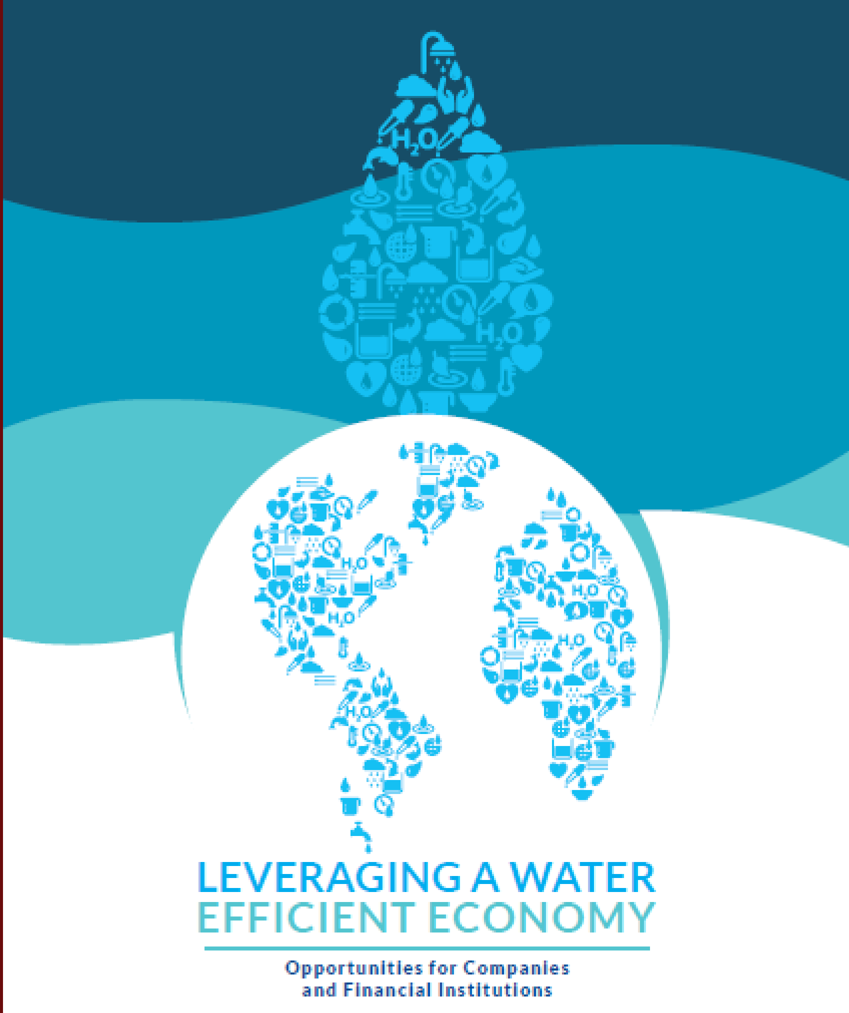
LEVERAGING A WATER EFFICIENT ECONOMY

Opportunities for Companies and Financial Institutions

Gustavo Pimentel
gpimentel@sitawi,net



June 14th, 2016

german cooperation
DEUTSCHE ZUSAMMENARBEIT

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

EMERGING MARKETS DIALOGUE ON FINANCE

cebds

PREPARADO POR:

SITAWI FINANÇAS do BEM

The objective is to assess and highlight business **opportunities for financial institutions** in the transition to a more water-efficient economy in Brazil

OBJECTIVES

- Select relevant water conservation technologies or business models and analyse their introduction in critical sectors and regions in Brazil
- Identify viable and more efficient technologies and estimate their investment gap
- **Identify financing opportunities for financial institutions**

SCOPE AND METHOD

- 9 sectors and 14 technologies
- Secondary research
- Water specialists' collaboration
- Interviews with relevant agents (sector associations, equipment and technologies suppliers)

The framework to analyze each technology was adapted from academics

Demand management

Usage optimization

Consumption Segmentation
Loss Management
Process and Equipment Change
Consumption and Effluents Indices

Supply management

Supply options

Effluents Reuse
Rainwater
Desalinization
Groundwater Recharge

Water Management Program

Source: Adapted from Mierzwa - Hespanhol (2007)

Each technology was further scrutinized based on a set of qualitative criteria prior to its feasibility analysis

<table>
<tr><th colspan="3">TECHNOLOGY</th></tr>
<tr><td>Sector Applied</td><td>Technology History</td><td>How It Works and Saves Water</td></tr>
<tr><td colspan="2">Process and Equipment Change</td><td rowspan="4">PICTURE</td></tr>
<tr><td colspan="2">Consumption and Effluents Indices</td></tr>
<tr><td colspan="2">Risks Mitigated</td></tr>
<tr><td colspan="2">Externalities / Additional Influence</td></tr>
<tr><td>Comparison with
Currently Used Technology</td><td>Main Costs Drivers and Changes</td><td>Current Suppliers</td></tr>
</table>

9 high water usage sectors and 14 water-conservation technologies were selected

#	Technology	Cattle Farming	Agriculture	Food Processing	Automotive	Petrochemical	Steel and Metallurgy	Mining	Beverages	Pulp and Paper
1	Hydrometer for Consumption Segmentation			X	X	X	X	X	X	X
2	Drip Irrigation		X							
3	Dust Disperser							X		
4	Sewage for Aquaculture	X								
5	Evaporation to Vinasse Concentration			X						
6	Water Loss Detector			X	X	X	X	X	X	X
7	Chemical Free Cooling Tower			X	X	X	X	X		X
8	Rainwater Harvesting			X	X	X	X	X	X	X
9	Ozone Treatment			X					X	
10	Artificial Wetlands	X	X	X	X	X	X	X	X	X
11	Ultra Filtration	X	X	X	X	X	X	X	X	X
12	Reverse Osmosis			X	X	X	X	X	X	X
13	Thermal Distillation			X	X	X	X	X	X	X
14	Reforestation	X	X	X	X	X	X	X	X	X

The 14 technologies were categorized according to the benefit generated: Reuse, Economy or Availability

#	Technology	Reuse	Economy	Availability
1	Hydrometer for Consumption Segmentation		X	
2	Drip Irrigation		X	
3	Dust Disperser		X	
4	Sewage for Aquaculture	X		
5	Evaporation to Vinasse Concentration	X		
6	Water Loss Detector		X	
7	Chemical Free Cooling Tower		X	
8	Rainwater Harvesting			X
9	Ozone Treatment		X	
10	Artificial Wetlands	X		
11	Ultra Filtration	X		X
12	Reverse Osmosis	X		X
13	Thermal Distillation	X		X
14	Reforestation			X

Source: SITAWI Finance for Good

giz CEBDS SITAWI FINANCEforGOOD

The economic sectors use water of different sources, degree of purity and total costs

COST OF PURCHASE/ADDUCTION

- Tariff charged by the water provider
- Public price for water usage, depending on the water basin
- Purchase price from other industries with own treatment facilities
- Cost of infrastructure and energy for water pumping

+

COST OF TREATMENT

- Depends on the quality of the water abstracted/purchased vs the quality required by the production process
- In case of a WTP, includes costs with chemicals, electricity and storage

+

COST OF DISPOSAL

- Function of the quality of the effluent released and the quality of the receiving body
- Defined according to the national classification of economic activities of the Brazilian Institute of Geography and Statistics - IBGE

=

TOTAL WATER COST

Total water cost must be compared to the estimated water break-even cost (WBC) to assess whether the investment has economic and financial benefits

When the Water Break Even Cost is lower than its Total Cost, the technology is potentially viable

Investment in Technology

Average CAPEX for a typical project

+

Operational Cost

Besides OPEX, includes other costs and benefits generated from the technology implementation, such as : input prices, productivity gains, environmental risks mitigation, etc

→

Water consumption reduction

Potential for water reused, saved or treated by the implementation of a medium sized project.

→

Water Break Even Cost

The minimum cost of saved water that compensate CAPEX and OPEX is called **Water Break Even Cost**, for a period of 15 years and taking into account the different costs and benefits associated to the implementation of the technology

IF **Water Break Even Cost** < **Water Total Cost** → **Technologic is Viable**

In order to estimate the market potential, we looked for the number, size and location of companies among other factors

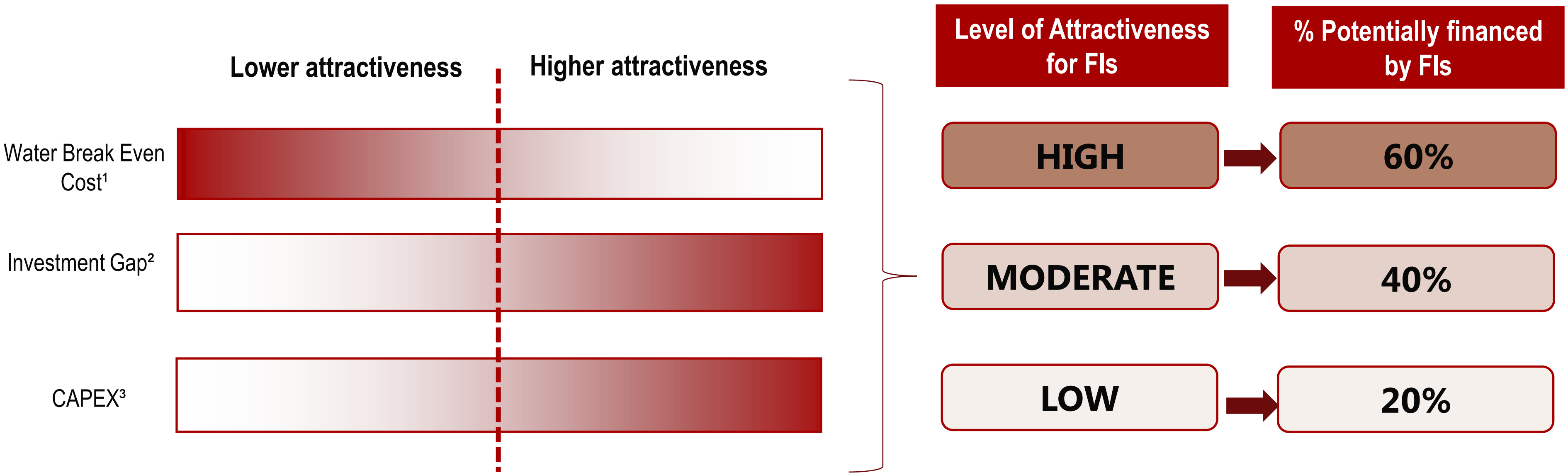
MARKET POTENTIAL

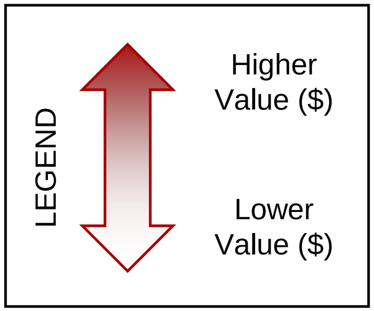
	SECTOR	SIZE	LOCATION	NUMBER OF COMPANIES	LEVEL OF USAGE
RATIONAL	Some technologies tend to naturally apply just to some sectors, E.g.: Irrigation to agriculture	Due to high average CAPEX or economies of scale in its use, we expect that some technologies apply only to medium/large plants	Some technologies depend on natural resources availability in a specific location, E.g.: Desalinisation is only viable close to the sea	Mapping of number of companies and production unit s that comply with sector, size and localization criteria for each technology,	Among the companies able to implement certain technologies, we estimated the percentage that already adopt these technologies, to avoid double counting
SOURC ES	Equipment suppliers, specialists and secondary research	Data from SIDRA/IBGE, The size classification also comes from IBGE	Data from SIDRA/RAIS of IBGE	Data from SIDRA/RAIS of IBGE, Secondary research	Based on secondary research and specialists opinion
OBSERVATION S	Most technologies are broad, not sector-specific		In cases where the technology was only feasible in remote areas, transportation infra costs were included in the CAPEX	Because of lack of data, not all the technologies had their market potential calculated this way, Proxies were used when necessary,	Technologies still incipiently used in Brazil were assumed as not yet implemented by the analysed companies

Source: SITAWI Finance for Good

giz CEBDS SITAWI FINANCEforGOOD

Attractiveness for FIs was estimated by projects CAPEX, Water Break Even Cost and Investment Gap





1. The smaller the Water Break Even Cost, the more feasible the technology and more positive the credit risk profile
2. The bigger the Investment Gap, the more efficient becomes the development of capabilities or products by FIs
3. Technologies that demand a higher initial investment, that is, higher ratios between Capex and Opex, are more likely to demand external funding

Source: SITAWI Finance for Good

giz CEBDS SITAWI FINANCEforGOOD

To look into each technology, we developed a framework with the main assumptions used (1)

DRIP IRRIGATION FOR SUGARCANE			
FEASIBILITY ANALYSIS		**MARKET POTENTIAL**	
1, GENERAL PARAMETERS			
A – CAPEX (R$)	R$ 4,000,000	E - Size of Companies that may Use the Technology	S/M/L
B – Annual OPEX (R$)	R$ 684,000	Applicable Sectors	Agriculture
C – Annual Water Saving per Equipment (m^3)	824,000		
2, OTHER COSTS OR BENEFITS OF THE TECHNOLOGY		G - Companies that Already Use the Technology (%)	0%
Productivity gains in comparison to central pivot		H - Number of Equipment	542
		I - Total Water Saving with the Technology (m^3)	447,066,675
		2, SPECIFIC PARAMETER OF THE TECHNOLOGY	
		J – Sugar Plantations Irrigated with Central Pivot (1.000 hectares)	542
D – Water Break Even Cost ((R$/$m^3$)	**R$ 1,21**	**K – Investment Gap**	**R$ 2,2 bi**

3, REFERENCES AND ASSUMPTIONS

A - Capex to install the technology in 1,000 hectares. Information provided by Amaggi (user).

B - Considering reduction in energy and maintenance costs for 1,000 hectares. Based on Amaggi.

C - Water saving in comparison to central pivot and rainfed irrigation for 1,000 hectares, assuming a productivity of 4 ton/ha and reduction of 206 m^3/ha of water.

D - Break Even cost of water to enable the investment in drip irrigation in comparison to central pivot.

E - Technology applicable to companies of all sizes.

F - Technology directed to soy agriculture with central pivot.

G - We assumed that the use of this model of irrigation is close to zero.

H - Each irrigation equipment corresponds to 1,000 hectares. The market potential is equal to the area of soy plantations that are irrigated with central pivots (J).

I - Potential market for the technology (H) times water saving provided by each equipment (C).

J - Soy production in 2015 was 95 Million tons (Conab, 2016). Given that 12% of soy crops are irrigated, and 19% of this amount is irrigated with central pivot, production in such model is 2,167,596 tons. Annual production of soy per hectare is 4 tons. Therefore, the area of soy plantations that are irrigated with central pivots is 542 thousand hectares.

K - Based on the number of equipment potentially sold (I), times CAPEX (A).

To look into each technology, we developed a framework with the main assumptions used (2)

HYDROMETER FOR CONSUMPTION SEGMENTATION			
FEASIBILITY ANALYSIS		**MARKET POTENTIAL**	
1, GENERAL PARAMETERS			
A – CAPEX (R$)	R$ 215,280	E - Size of Companies that may Use the Technology	S/M/L
B – Annual OPEX (R$)	R$ 0	Applicable Sectors	All but Agriculture and Cattle
C – Annual Water Saving per Equipment (m^3)	12,000		
2, OTHER COSTS OR BENEFITS OF THE TECHNOLOGY		G - Companies that Already Use the Technology (%)	50%
There are no other costs or benefits with the technology		H - Number of Equipment	89,799
		I - Total Water Saving with the Technology (m^3)	180,000
		2, SPECIFIC PARAMETER OF THE TECHNOLOGY	
		J - Companies Concerned about Water Scarcity	70%
D – Water Break Even Cost ((R$/$m^3$)	**R$ 1.21**	**K – Investment Gap**	**R$ 1,288 MM**

3, REFERENCES AND ASSUMPTIONS

A - CAPEX for 15 hydrometers with capacity of 1.5 m^3/hour. This technology does not have OPEX; however, the equipment must be replaced every 2 years. Thus, CAPEX for the period of 15 years is R$ 215,280.

B - The technology does not have OPEX.

C - The technology can reduce 10% of water consumption of a company. In the model we assumed a company that consumes 120,000 m^3/year, thus, water saving is equal to 12,000 m^3/year.

D – Break Even cost of water to enable investments in the technology.

E – Technology applicable to companies of all sizes.

F – Technology applicable to all industrial sectors.

G - We estimated that around 50% of companies already have initiatives to reduce their water consumption.

H - There are 18,735 companies in the sectors appointed in (F), from which 4,137 are medium companies and 1,200 are large companies. We assumed that each medium company can implement 15 hydrometers, small companies can implement half of that and large companies three times more, which results in 88,799 equipment. Data taken from SIDRA/IBGE.

I - We obtained the volume of water saving multiplying the number of equipment (H) potentially commercialized by the water saving generated by each hydrometer.

K - To obtain the investment gap we multiplied the number of equipment by the cost of each equipment for a period of 15 years.

giz CEBDS SITAWI FINANCEforGOOD

The potential annual water saving of the 14 technologies amounts to 19% of water withdrawn for industry and 3% for agriculture

	m^3/s	$m^3/year$	% of saving with technologies
Water withdrawal in Brazil in 2010 - industry	403	12,720,837,688	19%
Water consumption in Brazil in 2010 - - industry	197	6,223,722,105	39%
Water withdrawal in Brazil in 2010 - agriculture	1,281	40,393,831,680	3%
Water consumption in Brazil in 2010 - agriculture	836	26,361,573,120	5%

Sources: SITAWI Finance for Good, Agência Nacional de Águas (2010)

giz CEBDS SITAWI FINANCEforGOOD

The market potential for these technologies is R$ 49 bi, of which R$ 25 bi could be financed by FIs

Technology	Average Capex for project (R$)	Water Break Even Cost (R$ m^3)	Investment gap (R$ million)	Attractiveness for FI lending
Hydrometer for Consumption Segmentation	215,280	1.21	1,290	Low
Drip Irrigation for Sugar Cane	4,000,000	0.12	497	Moderate
Drip Irrigation for Soybeans	4,000,000	0.94	2,168	High
Dust Disperser	-	5.41	606	Low
Sewage for aquaculture	21,720	10.68	453	Low
Evaporation to Vinasse Concentration	30,000,000	1.38	3,780	High
Water Loss Detector	14,000	1.74	82	Low
Chemical Free Cooling Tower	310,000	0	10,809	Moderate
Rainwater Harvesting	9,150	8,20	321	Low
Ozone Treatment	150,000	3.64	21	Low
Artificial Wetlands	1,500,000	0.84	764	Moderate
Ultra Filtration	33,000,000	0.46	1,727	High
Reverse Osmosis	7,100,000	0.99	7,895	High
Thermal Distillation	8,500,000	1.80	15,735	High
Reforestation	133,000,000	1.26	2,660	Moderate
		TOTAL	48,808	

The assessment of attractiveness for FIs lending was based on projects Capex, Break-even Cost and Investment gap

Attractiveness for FI lending	Investment gap (R$ million)	Potentially financed by FIs (%)	Value of the opportunity for FIs (R$ million)
High	31,305	60%	18,783
Moderate	14,730	40%	5,892
Low	2,773	20%	555
TOTAL	48,808	-	25,230

giz CEBDS SITAWI FINANCEforGOOD

To seize this opportunity, FIs need to develop capabilities, products and commercial approaches

Understand the dynamics of water intensive sectors, as well as concerns of their industry associations

Search for **promising sectors and companies** that can use these technologies.

Develop specific credit lines or adapt the existing lines regarding their terms, interest rates and collaterals to accommodate promising technologies**.**

Create vendor lists to accelerate the process of technology identification, as well as using validated **vendors as promotional channels to credit lines.**

Determine which technologies are sufficiently efficient **to payback the investment while saving water.**

Train relationship managers to identify clients' Total Water Cost and compare to Water Break Even Cost for each technology

Assess the **possibility of creating structured finance operations** involving technology suppliers, funding agencies, ECAs, development banks, etc.

Develop scenarios in which the **scaling of technologies** will reduce prices and increase financing feasibility.

It is important that FIs consider water risk as a formal variable in their models of credit and portfolio risk, through actions such as:

1

Elaborate criteria regarding water risk exposure, total water cost and use of technologies in **models to assess the credit risk of its clients**.

2

Consider these variables for an assessment of portfolio water risk exposure, split by **sectors, geography and size of companies**

3

Develop alternative financial mechanisms (collaterals, bank guarantees, and insurance) to mitigate risks and stimulate clients **towards a more water-efficient economy.**

LEVERAGING A WATER EFFICIENT ECONOMY

Opportunities for Companies and Financial Institutions

Gustavo Pimentel
gpimentel@sitawi,net

June 14th, 2016

german cooperation
DEUTSCHE ZUSAMMENARBEIT

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

EMERGING MARKETS DIALOGUE ON FINANCE

cebds

PREPARADO POR:

SITAWI FINANÇAS do BEM