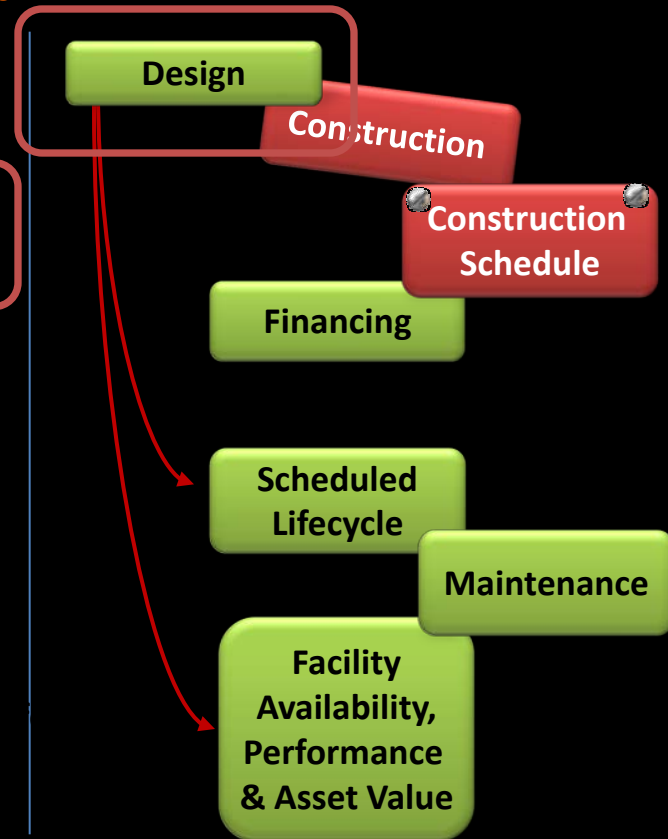
Traditional

IO-AFP: Design-Build-Finance-Maintain (DBFM)

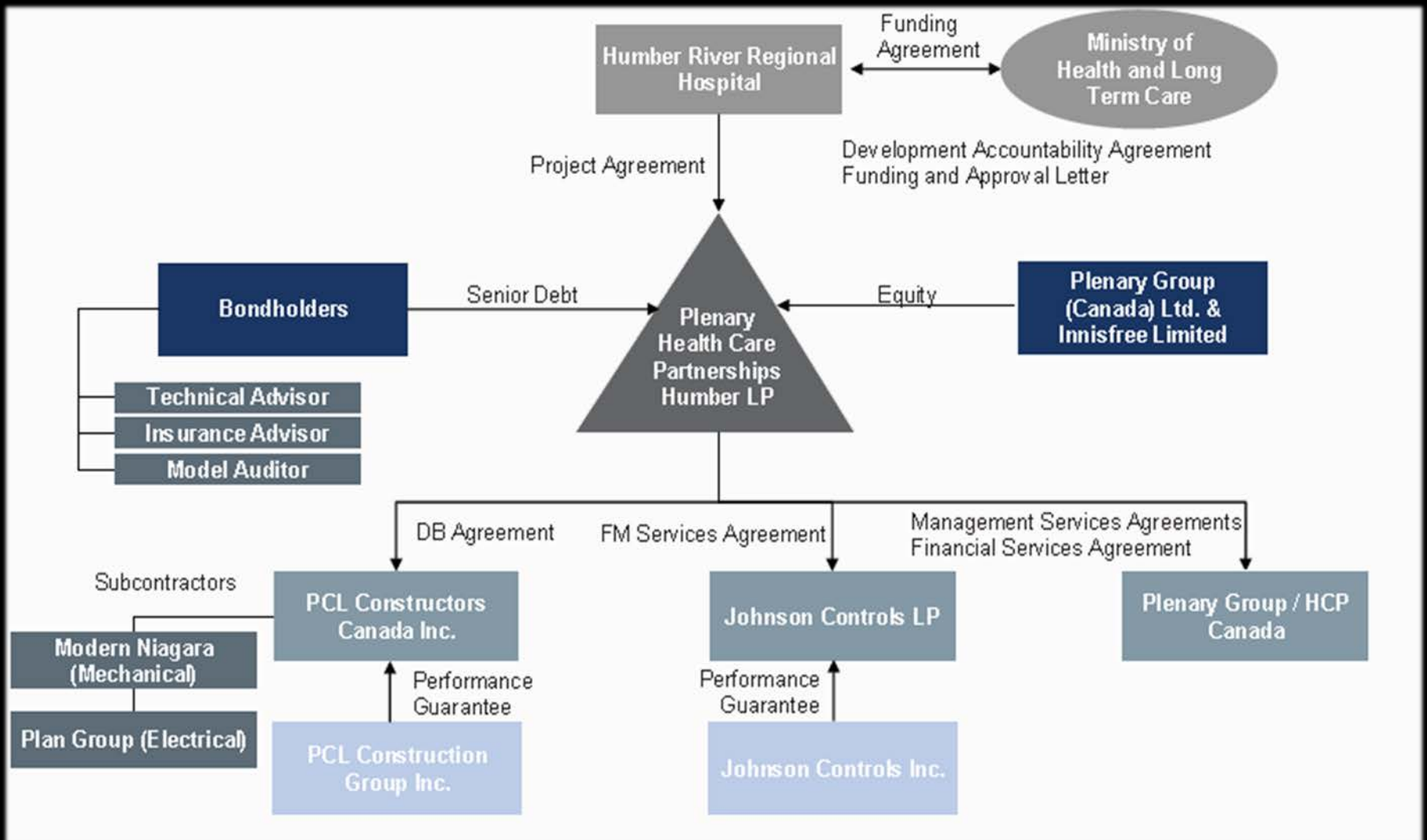
Public Sector Risks



Public Sector Risks



Team Organization



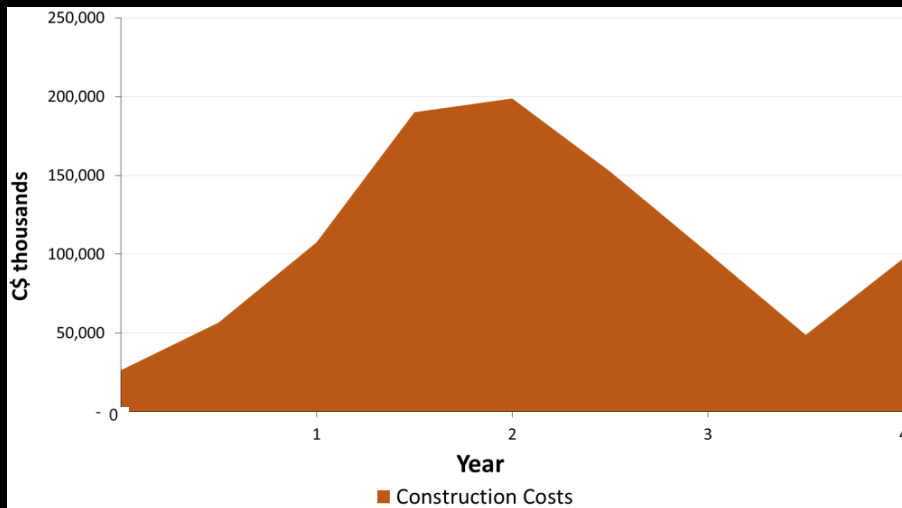
Project Costing

Construction Costing

- Site Construction
- Concrete
- Masonry
- Metals
- Wood & Plastic
- General Expenses & Fees
- Thermal & Moisture Protection
- Windows & Curtain Wall
- Specialties
- Equipment
- Special Construction
- Conveying Systems
- Mechanical
- Electrical
- Finishes & Interior Construction
- Public
- Art

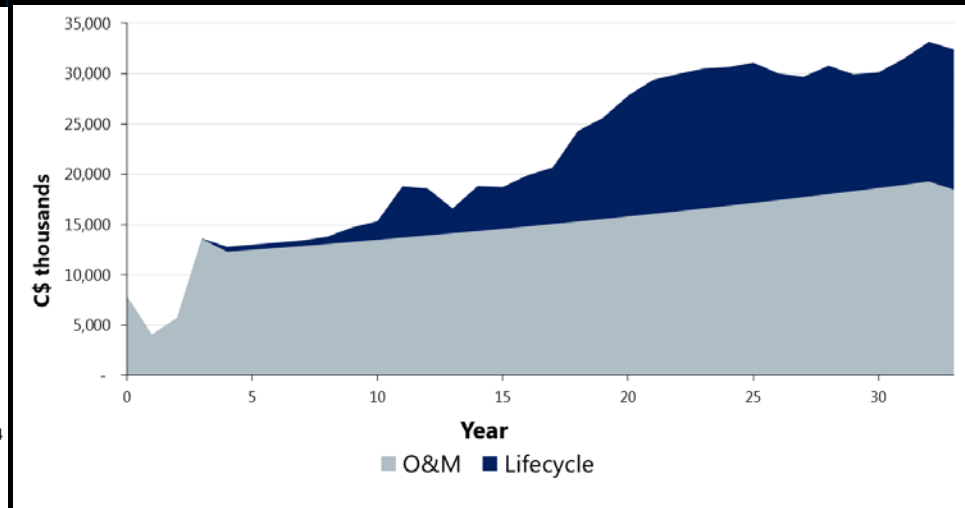
Operations, Maintenance, and Lifecycle Costing

- Cleaning Expenses
- Maintenance & Repairs
- Life & Safety
- Utilities
- Roads & Grounds
- Security
- Administration
- Parking Operations
- Vans & Fleet
- Fixed Expenses
- Leasing Expenses
- Rent
- Subcontracts
- Food Services
- ICAT
- Risk & Security



Total Construction Cost: ~\$979 million

Source: Plenary Health Care Partnership



Average Annual O&M Cost: ~\$14.6 million

Total Lifecycle Cost: ~\$238 million

What is Project Finance?

Project Finance

- **The raising of funds on a non-recourse basis to finance an economically separable capital investment project where the providers of the funds look primarily to the cash flow from the project to service their loans and provide the return on their equity invested in the project**

Corporate Finance

- **Lenders and equity investors look to the firm's entire asset portfolio to generate the cash flow to service their loans and provide a return on equity**
- **The assets and their financing are integrated into the firm's asset and liability portfolios. Often, loans are not secured by any pledge of collateral**
- **Lenders look to the firm's entire balance sheet and projections extrapolated from its past cash flow and profit record, and assume the firm will remain in business for an indefinite period and, therefore, keep renewing its loans**

Characteristics of Project Finance

“Ring-fenced” project

- Project undertaken via special purpose entity (“SPE”)
- Establishment of a Project Company (“Project Co”) to undertake Project
- Bankruptcy remote
- Negative covenants

“Greenfield” project

- Typically involves new construction
- Single asset rather than multiple assets
- “Brownfield” project finance also exists through refinancing of original capital

“Non-recourse” financing

- Lenders seek repayment of debt exclusively from project cash flow and assets
- No guarantees from equity sponsors

High “leverage”

- Debt-to-equity ratio of 1.5:1 (60:40) or greater

Reliance on forecasted cash flow and contracts

- Usually no historical cash flow
- Little reliance on physical assets
- Revenue provided through off-take agreement

Project has finite life

- Project debt repaid during life of the project
- Term of the off-take or concession agreement
- Life of oil and gas resource

AFP Model: Financing Mechanism

	Design/Build Finance (D/BF)	Design Build Finance Maintain (DBFM)
Payment is Due	Upon completion of a project	When facility is operational
Type of Payment	Lump sum payment by public sector	Installment payments over a fixed period – usually 30 years
Type of Financing	Debt	Debt and equity
Providers of Financing	<ul style="list-style-type: none"> • Project Co's Lender • Payment is provided by public sector at completion 	<ul style="list-style-type: none"> • Project Co's Lender • Project Co's Shareholders • Payment is provided by public sector over 30 years

Driving Change: The new financial frontier

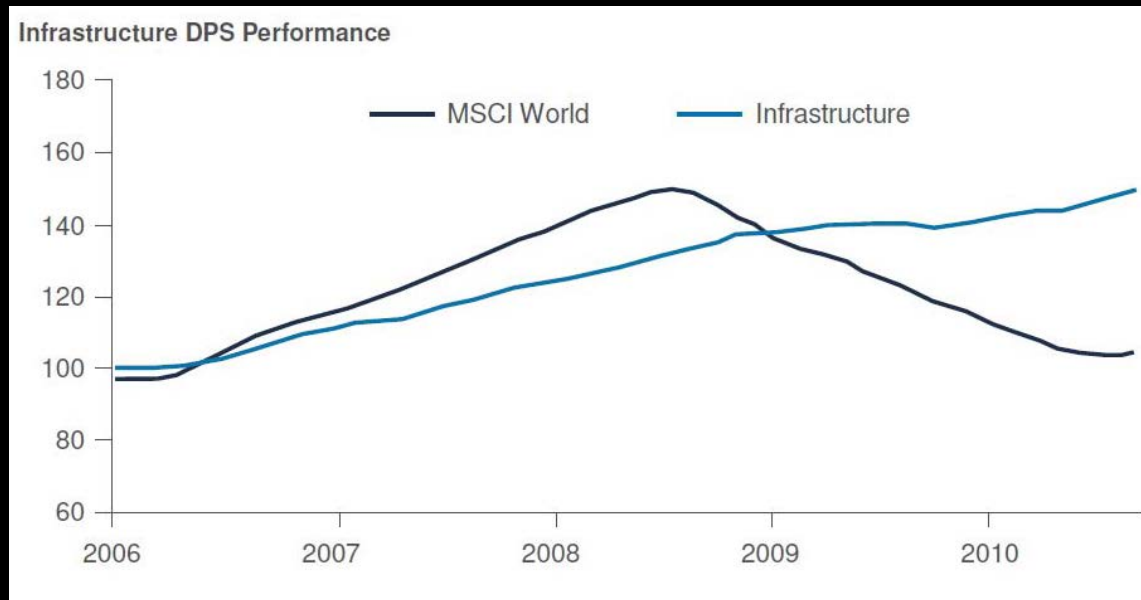
Institutional funds are seen as sources of long-term capital (private) with an investment horizon tied to long-term liabilities (public)

Fig. 26: Largest Infrastructure Investors - Global

Rank	Investor	Currently Committed to Infrastructure (\$bn)	Investor Type	Investor Location
1	OMERS	15.5	Public Pension Fund	Canada
2	CPP Investment Board	8.6	Public Pension Fund	Canada
3	Corporación Andina de Fomento (CAF)	8.4	Government Agency	Venezuela
4	Ontario Teachers' Pension Plan	8.1	Public Pension Fund	Canada
5	APG - All Pensions Group	7.2	Asset Manager	Netherlands
6	TIAA-CREF	6.5	Private Sector Pension Fund	US
7	CDP Capital - Private Equity Group	5.9	Asset Manager	Canada
8	AustralianSuper	5.3	Superannuation Scheme	Australia
9	PGGM	3.5	Asset Manager	Netherlands
10	QIC	3.5	Asset Manager	Australia

Source: Preqin Infrastructure Online

Infrastructure - dividends/share (DPS) performance



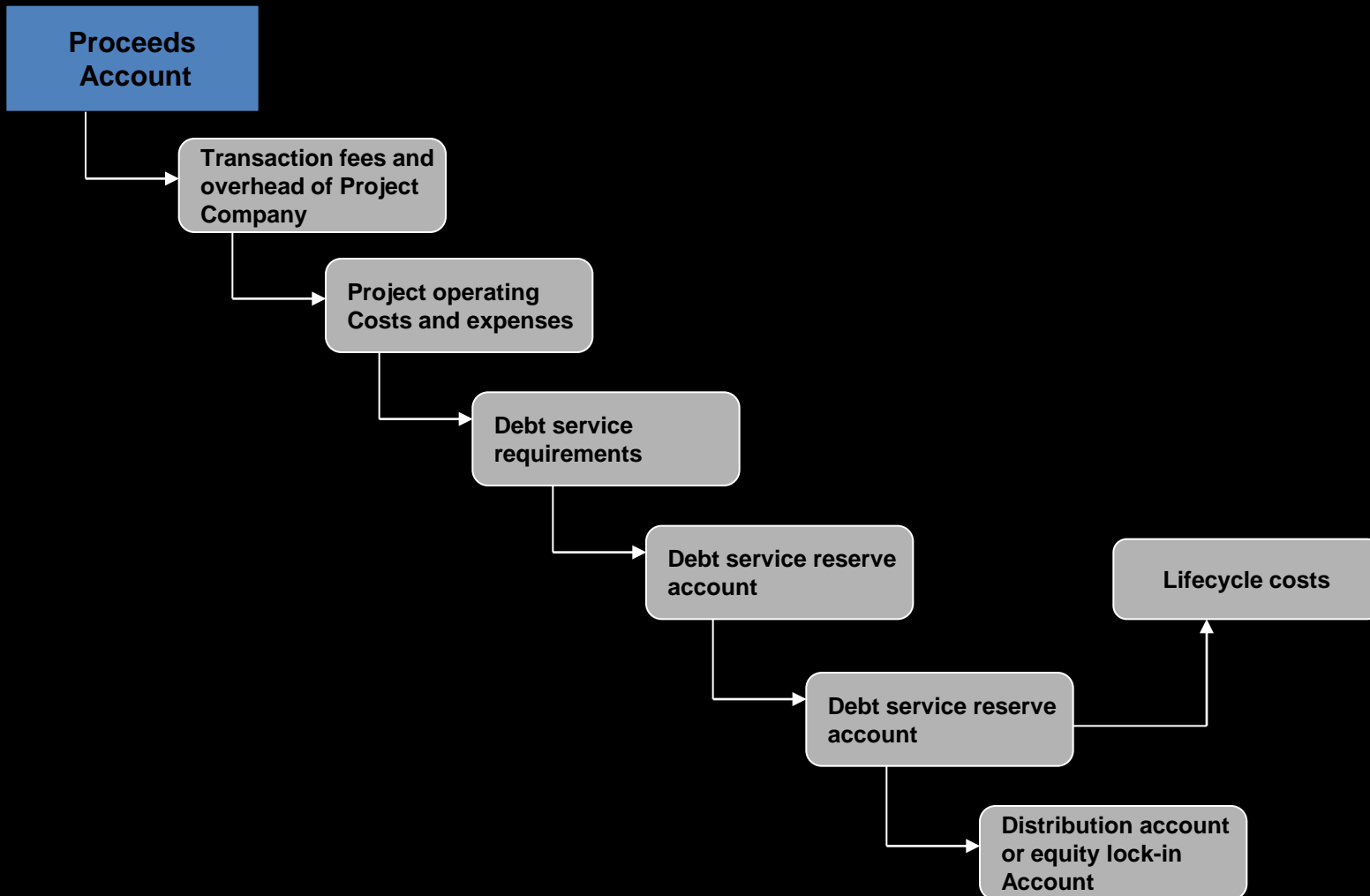
Resilience in uncertain times

During the continuing economic uncertainty, infrastructure has been one of the few asset classes that has performed in line with expectations. In many respects, infrastructure is in better shape to face an uncertain future than before the 2008 global financial crisis. This crisis played a valuable role in encouraging investors to de-lever and strengthen the balance sheets of privately held infrastructure assets. The result is that both listed and unlisted infrastructure are entering the calendar year 2012 in relatively good health.

Infrastructure has continued to deliver secure and stable cash flows, as can be seen from the following graph comparing the growth of dividends per share of listed infrastructure versus broader equity markets.

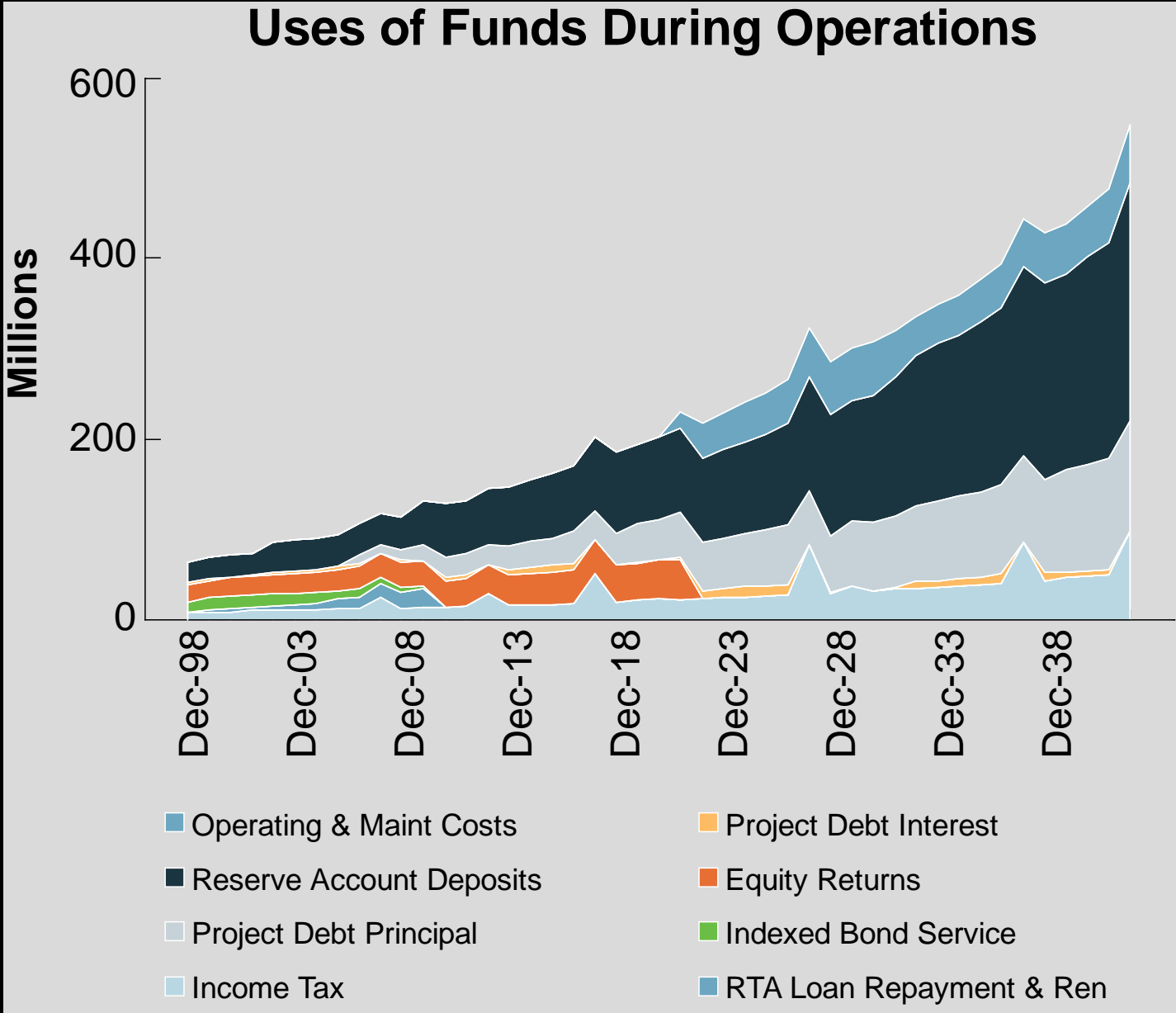
Source: AMP Capital

Financing PPPs - Flow of Funds



Cash waterfalls ensure that available cash is used with appropriate priorities

Private sector- cash flow and risk profile



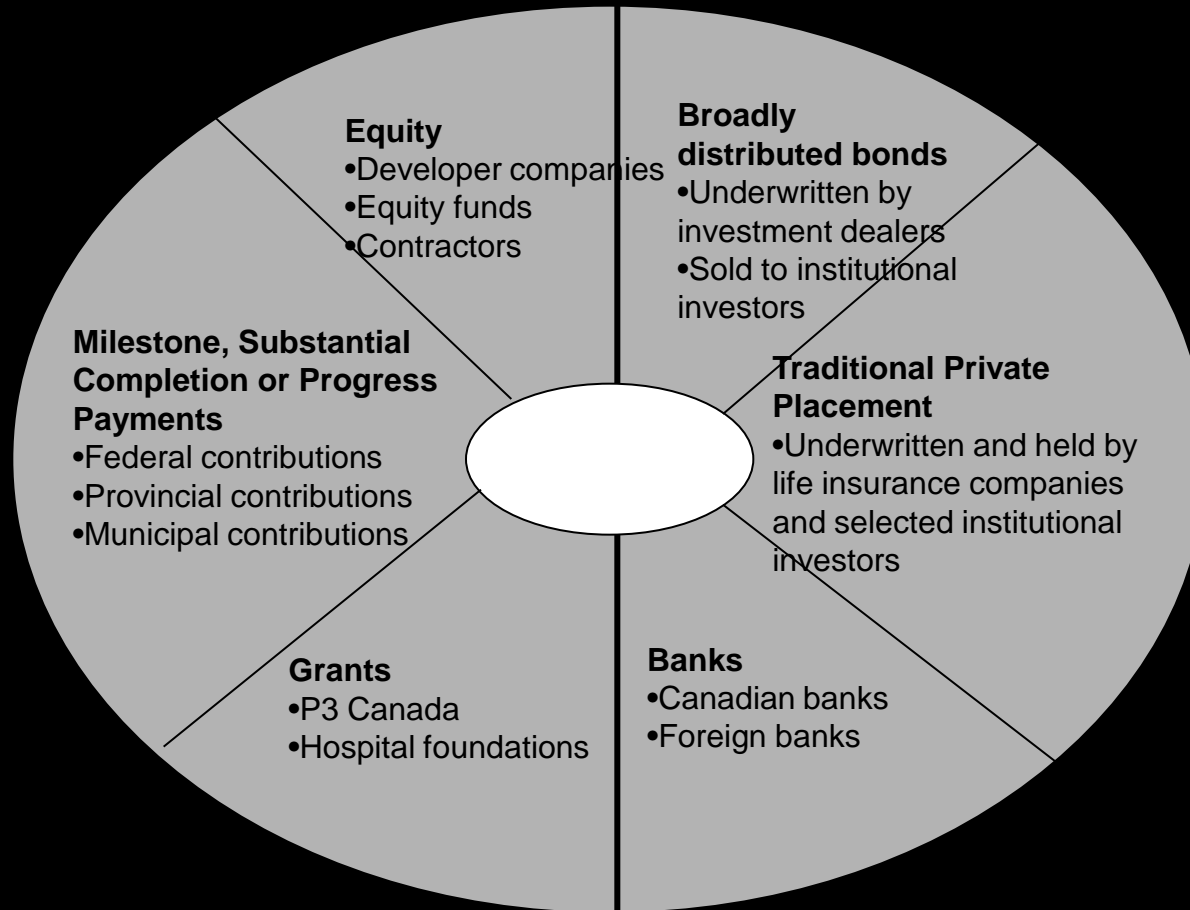
Lifecycle Costing

Lifecycle reserve mechanism

- Holdbacks on JCI depending on level of payments relative to work performed
- First-ever implementation

	Plenary Lookback	Plenary Lookforward	3 rd Party Lookforward
When	Annual	Years 10, 15, 20	Years 15, 18, 21
Test	Compare amount JCLP paid (A) vs work done (B)	Compare projected lifecycle costs (C) vs remaining scheduled payments (D)	Compare projected lifecycle costs (E) vs remaining scheduled payments (F)
Implication	If $A - B > \$10.5M$ (7% of original L/C budget) then JCLP must post security or we withhold for the amount in excess	If $C > D$ then JCLP must repay, post security or we withhold for the amount of the payment in excess of work done ($A - B$), with no floor, for this testing period	<ul style="list-style-type: none"> • If $E - F > \\$10.5M$ (7% of original L/C budget) then JCLP must post security or we withhold for the amount projected short beyond \$10.5M and up to a cap of \$29.9M (20% of original L/C budget) • Plenary equity lock-up beyond

Sources of Funding for PPPs in Canada

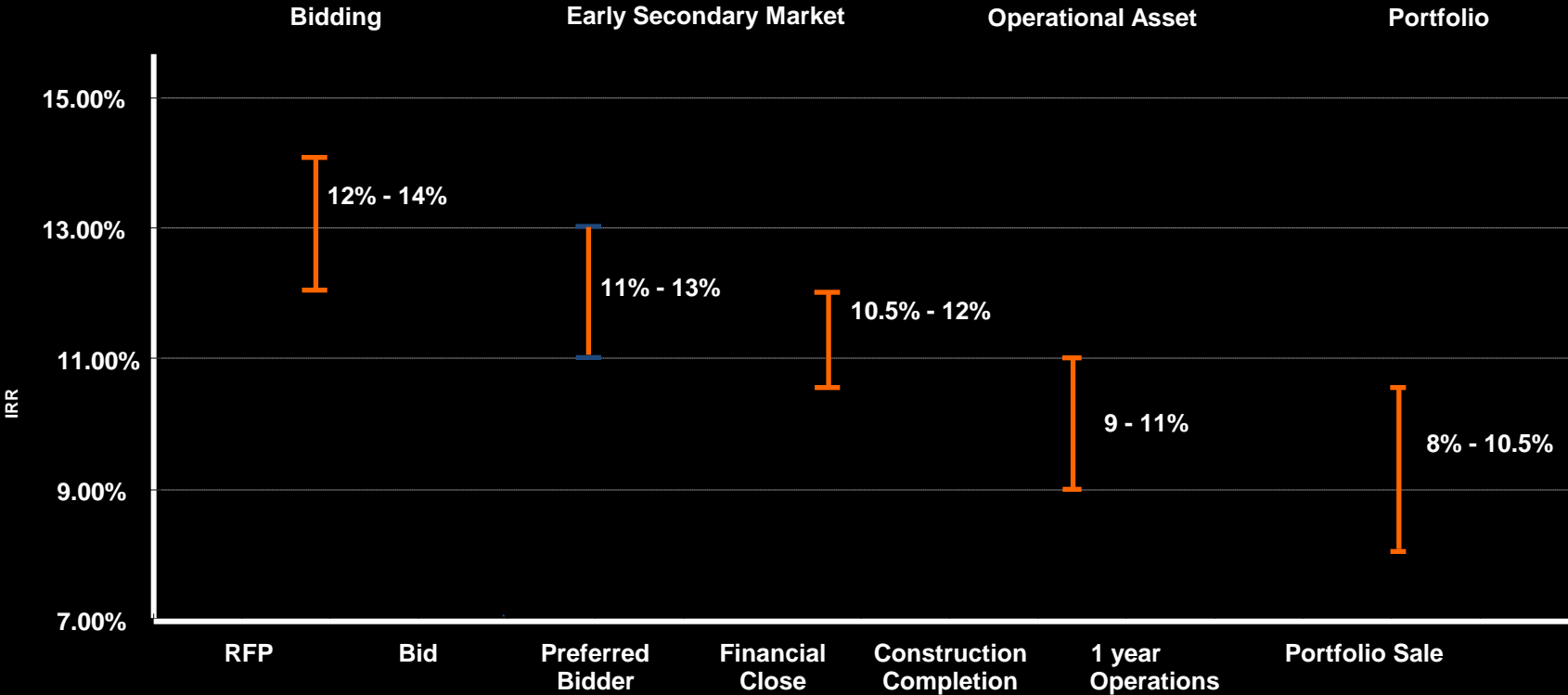


Grants
and Equity



Debt

Typical Equity Return Profile



Commercial and Financial Close

On Day T-1:

Several agreements must be tabled into escrow on (or before) Day T-1:

- Project Agreement (“PA”)
- Design Build Agreement (“DBA”)
- Facility Maintenance and Services Agreement (“FMSA”)
- Lending Agreements
- Completion Documents
- Amended and restated PA
- CC and FC Opinions

Final credit spread is locked in at noon

- Debt Coupon = Base Rate + Spread
 - Even after spread is locked in, base rate fluctuates before being set via the rate set protocol

Commitment Letter is reissued by Project Co without conditions at 2PM

A final “dry run” happens at 3PM

Commercial and Financial Close

On Day T:

At 8AM Counsel to the Parties releases documents from escrow and confirms the achievement of CC

Project Co delivers CC Letter of Credit simultaneously with IO's return of their PPN Letter of Credit

Rate Set / Live Run at 10AM

Following Rate Set, populate:

- **Amended and Restated PA, DBA, FMSA, Lending Agreements, Completion Documents, and FC Opinions**
- **with financial data and retain in escrow**
- **Escrow agent confirms receipt of the above**

On Day T+3:

Counsel confirms that Bond proceeds have been deposited

Escrow Agent releases the Amended and Restated PA, DBA, FMSA, Completion Documents, Lending Agreements, and FC Opinions

Project Co's CC Letter of Credit is returned

How much should government contribute?

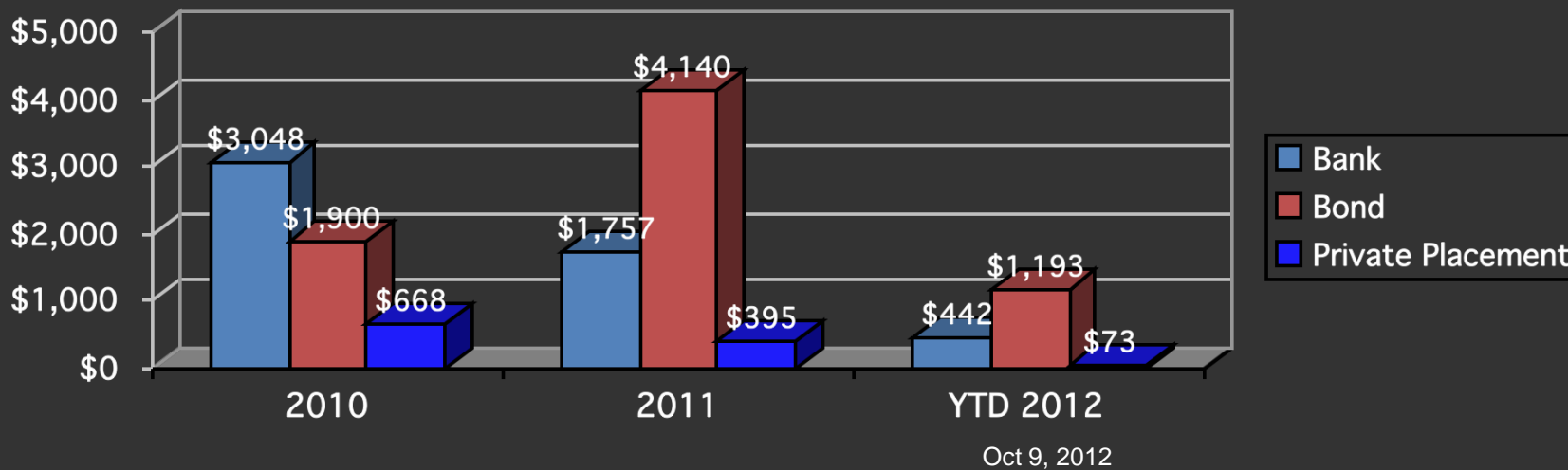
Ontario	Up to 85% for transportation infrastructure Up to 50 % for accommodation infrastructure
Alberta	Typically 50% to 70%
British Columbia	Typical 40% to 60%
Quebec	Typically up to 50%

More an art than a science – governments in many cases specify a dollar amount (rather than percentage amount) without knowing the final bid price

The actual contribution may be a higher or lower percentage than the anticipated contribution depending on the actual bid price relative to the expected bid price

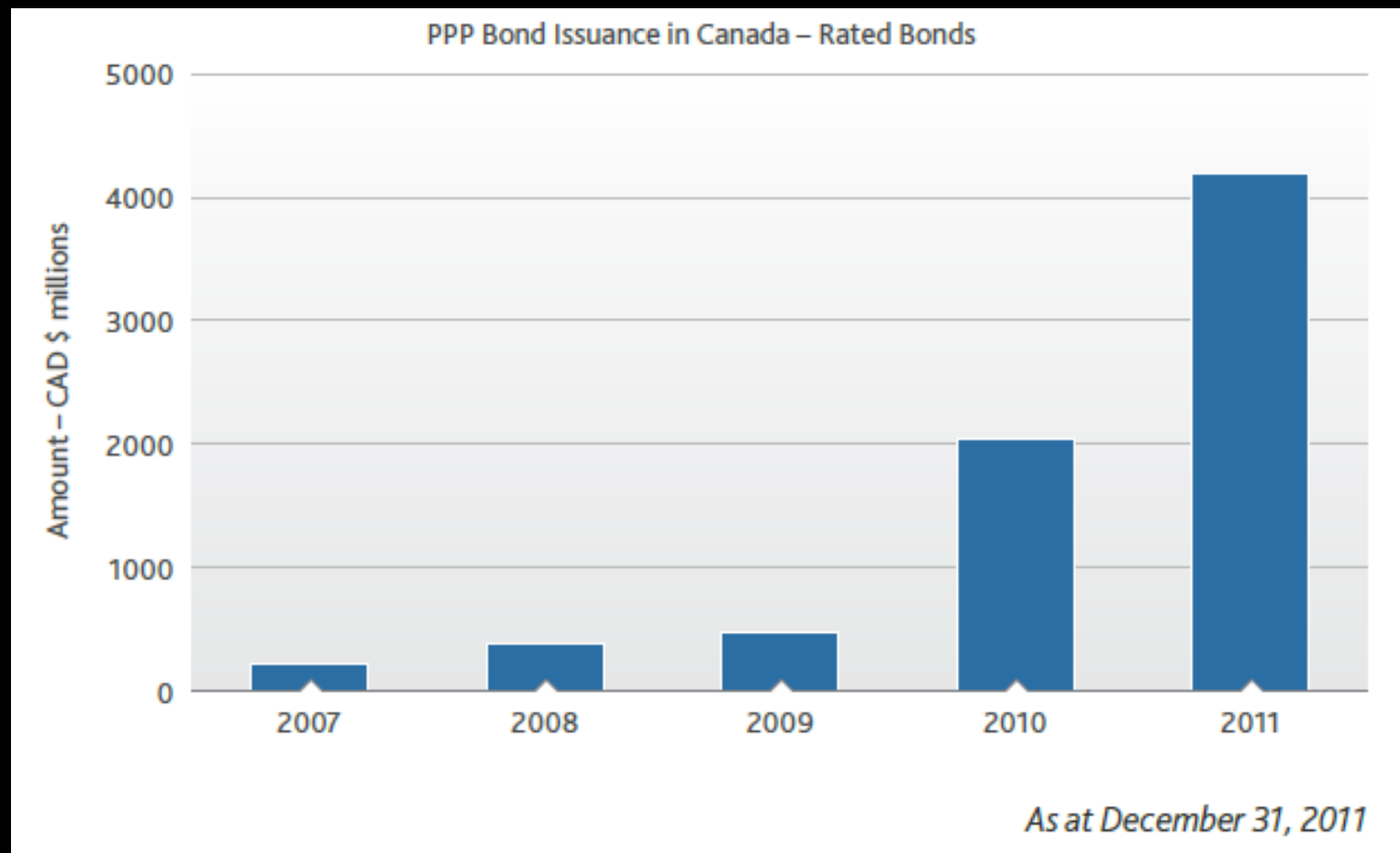
Bond Financing

- Sources of funding for PPPs has changed over time
- More long-term DBFM projects has led to a decrease in the relative use of banks as a financing solution
- Big projects requiring more financing, a growing investor base and a decrease in the clearing spreads has led to broadly marketed bonds becoming the preferred solution to traditional private placement for many equity sponsors



Demand for infrastructure financing outstripping the supply of new funds

On the demand side of infrastructure - \$2.2 trillion needed in the United States, \$21 trillion in emerging economies, and an estimate for Canada of \$1 trillion by 2050.

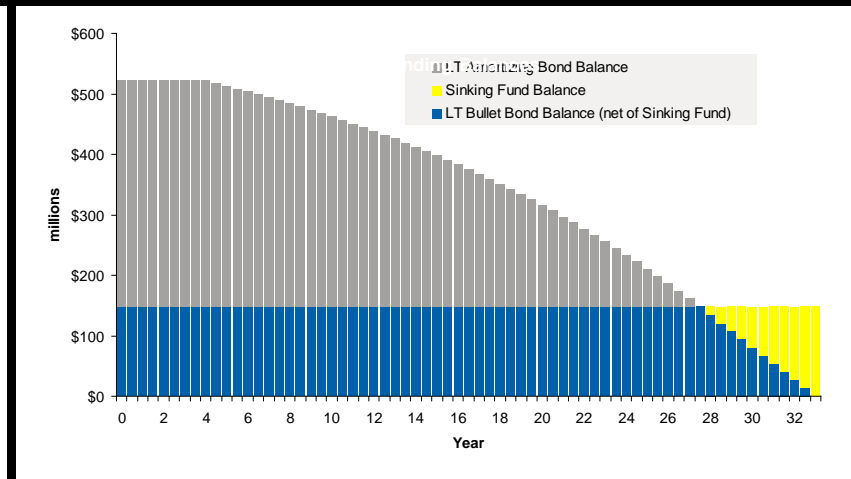
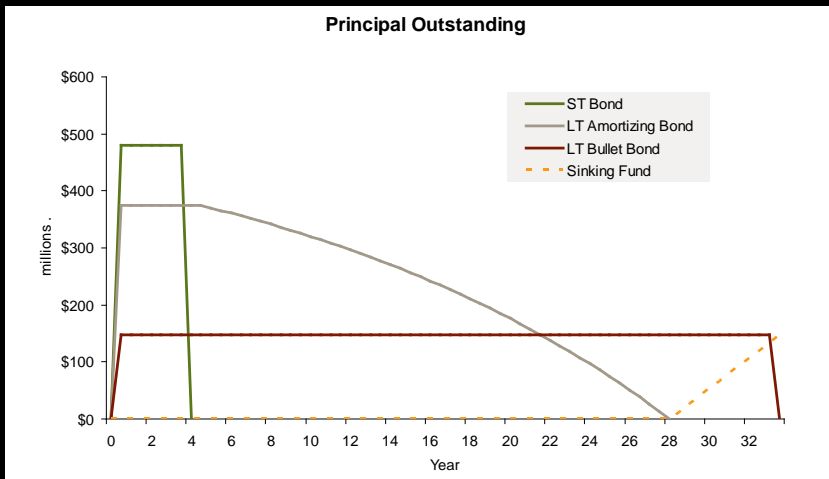


Financing strategies

- Committed financing solution – Humber River Regional Hospital 2012

Source	Amount	Tenor
Long Term Amortizing Bond	\$375 million	~27.7 years (~18.4 year average life)
Long Term Bullet Bond	\$149 million	~33.2 years
Short Term Bond	\$482 million	~3.6 years fixed + 1.25 years floating
Equity	\$80 million	n/a
Total	\$1,086 million	

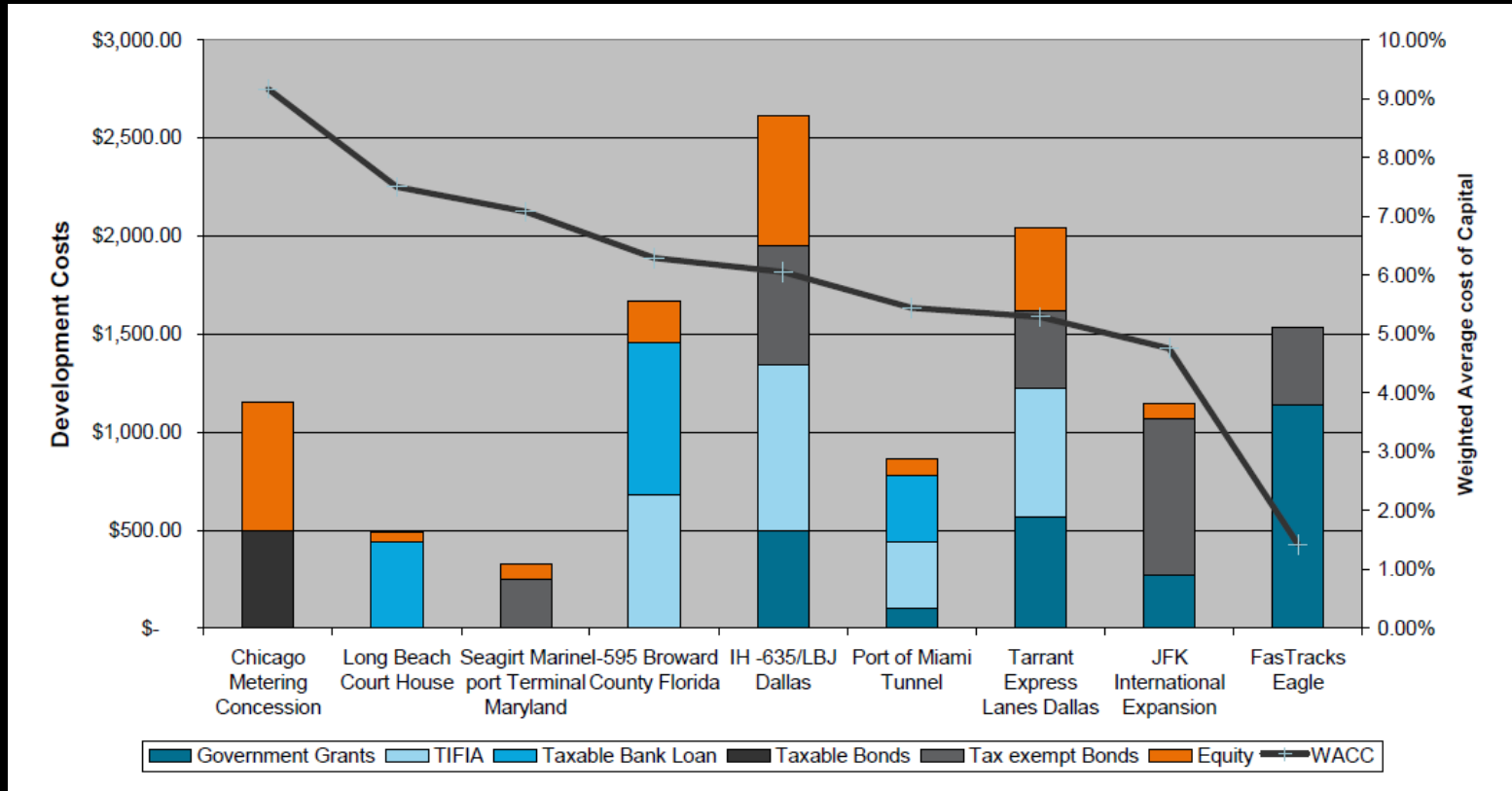
- All bonds rated A by both S&P and DBRS
- Third-largest PPP bond ever issued in Canada at the time
- First PPP in Canadian history to combine LT amortizing and LT bullet bonds



- Financing must consider size of Substantial Completion payment and the resulting effect on operational resiliencies, which further impacts ratings for project debt

Recent US PPP financing structures

Source: Barclay's Capital



In the US, currently most infrastructure projects are funded by a combination of federal grants and low interest loans plus municipal bonds raised by local authorities. The consequence is that nominal funding costs are low by Australia and UK standards. This makes it difficult for the private sector to compete with traditional funding structures.

TIFIA Loans - Transportation Infrastructure Finance and Innovation Act



\$57 trillion

global infrastructure investment
needed in 2013–30

\$101 billion

annual cost—in excess fuel costs and time—
of road congestion in the United States

4 years

average time to obtain
complete permitting for
a power infrastructure
project in Europe

70%

of water in Nigeria
is “non-revenue”
(unmetered or stolen)

\$2.5 trillion

additional infrastructure financing by 2030 if
institutional investors meet their target allocations

0 gain in construction sector labor
productivity over the past 20 years in
Japan, Germany, and the United States

The Infrastructure Challenge



\$1 trillion

annual savings from a viable 60 percent improvement in infrastructure productivity

35%

proportion of infrastructure projects rejected upon scrutiny by Chile's National Public Investment System

15%

potential savings from streamlining infrastructure delivery

20%

reduction in Denmark's road maintenance costs through a total cost of ownership approach

30%

potential boost in the capacity of many ports through more efficient terminal operations

\$1.2 billion

overall net present value of Stockholm's congestion-charging scheme

The Infrastructure Opportunity

McKinsey Global Institute

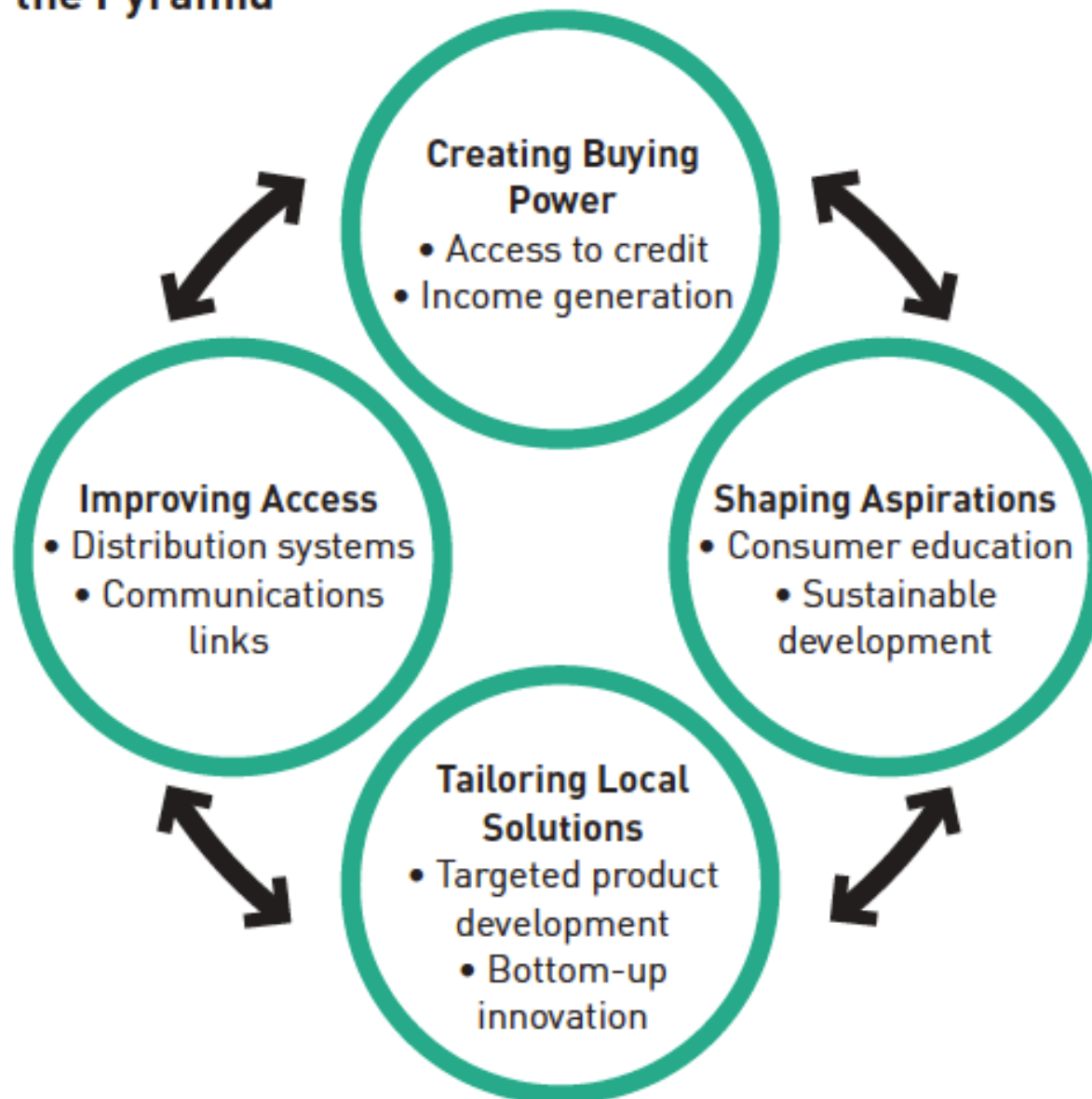
Aligning demand and supply

Aligning demand and supply involves improving lives by producing and distributing products and services in culturally sensitive, environmental sustainable, and economically profitable ways

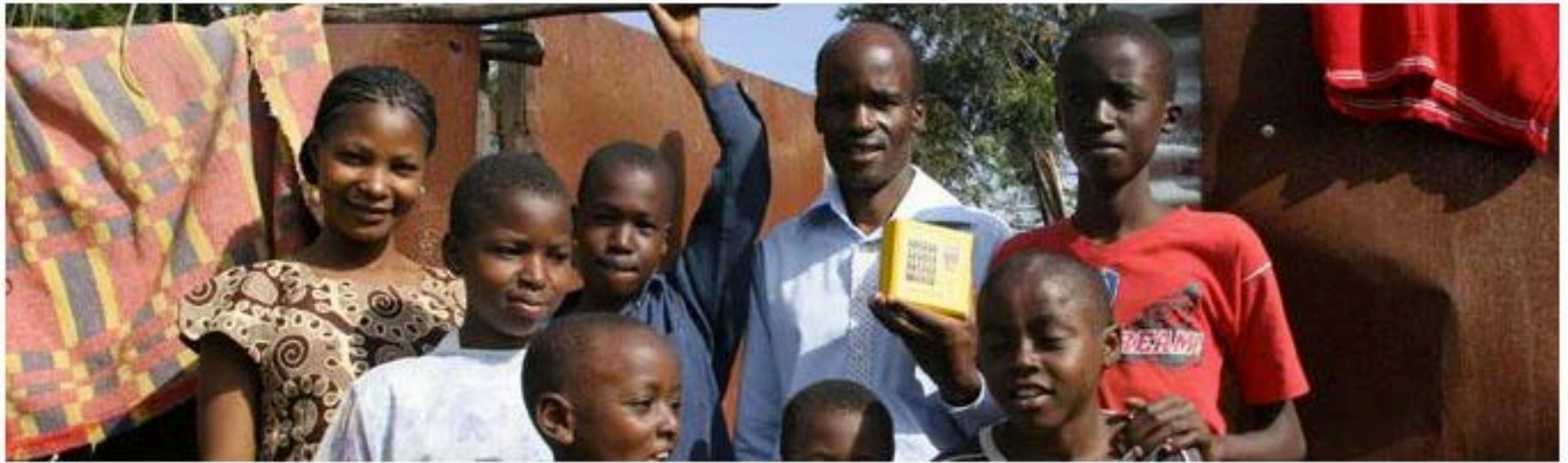
Investment at the “bottom of the pyramid” means lifting billions of people out of poverty and desperation, averting social decay, political chaos, terrorism, and environmental meltdown that is certain to continue if the gap between rich and poor countries continues the divide.

C.K Prahalad

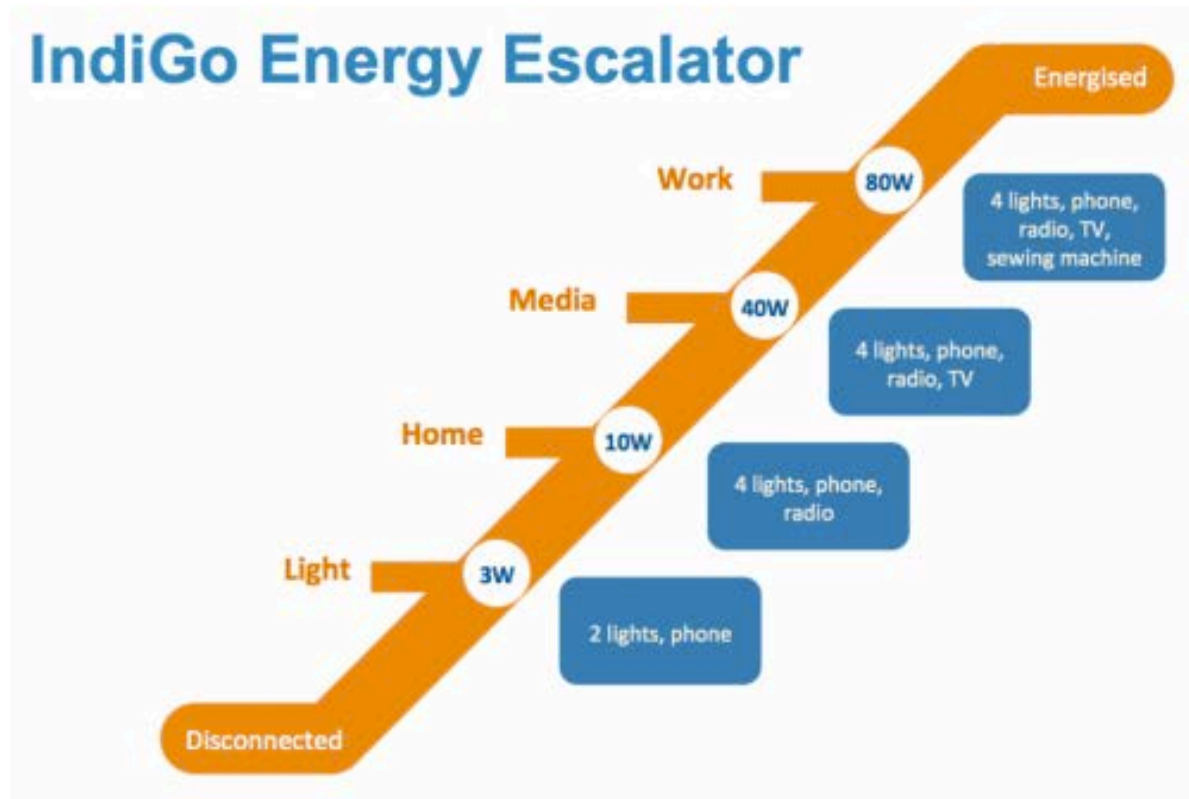
The Commercial Infrastructure at the Bottom of the Pyramid



Pay-as-you-go solar



There is a common problem with most renewable sources of energy – customers are used to paying for energy as they use it but for renewables, the cost is all up front in the purchase price. This puts technologies such as wind turbines or traditional solar beyond the reach of many users. Eight19 has introduced **IndiGo**, a way of combining mobile phone technology with solar power to offer pay as you go solar. Users buy scratchcards to pay for their solar power using the money they save on kerosene. In fact, in Kenya, IndiGo deployments are so cost-effective that users spend half as much on their IndiGo solutions that they previously did on kerosene.



But this is only half the story. Today a user may purchase an entry-level IndiGo system capable of lighting 2 rooms and charging one mobile phone. But over time, that person's requirements will grow. They may want more lights, to power a radio or TV or even power a sewing machine to enable them to make more money. IndiGo grows with these needs allowing customers to ride the "energy escalator" by which products are progressively upgraded over time to grow from simple systems to full home electrification.

How IndiGo works



IndiGo is best thought of as "pay as you go" solar power.

Each IndiGo power unit has a unique serial number. To add credit to the unit, the user purchases a scratch card for a period of time such as a day, a week or a month. This scratchcard number, along with the unit serial number, is sent by SMS text message to the IndiGo server which validates the number and sends back a unique passcode. The user enters this passcode into the unit and the output is enabled for the period of the credit.



IndiGo works with any mobile phone and any mobile operator. The system enables products such as high quality solar lighting, mobile charging and other low power uses of solar energy.