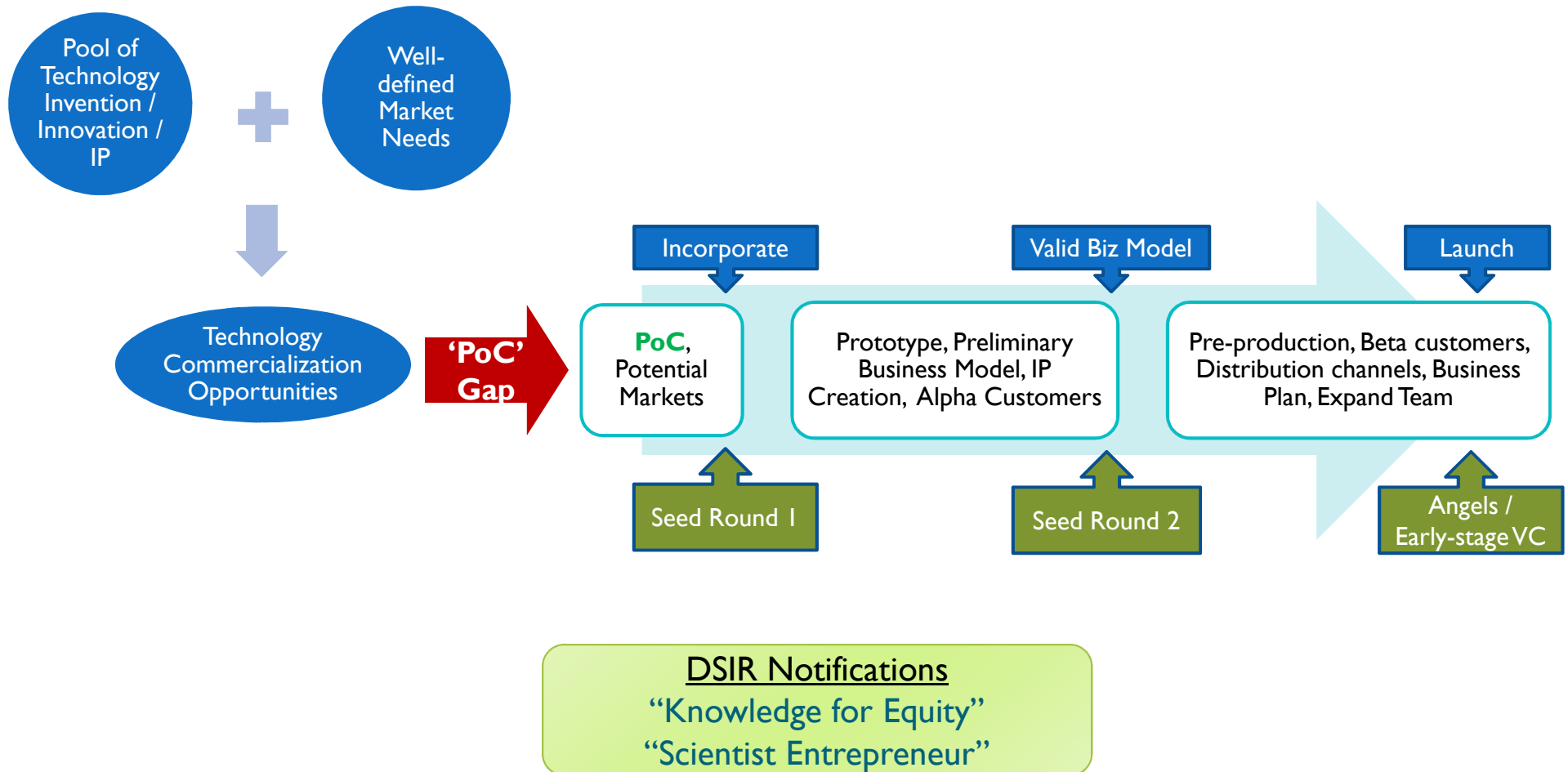




Water: Opportunities for Impact

13 November 2010

Lab2Mkt Program (Technology Commercialization via Spinoffs)



Competencies → Technologies → Products

Focus	<ul style="list-style-type: none"> • Materials & Methods • Insights • Potential applications 	<ul style="list-style-type: none"> • Prototype • Pilot plant • Potential market 	<ul style="list-style-type: none"> • Product • Service • Well-defined market
Activity	<ul style="list-style-type: none"> • R (&D) • Create IP 	<ul style="list-style-type: none"> • Process/Product Engineering • Strengthen IP 	<ul style="list-style-type: none"> • Manufacturing & Marketing • Monetize IP
Value Prop.	<ul style="list-style-type: none"> • Discover 	<ul style="list-style-type: none"> • Define (business model) 	<ul style="list-style-type: none"> • Deliver



Goal: PoC projects → Spinoffs

Match the following

- ▶ Market insights
- ▶ Scientific competencies → Technology-based solutions
 - ▶ Material, chemical & biological sciences
- ▶ (Venture) investment opportunities

Candidate: Water

- ▶ ~ \$500B industry worldwide
- ▶ Significant role for technology
- ▶ ‘The Next Oil’, ‘Blue Gold’, ...

Note: Water Enthusiasts, NOT Experts!

What we've spent time on

- ▶ Secondary market research
- ▶ Technology perspective
 - ▶ Material science
- ▶ Top-down / analytical approach

What's missing?

- ▶ Primary market research
- ▶ Field experience
 - ▶ Industry professionals, entrepreneurs, NGOs, policy-makers, ...
- ▶ Unsavory bits

Today's Agenda

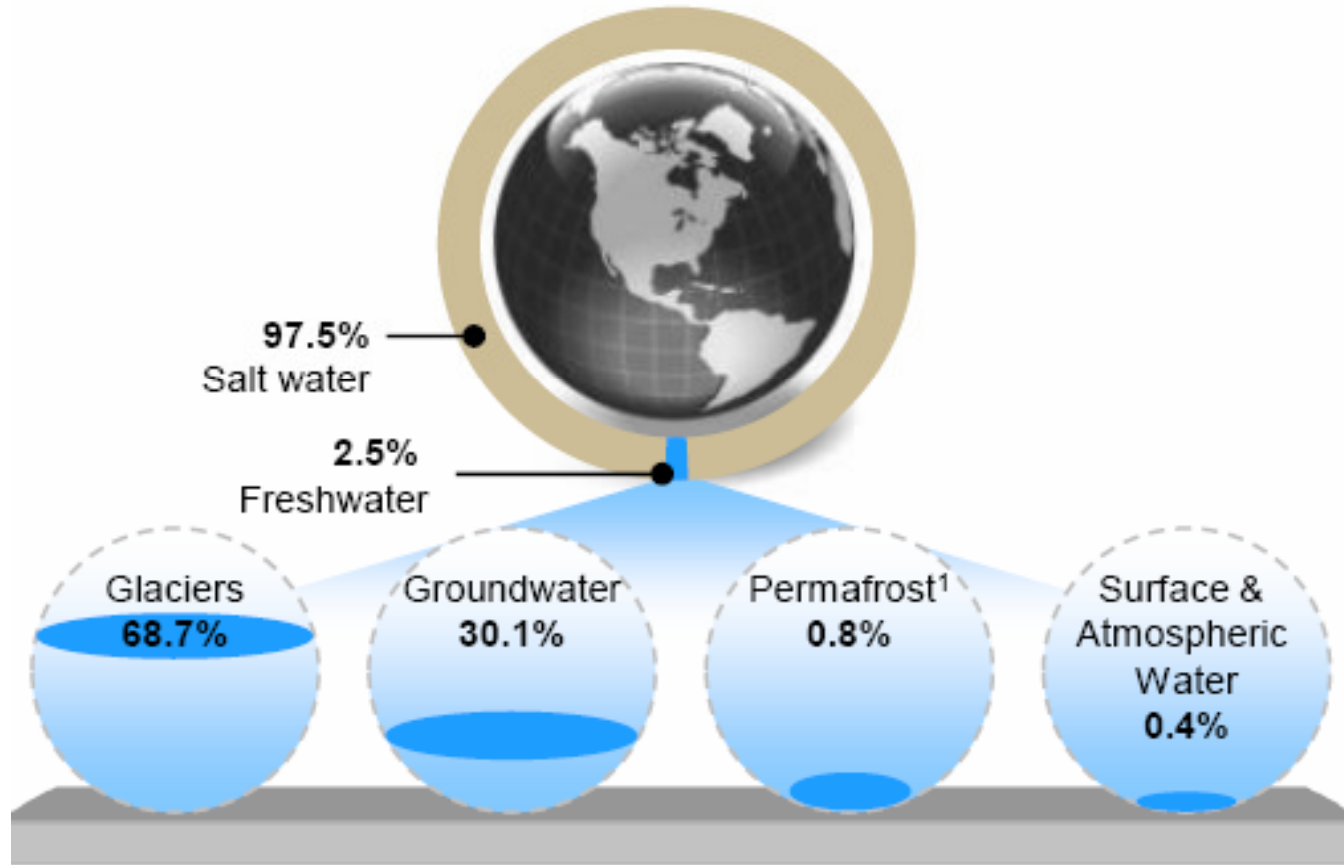
- ▶ Global markets
 - ▶ Overview
 - ▶ Market segments
- ▶ Indian markets
 - ▶ Overview
 - ▶ Market segments
- ▶ Investing in water
- ▶ Opportunities for impact
 - ▶ Pricing
 - ▶ Technology

NOT Covered

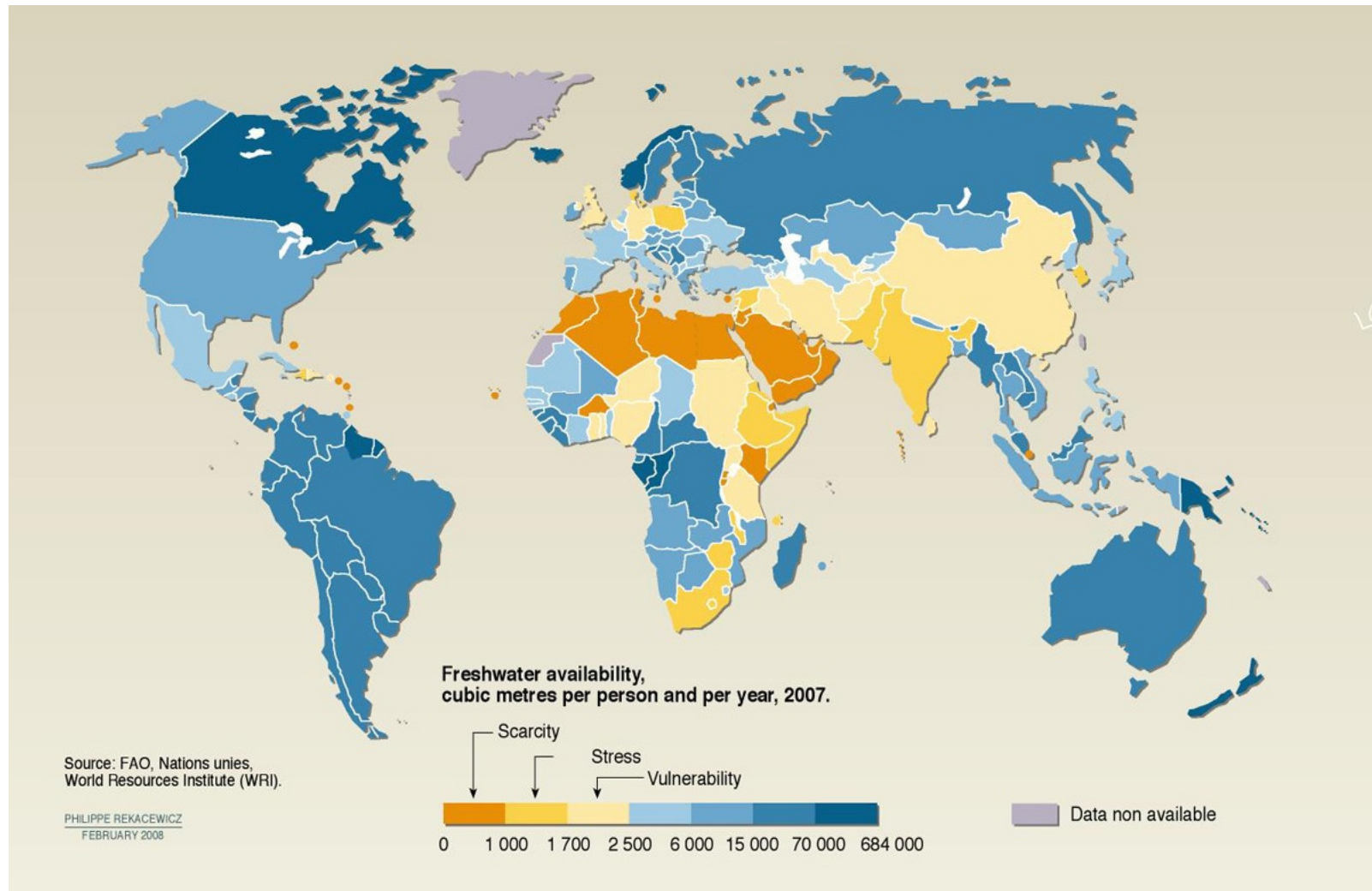
- Infrastructure / EPC
- Public health
- Climate change

Global Water Markets

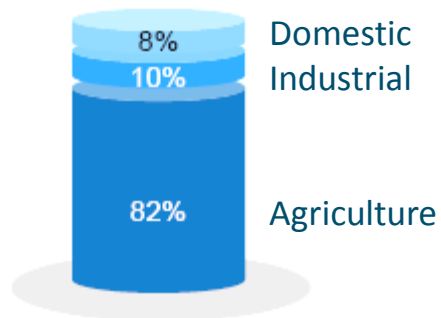
No Shortage of Water ?!



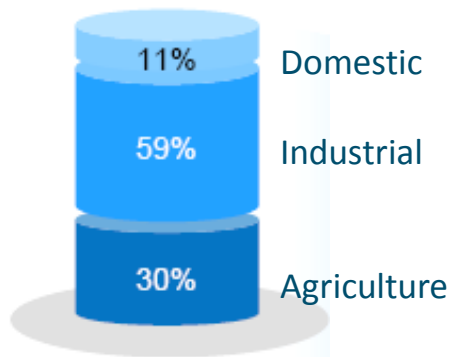
(Affordable, potable) Water is Scarce



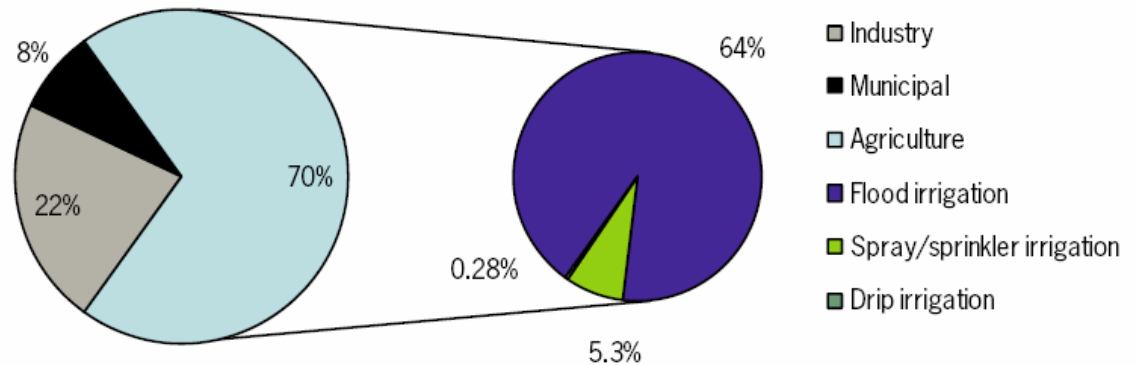
Water Usage: Agriculture → Industry



Developing Countries

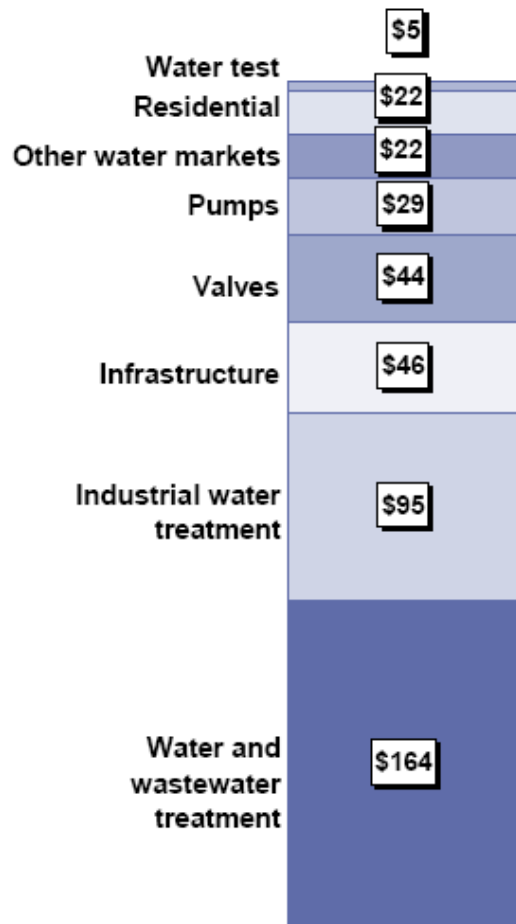


Developed Countries



Source: U.N. Food and Agriculture Organization and Lux Research analysis.

Water is a ~ \$500B Industry Worldwide

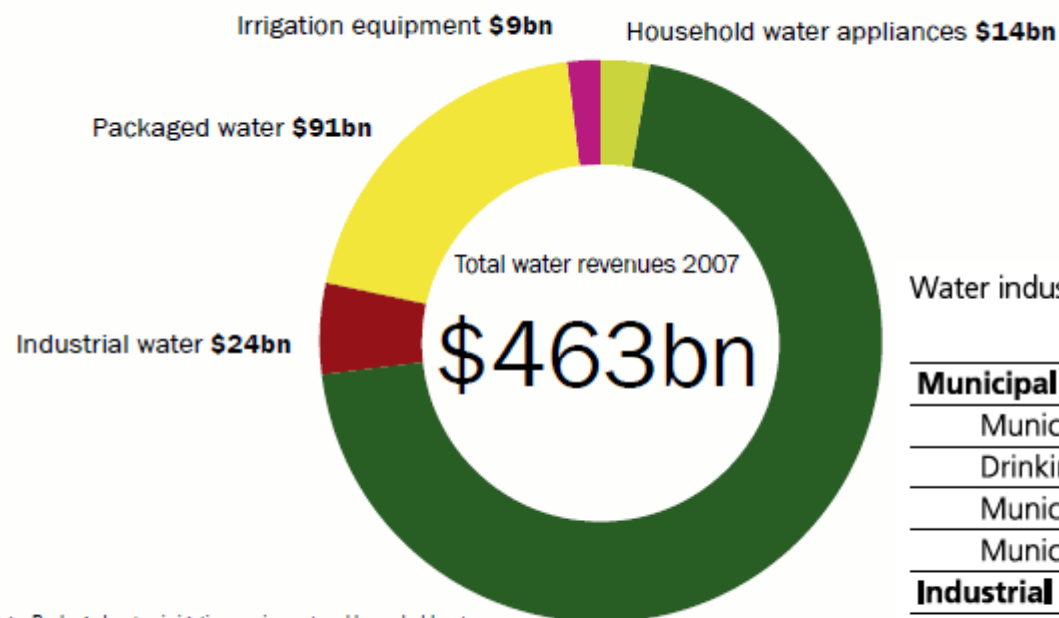


Source: Goldman Sachs Research estimates.

Expected growth of 6-7% p.a. → \$IT market by 2020

Municipal Utilities: 50-70% of Total Market

The global water market 2007 (broad definition)



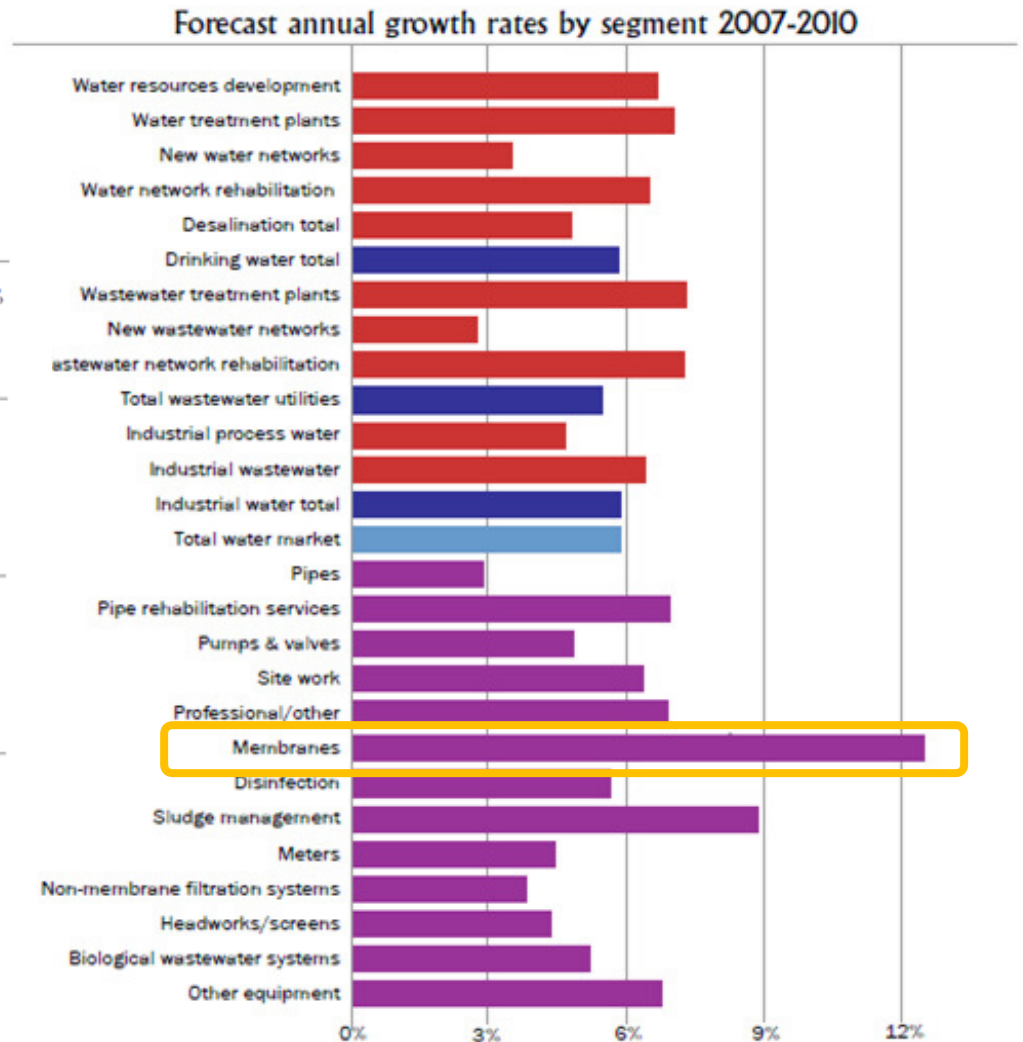
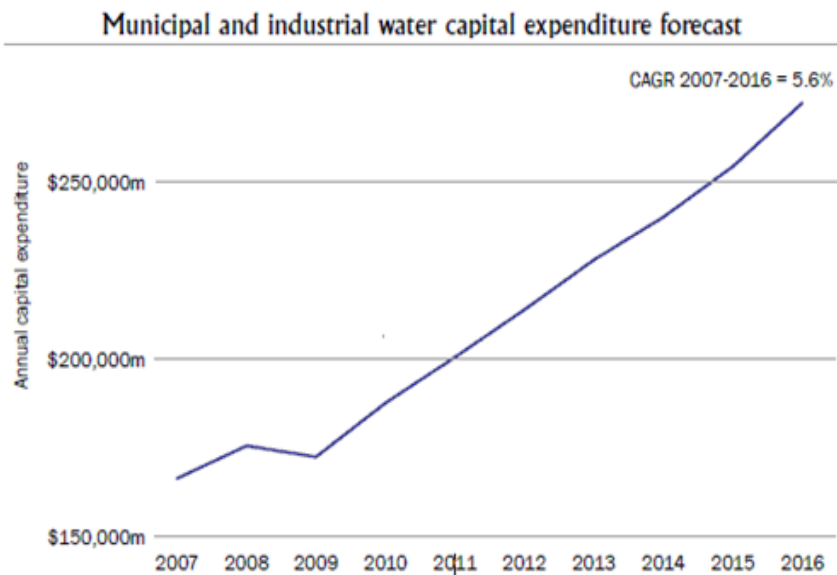
Note: Packaged water, irrigation equipment and household water appliances are not covered in detail by Global Water Market 2008

Water industry size, CY2007 (US\$ bn)

Municipal water market	325
Municipal wastewater capex	100
Drinking water capex	90
Municipal wastewater opex	70
Municipal water opex	65
Industrial water market	25
Industrial chemicals and services	13
Industrial equipment	12
Packaged water	91
Household water appliances	14
Irrigation equipment	8
Total	463

Source: Global Water Markets 2008

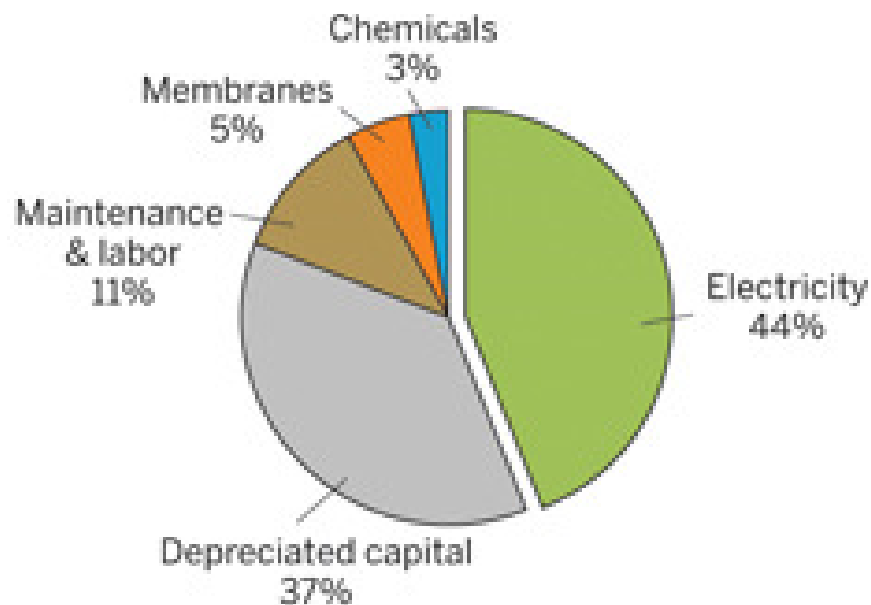
Growth Drivers: *Population, Industrialization, Urbanization, Pollution, Irrigation, Westernization, ...*



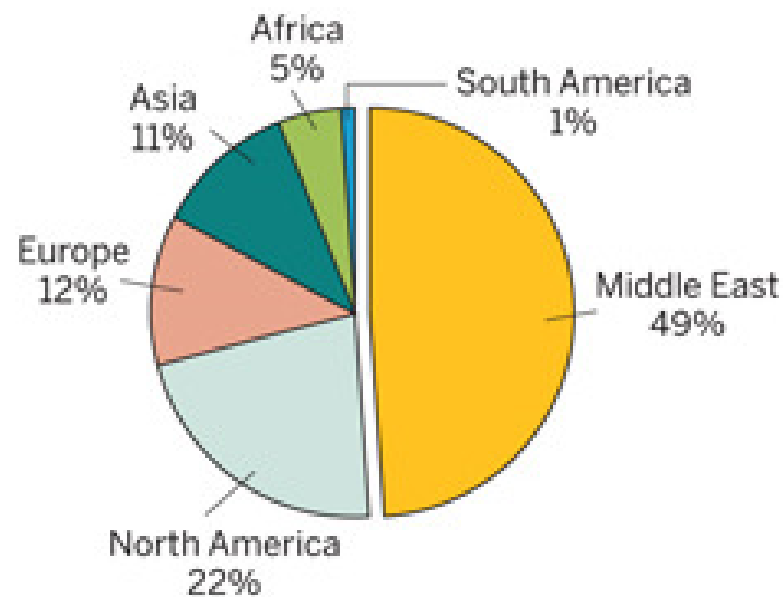
Advanced Water Treatment

	Market volume 2010 (USD bn)	Expected annual growth (2010-2016 CAGR)
Primary intakes/screens	2.9	7%
Standard process equipments: aeration/flocculation/clarifiers/sedimentation/mixers	10.9	5%
Ultrafiltration/microfiltration membranes	0.7	18%
Reverse osmosis/nanofiltration	0.6	18%
Membrane bioreactor	0.1	17%
Ion exchange/electrodeionisation	0.3	15%
Disinfection	3.0	6%
Zero liquid discharge	0.4	26%
Sludge management	7.1	9%
Media filtration	3.7	6%
Monitoring control/analytics/chemical feed	2.3	7%
Other specialist systems	2.6	2%
Industrial water treatment services	2.9	5%
Desalination plants	11.0	9%

Desalination (Issues: Capex, Energy, Wastewater)



Average global cost of desalinated water in 2008 = \$3.67 per thousand gal



Volume of desalinated water in 2008 = 4,780 billion gal

Indian Water Markets

\$30B - FY2012 (Majority: Agricultural/Municipal)

Exhibit 1 Significant business opportunities in water

Revenue opportunities in water (US\$ mn), FY2012E

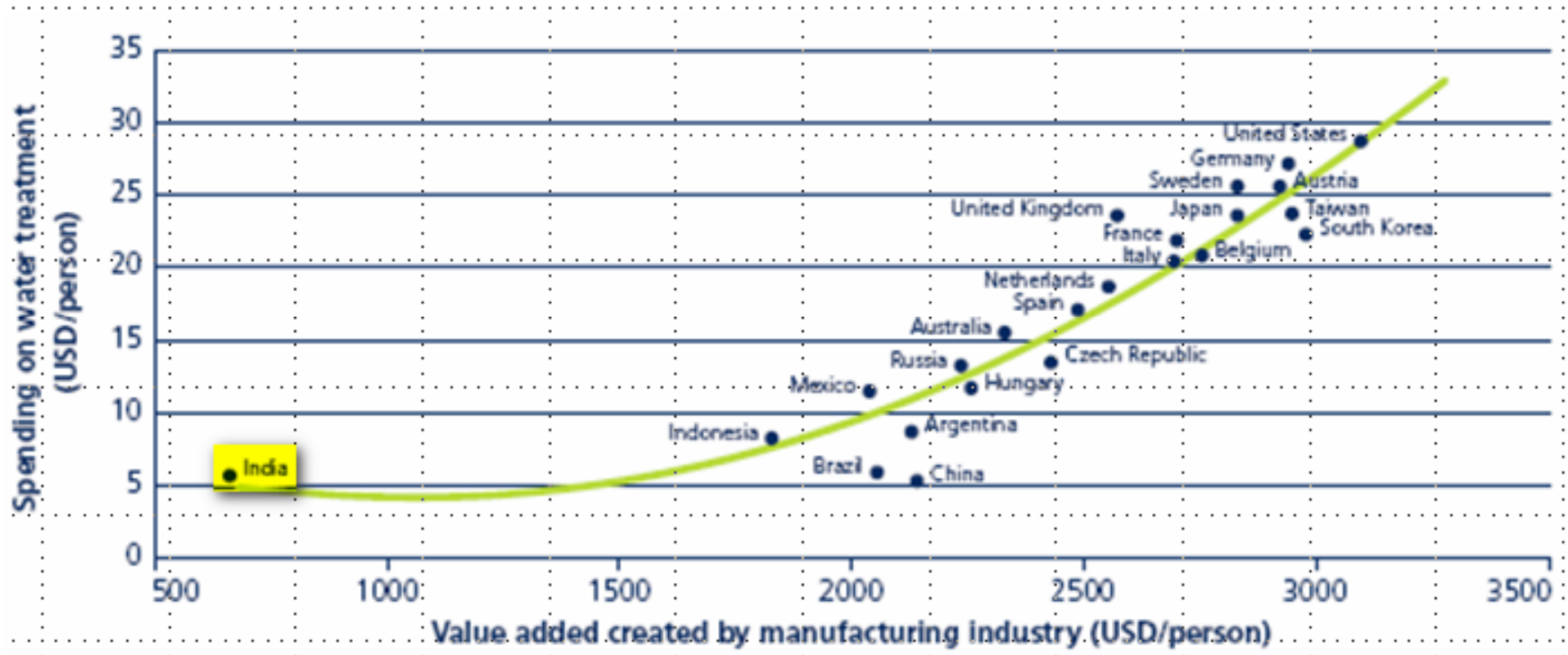
Segment	Sub-segment	US\$ mn	Comments
Supply side			
Agriculture	Irrigation	17,486	Complete government control, planning commission estimates
Residential/Industrial	Water supply, sanitation	8,927	Complete government control, planning commission estimates
Residential	Desalination	299	Based on 2.5 bn l/d desalination capacity, 10 year completion
Residential/Industrial	Waste water disposal	403	Estimate assuming Rs2.8 mn per mld, 4 year completion
Sub-total		27,114	
Demand side			
Agriculture	Pumps	761	Private, fragmented industry
Agriculture	Irrigation equipments	370	Private, fragmented industry
Residential	Bottled water	696	Private, fragmented industry, MNCs, large Indian companies present
Residential	Purifiers	668	Private, fragmented industry
Residential/Industrial	City water distribution	646	Jamshedpur private; Nagpur, Khandwa, Latur, etc. have started pilots
Sub-total		3,142	
Total		30,256	

Source: Kotak Institutional Equities estimates

Water Demand / Usage: 80% for Irrigation

Use	Year 2010		
	Surface water	Ground water	Total water use
	km ³	km ³	km ³
Irrigation	330	213	543
Domestic	23	19	42
Industries	26	11	37
Power	14	4	18
Inland Navigation	7		7
Environment & Ecology	5		5
Evaporation Losses	42		42
TOTAL			694

What To Expect As We Manufacture More Stuff

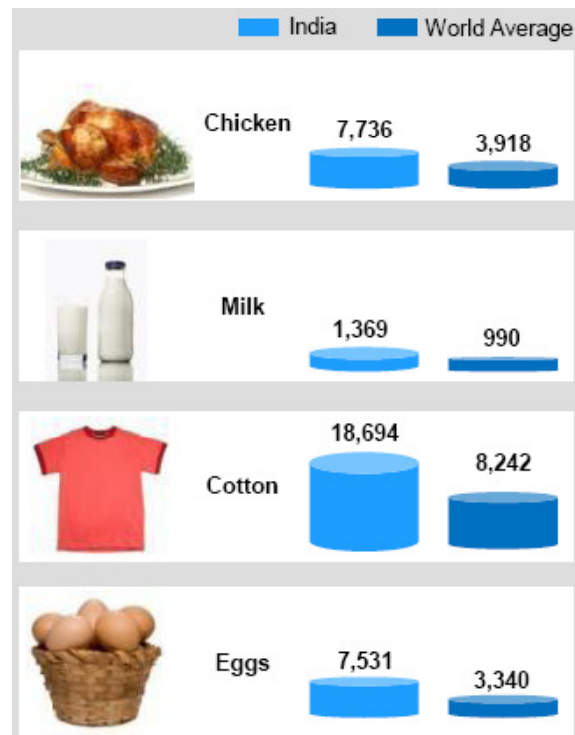


Differing Degrees of Use & Reuse

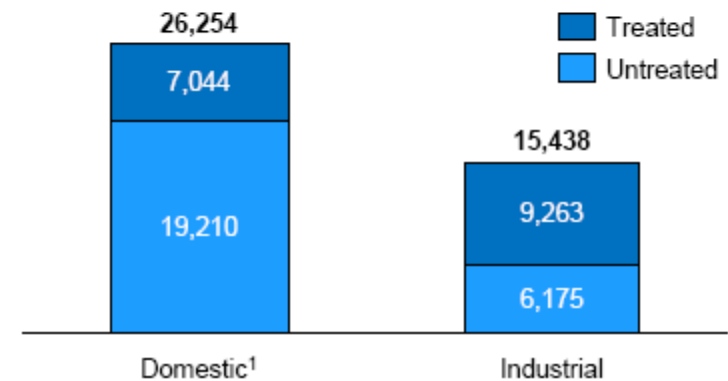
Industry	Avg Vol of WW/unit of product		% Reuse achievable
Thermal Power Plant	1550000	L/hr/MW	98
Pulp & Paper	2500000	L/ton	50
Iron & Steel	1500000	L/ton	40
Pharmaceutical	45000	L/kg	40
Distillery	15	/L of alcohol	25
Textile	250	L/kg of cloth	15
Tannery	34	L/kg of raw hide	12

Inefficient Use & Reuse: Agriculture, Wastewater

Water Footprint ⁴ (‘000 liters/mt)		
Crop	India	Global
Wheat	1,654	1,334
Rice ⁵	2,850	2,291
Sugarcane	159	175



Sectoral Wastewater Generation, 2003 (MM liters/day)

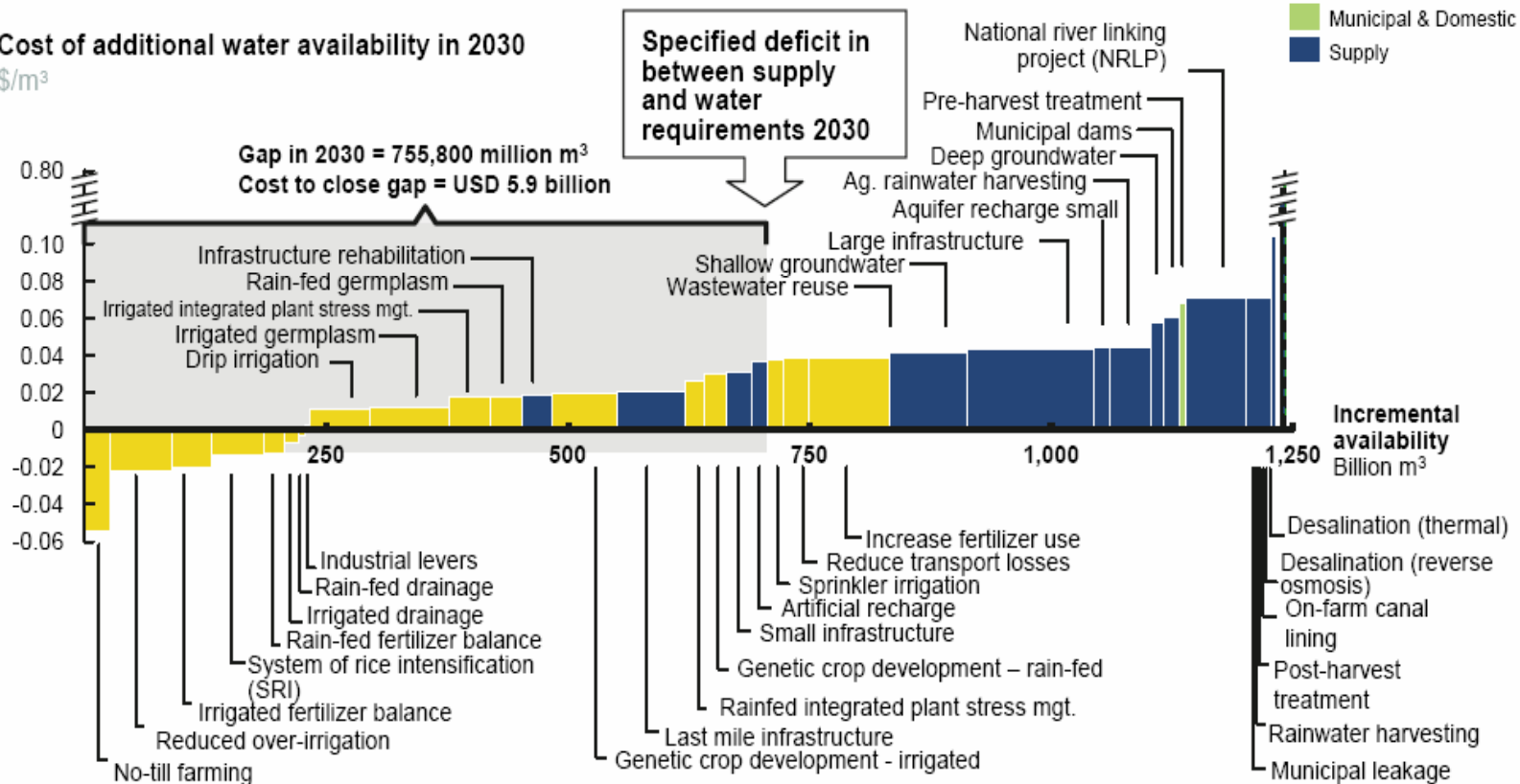


A Wide Variety of (Supply & Demand) Options

Exhibit V

India – Water availability cost curve

Cost of additional water availability in 2030
\$/m³



SOURCE: 2030 Water Resources Group

Grand Challenges: Water In India

- ▶ Efficiency (*reduce demand*)
 - ▶ Irrigation
 - ▶ Wastewater treatment
 - ▶ Infrastructure (40%+ water lost to leakage ?!)

- ▶ Availability (*increase supply*)
 - ▶ Water harvesting
 - ▶ Desalination
 - ▶ Purification (contaminants: heavy metals, pesticides, effluents, ...)

- ▶ ‘Virtual Water’
 - ▶ Embedded water in exported goods
 - ▶ Eg: 1 tonne of cloves = 61,000 m³ of virtual water

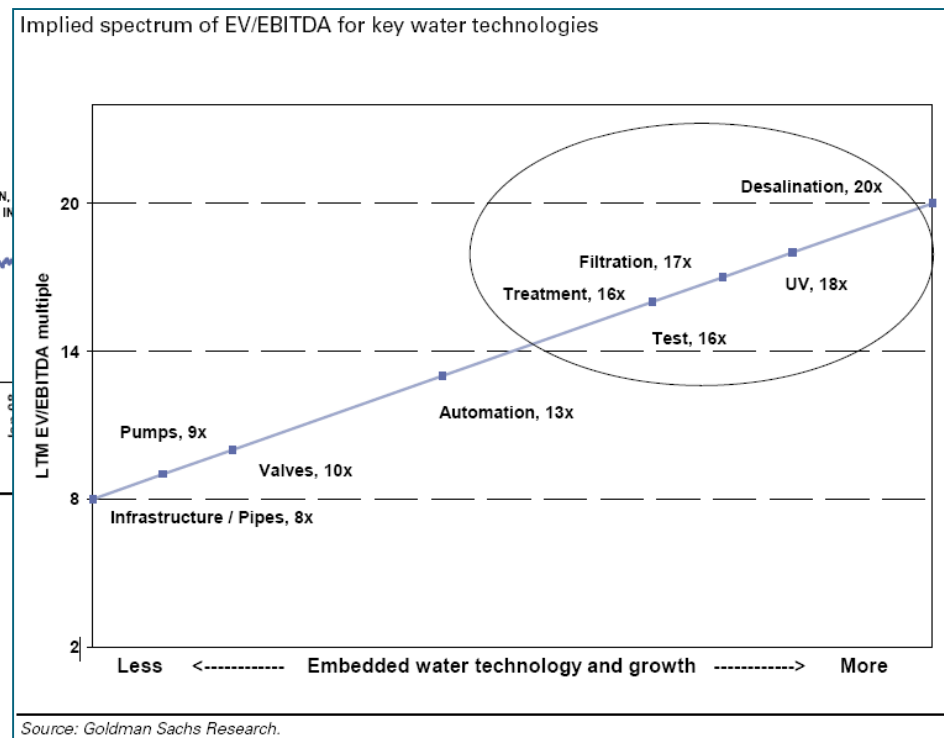
Investing in Water

A Bull Market in Water

Exhibit 3: Water sector outperformance relative to the S&P 500
 January 2000 = 100; Equal-weighted performance

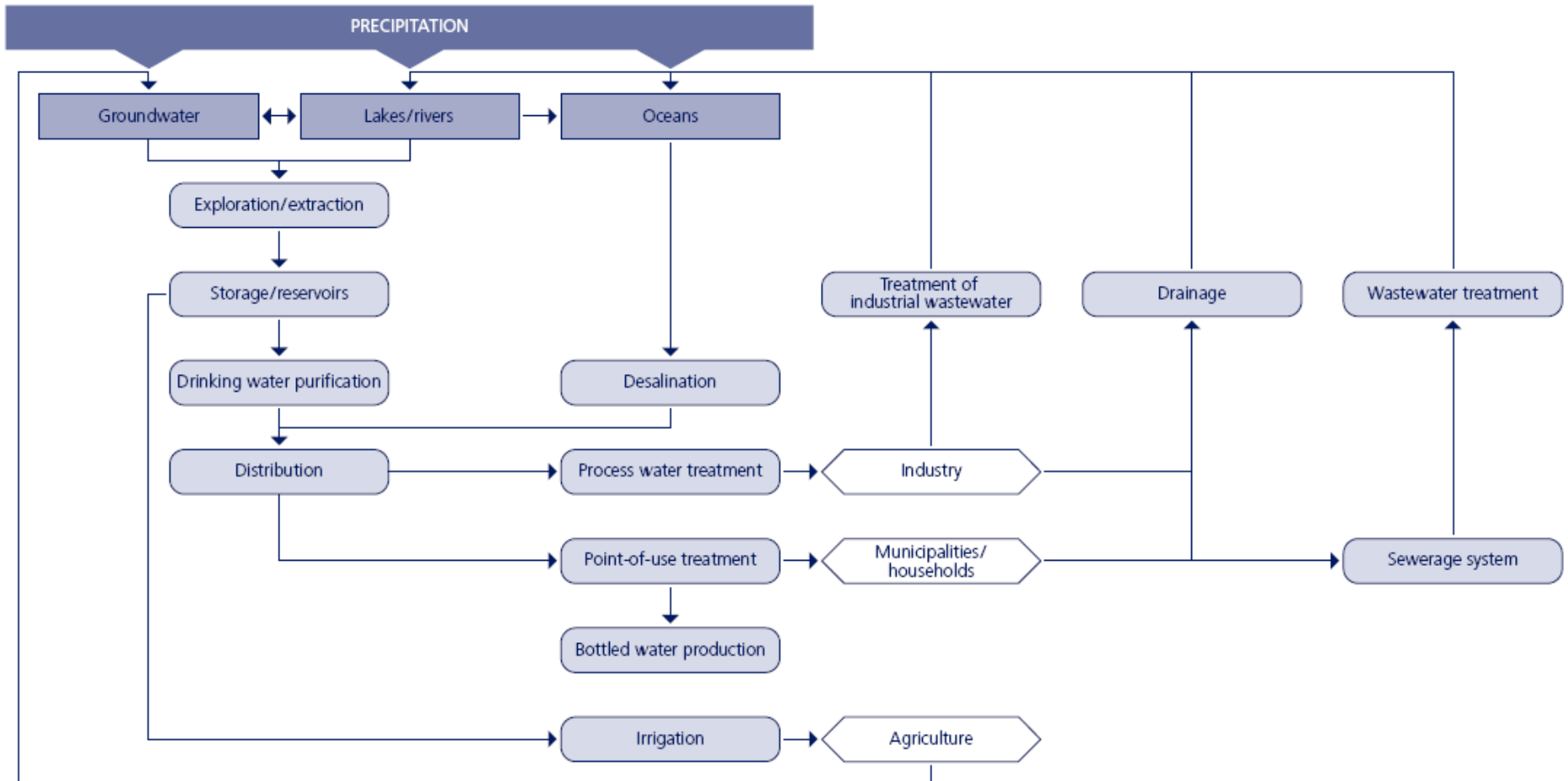


Source: FactSet, Goldman Sachs Research.



Source: Goldman Sachs Research.

Investing Across the Water Value Chain



Plethora of Investment Options

- ▶ **Indices/ETFs**
 - ▶ PowerShares Water Resource Portfolio
 - ▶ Claymore S&P Global Water Index Fund
 - ▶ First Trust ISE Water Index Fund

- ▶ **Listed companies**
 - ▶ 400+ publicly traded 'water' stocks on global exchanges
 - ▶ M&A, IPO, municipal bonds, ...

- ▶ **Private companies**
 - ▶ Private Equity
 - ▶ Venture Cap (\$150M - \$250M invested in water startups each year)
 - ▶ PoC/Lab2Mkt

Water Startups funded by VCs in 2009

Company	Funding (U\$M)	Water Sector	Country
Aquapure	0.7	Mechanical	Israel
BPT	12.0	Filtration	Israel
Checklight	2.0	Contaminated Detection	Israel
Inge AG	6.9	Filtration	Germany
Microvi Biotech	1.0	Purification	US
Nordaq	0.7	Filtration	France
P2i	6.7	Filtration	UK
Rotec	0.1	Filtration	Israel
Checklight	0.5	Contaminated Detection	Israel
EcoSolids Intl	1.1	Biological	UK
Guang Bossco EPT	2.9	Other	China
HydroPoint Data Syst	8.0	Smart Metering And Control	US
i20 Water	6.3	Smart Metering And Control	UK
Shaw Water Engrg	1.2	Contaminated Detection	UK
Sorbisense	0.5	Contaminated Detection	DK
WaterHealth India	2.6	Purification	India
Xeros	1.5	Water Saving Appliances	UK
Advanced Hydro	0.5	Filtration	US
Amiad Filtration Syst	9.0	Filtration	Israel
AtraNova	0.7	Mechanical	UK
Bluewater Bio Intl	3.2	Biological	UK
Oasys	10.0	Desalination	US
Pump Engineering Inc,		Desalination	US
AquaVenture	15.0	Desalination	US
Triton-Format	12.0	Other	Germany
Water Health Intl	10.0	Purification	US
Micromedia Filtration	3.0	Purification	US
HydroPhoton	2.0	Purification	US

Watch:
Israel & Singapore

Water Investments in India

▶ Stocks

- ▶ IPO:VA Tech Wabag (NSE: VATECH) raised ~ Rs 470 crore
- ▶ Thermax, Tata Chemicals, ... (but what % of value is water-related?)

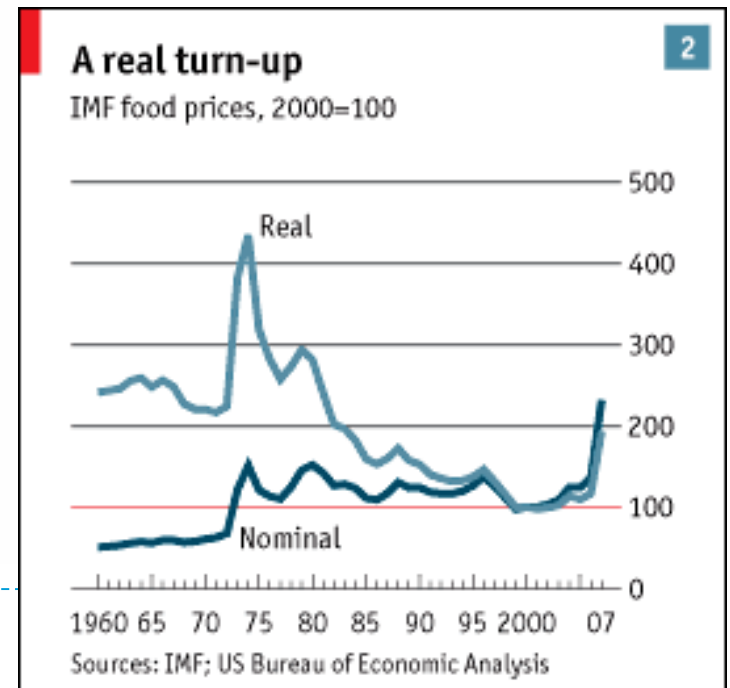
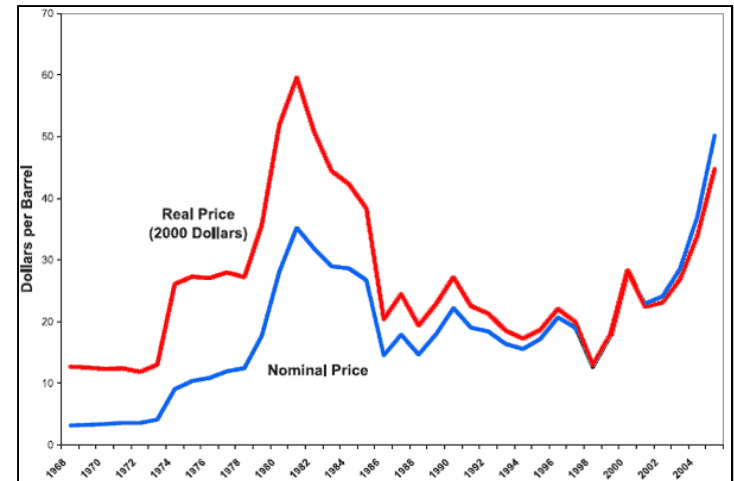
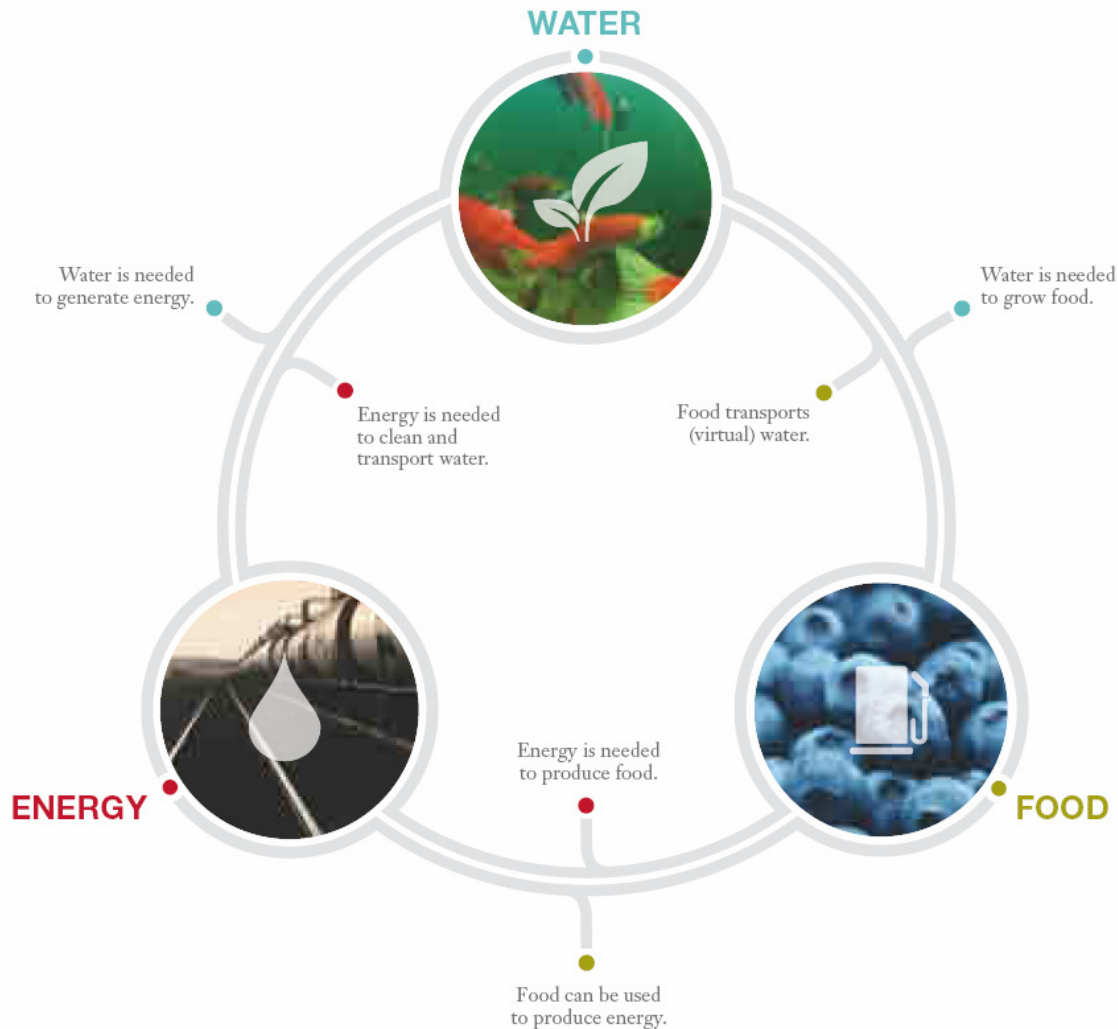
▶ PE

- ▶ Aqua Designs (Rs 55 cr from Peepul Capital)
- ▶ UEM Group (Rs 90 cr from India Value Fund)
- ▶ Concord Enviro Systems (Rs 45 cr from Sage Capital)

▶ VC

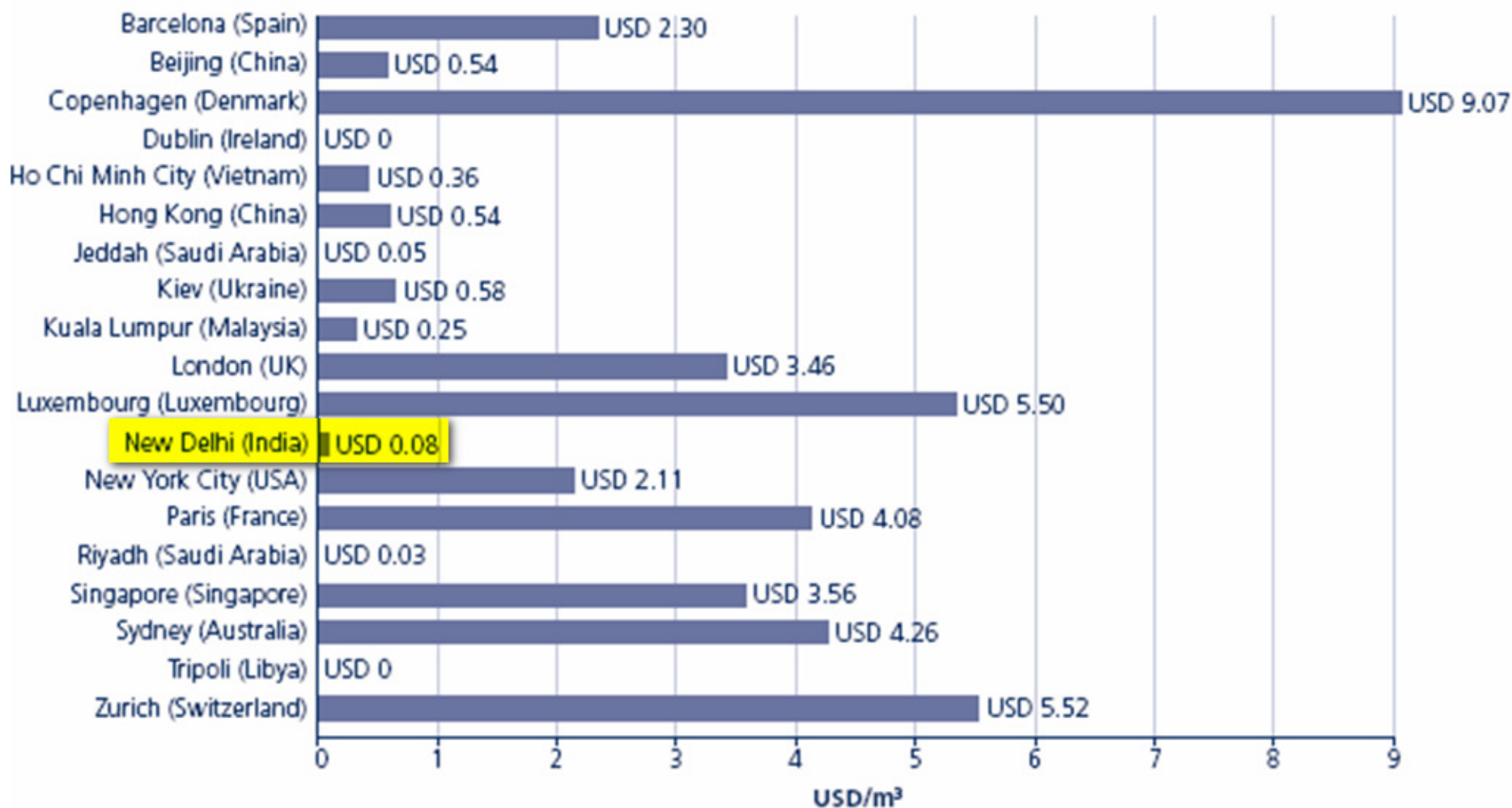
- ▶ Environment Planning Group Limited (Acumen Fund)
- ▶ Sarvajal (Piramal)

Food – Water – Energy Nexus

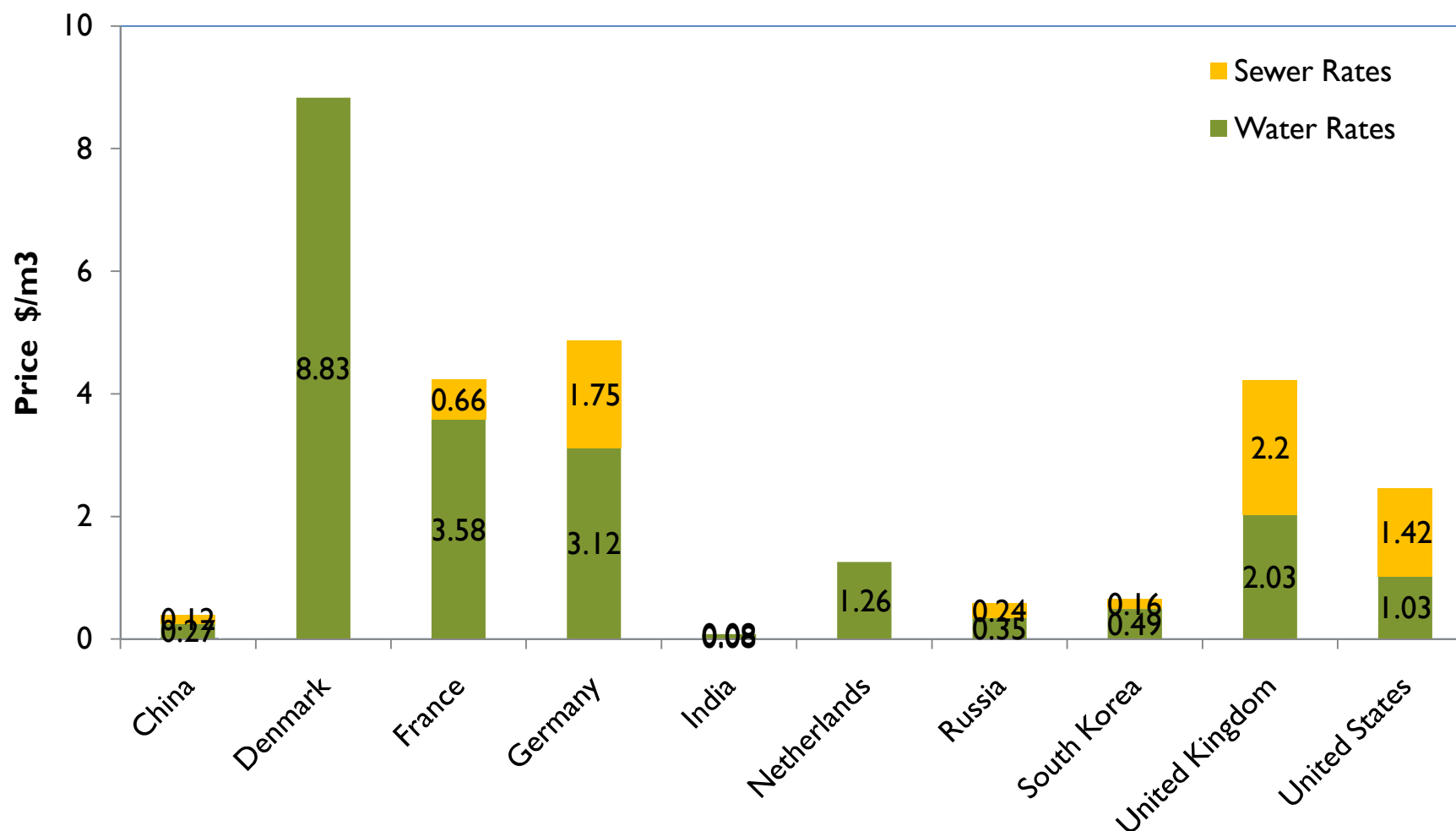


Opportunities for Impact - Pricing

Water Pricing: Too Cheap?



Water Pricing: Dump At Will



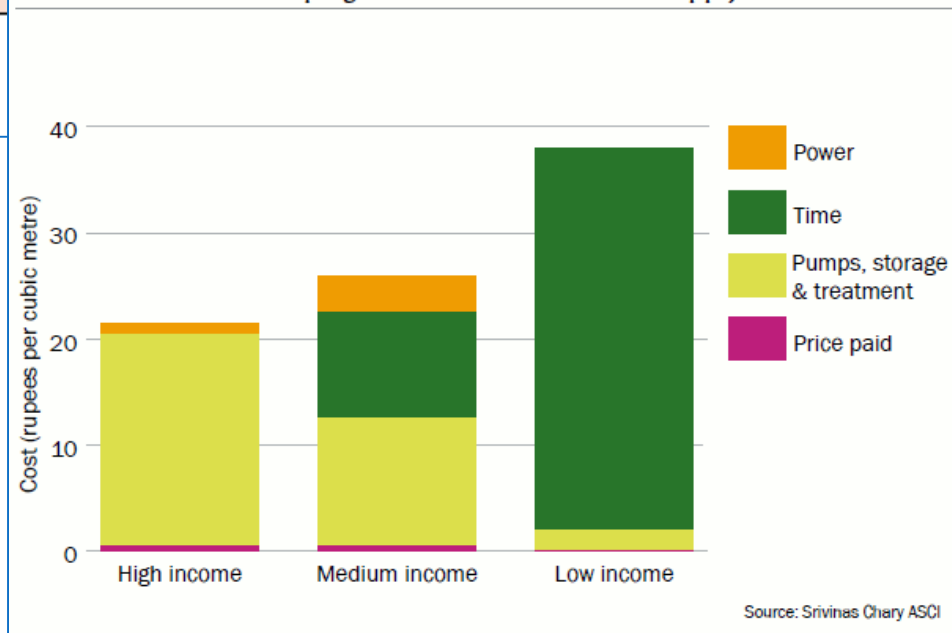
What If Water Cost 10x? 100x?

Price of water according to its source

Water source	Rs/m ³	US\$/m ³
Ground water	-	-
Municipal	5	0.1
Tanker	80	1.7
Bottled water	>12,000	>261.0

Source: Kotak Institutional Equities estimates

The cost of coping with intermittent water supply in India



UN: "Clean Water is a Fundamental Human Right"

Venture Opportunities

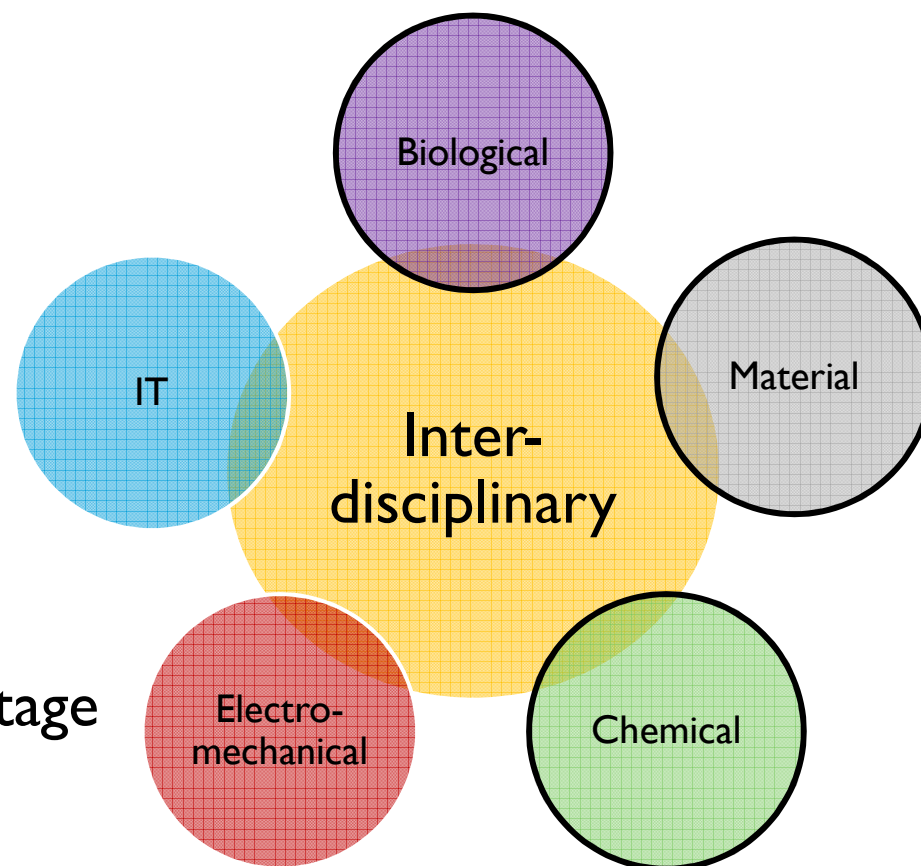
- ▶ Metering/Billing
 - ▶ Hardware, software
- ▶ Testing/Diagnostics
 - ▶ Real-time, affordable
- ▶ Pricing algorithms
 - ▶ Availability, quality, efficiency of use/reuse, opportunity cost, etc.
- ▶ Transport!
 - ▶ S2C Global: Sell water from Alaska in Mumbai (transport via VLCCs)



Opportunities for Impact - Technology

Water Technology – Goals, Categories

- ▶ Purify water
 - ▶ Potable water
 - ▶ Other domestic, municipal use
 - ▶ Industrial use
- ▶ Treat, reuse wastewater
 - ▶ Municipal
 - ▶ Industrial
- ▶ Reduce water loss, theft, wastage
- ▶ Analyze, test water



Ideas for Tech Products/Ventures ...

- ▶ Hydrocarbon removal / storm water treatment
 - ▶ Residential & industrial storm water runoff
 - ▶ Low energy + High flow rate + Custom solutions

 - ▶ Heavy metal removal
 - ▶ Regional contamination (eg. Arsenic in West Bengal)
 - ▶ Add-on modules to home water purifiers?
 - ▶ Effluents (eg. Mercury from coal-fired power plants)
 - ▶ An extra phase in an ETP ?

 - ▶ Evaporation losses
 - ▶ Dams & reservoirs
 - ▶ Especially in summer!
 - ▶ Significantly large (vs. domestic/industrial water use)
-

... Ideas for Tech Products/Ventures

- ▶ Flood protection
 - ▶ Inflatable bags with super absorbing polymers
- ▶ Leak detection & prevention
 - ▶ Municipal distribution systems
- ▶ Energy-Water nexus
 - ▶ Energy is needed to capture, purify, transport and use water
 - ▶ Water is needed to extract, process and refine fuels

Where Are The Real Opportunities?

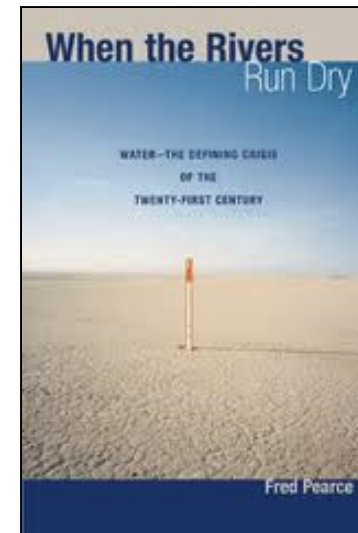
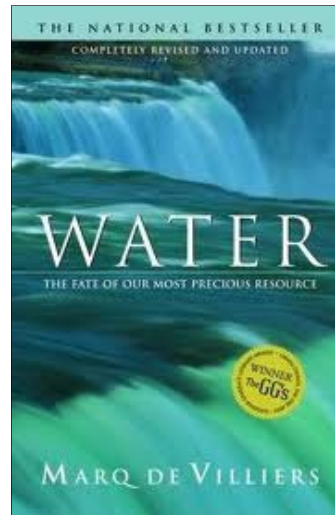
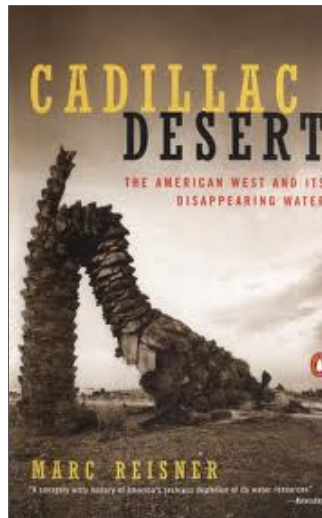
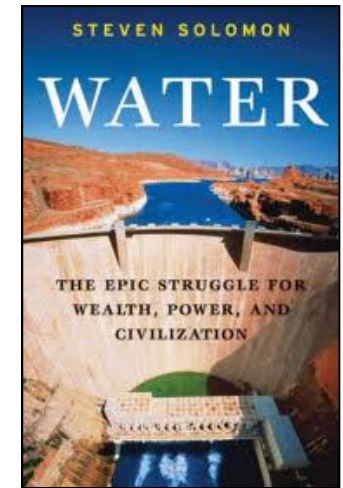
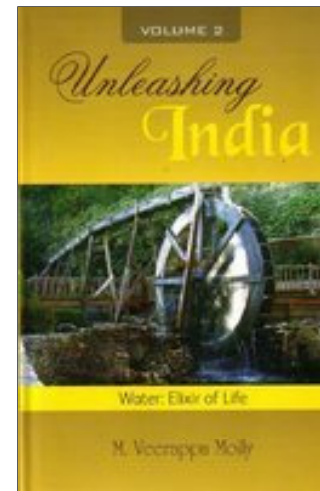
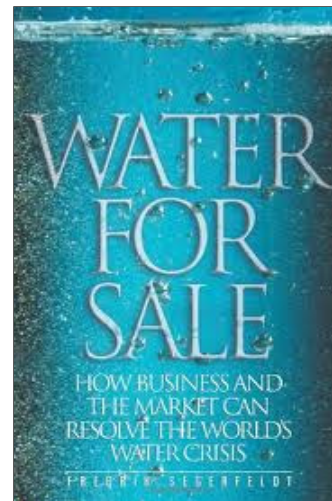
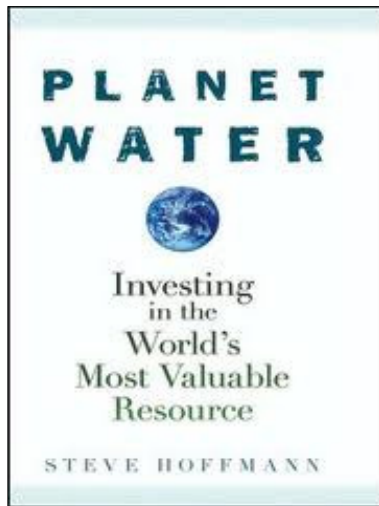
Anand Prakash, FE Clean Energy Asia

“Water is like waste. Anybody living in any city in India knows that this is the future. But the problem for water is same as problem for electricity in dealing with municipalities so while the opportunity is tremendous, I do not know when it is going to turn into a viable business model.”

Asit Biswas, Winner of the Stockholm Water Prize

“The problem we have is not scarcity but mismanagement. The solution to shortages is simple: Water must have a price. Anything that is free won't be used prudently.”

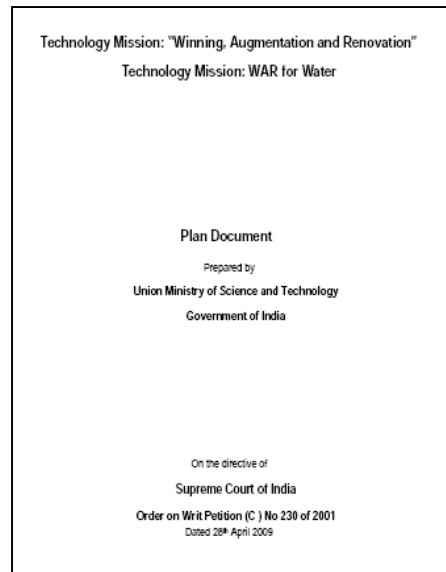
Learn more: Books @ VC Library



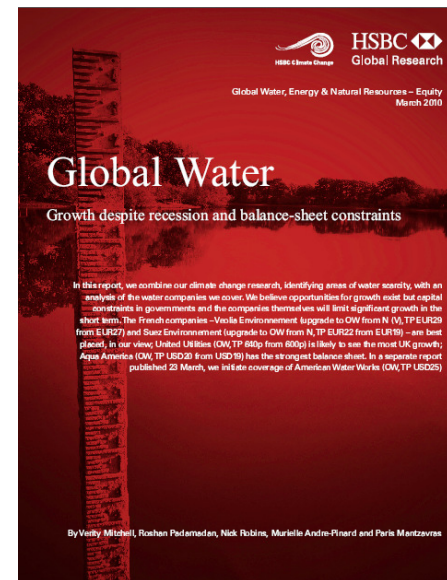
Learn more: Reports @ VC Library



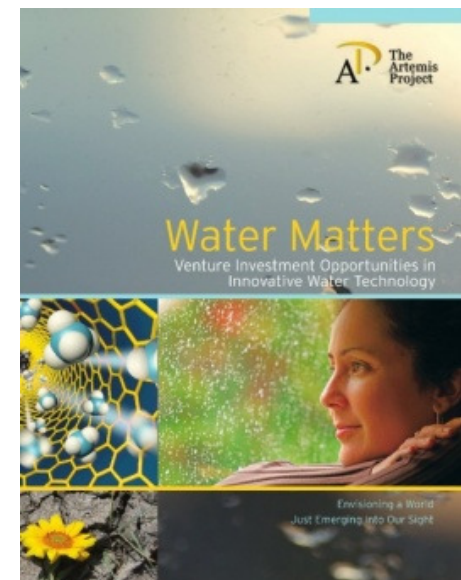
McKinsey



DST



HSBC



Artemis Project

Next Talk:

(60) Water Technologies/Startups

(Tentative: Monday, December 20)



Thank You.

water@venturecenter.co.in

Slides: <http://venturecenter.co.in/research.php>

Climate Change → Water Stress & Scarcity

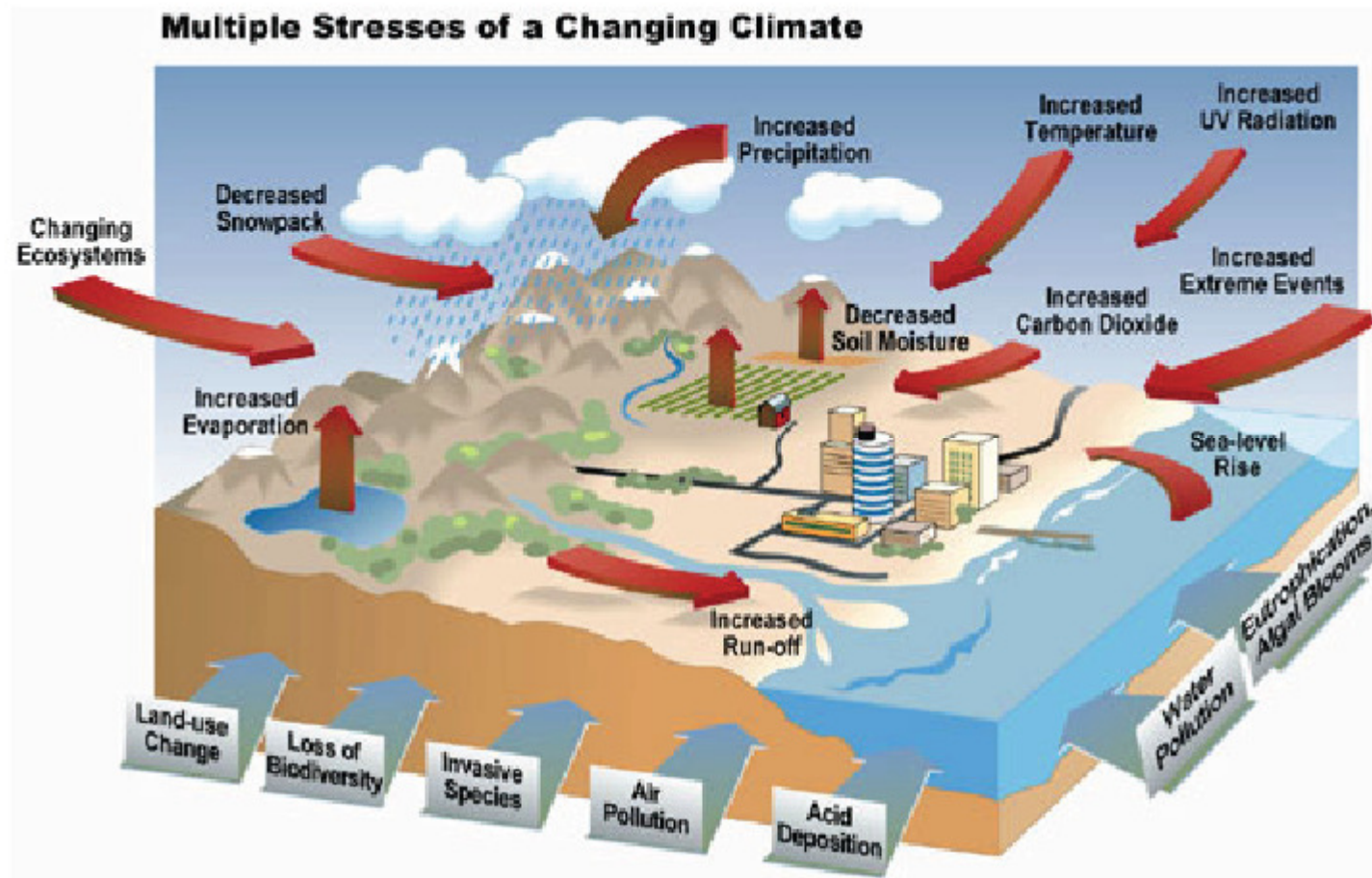
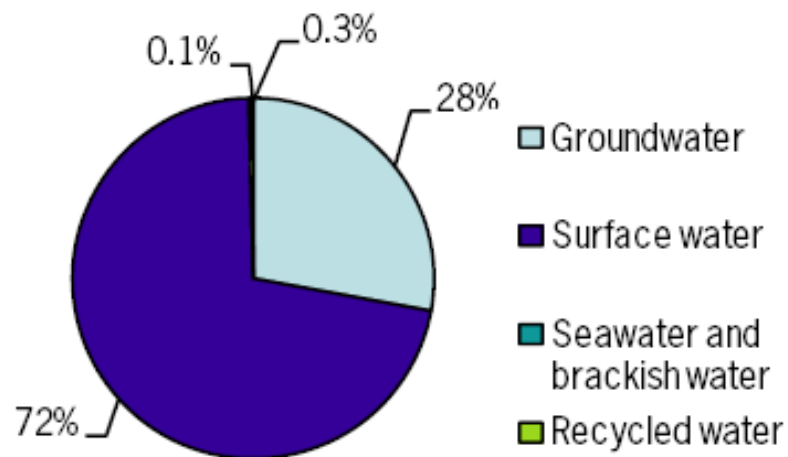


Figure 3: Source: Responding to Climate Change Impacts to California's Water Resources, testimony on August 23, 2003, John T. Andrew of the California Department of Water Resources

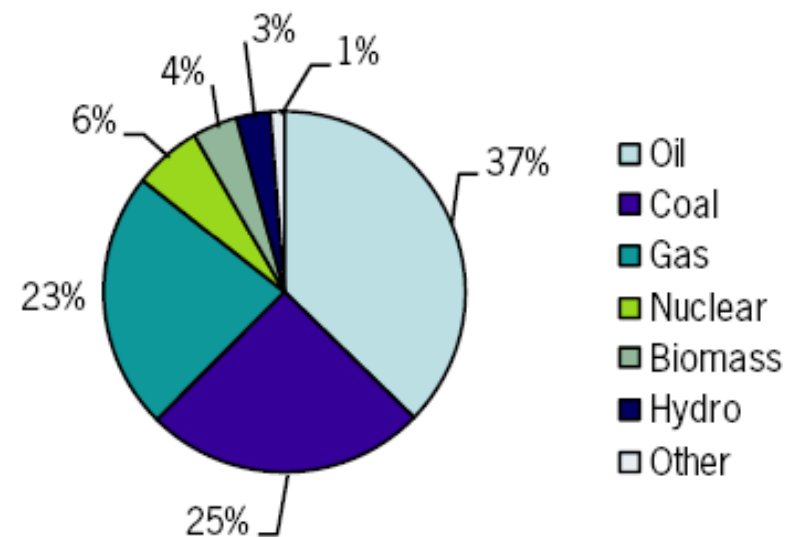
Poor Diversity of Water Supply

3-1: World water sources: undiversified



Source: U.N. Food and Agriculture Organization.

3-2: World energy sources: diversified



Source: BP 2006 Statistical Review.