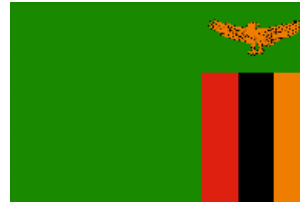


Batoka Gorge Hydro Electric Scheme

Project Location

Zambezi River, 54km downstream of Victoria Falls

Owners & Project Sponsors



Government of Zambia



Government of Zimbabwe

Implementing Partners



Zambezi River Authority



Zimbabwe Electricity Supply Authority

Regional Economic Community



Southern African Development Community

Description & Impact

Batoka Gorge Hydro Electric Scheme

- The development of a hydro-power scheme on the Zambezi River, 54km downstream of Victoria Falls.
- A 181m high, 720m long roller compacted concrete gravity arch dam.
- Two by 1,200MW surface power plants, one on either side of the river bank, for Zimbabwe and Zambia
- More than 9,000 GWh of energy will be generated annually by the two power plants.
- The project may lower the energy tariff in the region with an anticipated unit cost of generation of US\$^c 3.22/kWh.
- The hydro electric scheme will enhance power capacity in the region, and improve regional power stability.
- The Project is expected to create an average of 34,500 annual jobs.

Location

Batoka Gorge Hydro Electric Scheme



Technical Features

Batoka Gorge Hydro Electric Scheme

- A 181m high, 720m long roller compacted concrete gravity arch dam.
- Four intakes in the reservoir which will take the water through 4 tunnels to the two power plants.
- Two surface power plants, one on either side of the river bank, each having a capacity of 1,200MW.
- 6 x 200MW turbines in each powerhouse.
- Transmission lines: 330kV in Zambia and 400kV in Zimbabwe.

ENERGY (GWH)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FIRM	413	528	826	1,008	1,049	577	395	299	215	172	159	242	5,883
SECONDARY	269	377	508	445	475	730	433	208	137	107	113	182	3,984
TOTAL	682	905	1,334	1,453	1,524	1,307	828	507	352	279	272	424	9,867

Environmental & Social Assessments

Batoka Gorge Hydro Electric Scheme

Water Abstraction



The Zambezi's Upper Catchment is predominantly rural and the largest abstractions from the river are for irrigated agriculture (direct abstractions in 2010 <0.5% of annual run-off)

Water Quality



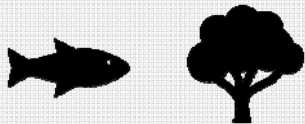
There has been no significant change in the chemical constitution of water above Victoria Falls in recent decades.

Water Flows



The Project will be operated primarily as a run-of river scheme, with most power generated in the high flow season. Daily peaking may have a significant impact on the riverine ecosystem due to flow disturbance.

Ecology



Building of large dams on the Zambezi converts long stretches of flowing riverine habitat to broad standing water pelagic habitat, which will impact on the existing ecology and natural habitats, and should be monitored and managed accordingly.

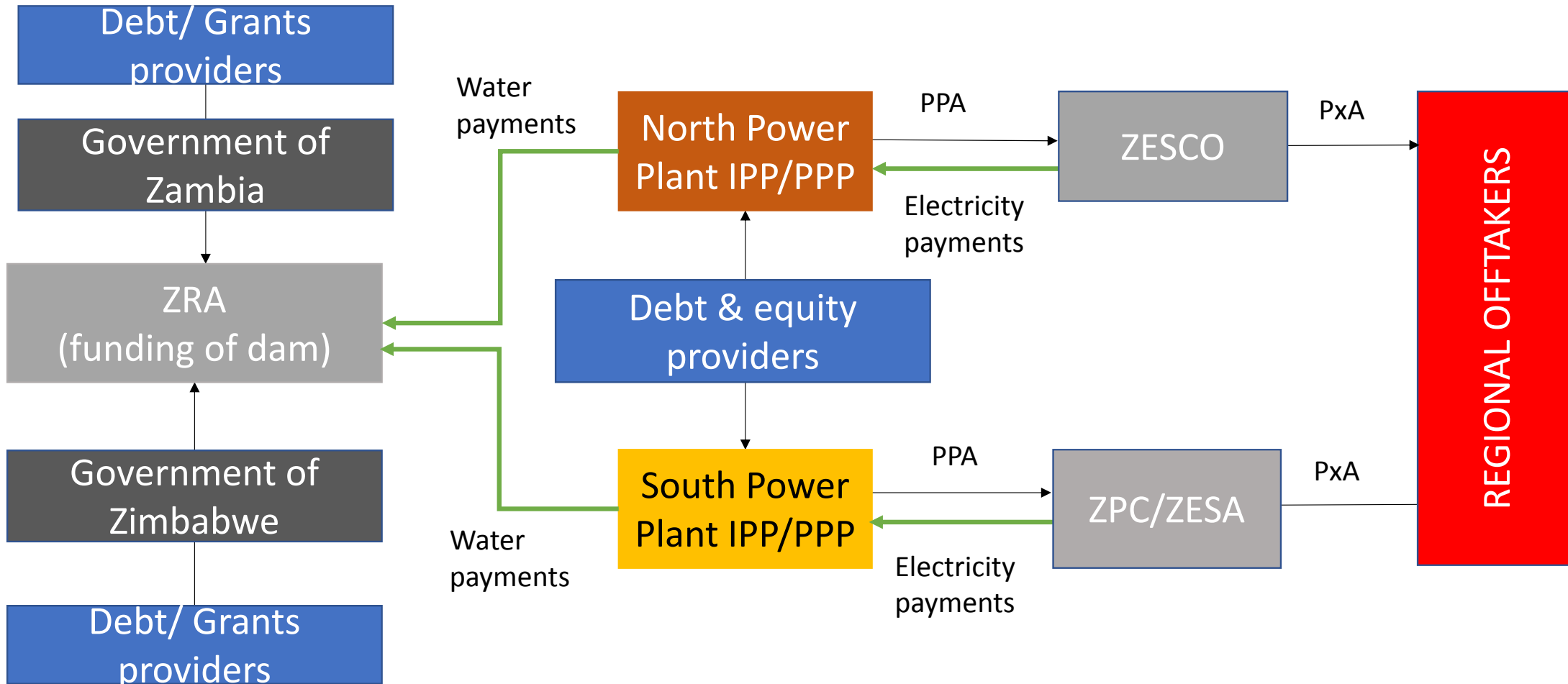
Resettlement



The reservoir will be contained within the Gorge and will not cause displacement of people. The proposed Project is expected to cause some in-migration. However, project benefits are forecast to include increased employment, purchase of local goods, and community development.

Business Model

Batoka Gorge Hydro Electric Scheme: 2 x IPPs + Publicly Financed Dam via ZRA



Key features of the Batoka Gorge HES

- The Batoka Gorge Hydro Electric Scheme is a National priority project in the two Contracting States
- It is a Regional priority Project under Southern Africa Power Pool (SAPP)
- It is a priority project under NEPAD's PIDA projects hence this presentation
- The African Development Bank has been nominated as mandated lead Arranger for Financial mobilization
- Options analysis, Legal analysis, Market analysis, Economic analysis, Market sounding, Investors' conference & Risk assessment report concluded

Project Costs

Batoka Gorge Hydro Electric Scheme

Implementation Costs

USD'000, 2015 TERMS	DAM	NORTH BANK POWER CO.	SOUTH BANK POWER CO.	TOTAL
CONSTRUCTION COSTS	1,642,076	617,582	617,582	2,877,240
INTEREST DURING CONSTRUCTION	400,737	64,763	64,763	530,263
PRE-FUNDING OF DSRA	-	27,734	27,734	55,468
OTHER FEES	96,016	21,936	21,936	139,888
TOTAL PROJECT COSTS	2,138,829	732,015	732,015	3,602,859

Funding Required

EQUITY	-	219,552	219,552	439,104
SENIOR DEBT	2,138,828	512,464	512,464	3,163,756
TOTAL SOURCES OF FUNDS	2,138,828	732,015	732,015	3,602,858

Financial Analysis & Revenue Model

Batoka Gorge Hydro Electric Scheme

- ZRA will be entitled to water payments from the power companies
- The water payments will be passed through to ZESCO and ZPC via the two PPAs.
- The PPAs will include both availability charges (to cover fixed costs) and usage charge (to cover variable costs)
- Tariff very competitive relative to region (avg \$c8/KWh)

Dam Calculation	SPV calculation
<i>Revenue</i>	Powerplant: Profit & Loss
<i>Revenue</i>	<i>Revenue</i>
+ Water payment	+ Power payment
<i>Costs</i>	<i>Costs</i>
- Financing (Debt)	- Financing (debt/equity)
- Operational Costs	- Operational Costs
	- Water payment
	- Tax payments

COMPONENT	POWER PAYMENT (\$C/KWH)	WATER PAYMENT (\$C/KWH)
DAM CAPACITY CHARGE	1.19	-
DAM FIXED O&M CHARGE	0.17	-
DAM VARIABLE O&M CHARGE	-	-
WATER PAYMENT TO ZRA	1.36	1.36
SPV CAPACITY CHARGE	1.59	-
SPV FIXED O&M CHARGE	0.26	-
SPV VARIABLE O&M CHARGE	-	-
POWER PAYMENT/TARIFF (2015 TERMS)	3.22	-

Funding Opportunities

Batoka Gorge Hydro Electric Scheme

Funding the Dam (via ZRA)

- Innovative approaches will need to be considered that will allow DFIs to extend concessionary loans totalling US\$2,139 million.
- The Green Climate Fund (GCF), should be investigated as a source of concessionary loans, grants and guarantees.

Funding the Power Plants (via IPPs)

- An opportunity may exist to finance the two IPPs via project bonds once the power plants have been commissioned and offtake agreements have been put in place with regional off-takers.
- Project bonds may also offer an opportunity to raise funding in local currencies which may be attractive to Zambian and Zimbabwean institutional investors.

BGHES will Generate an Estimated 2.1 Million Jobs*

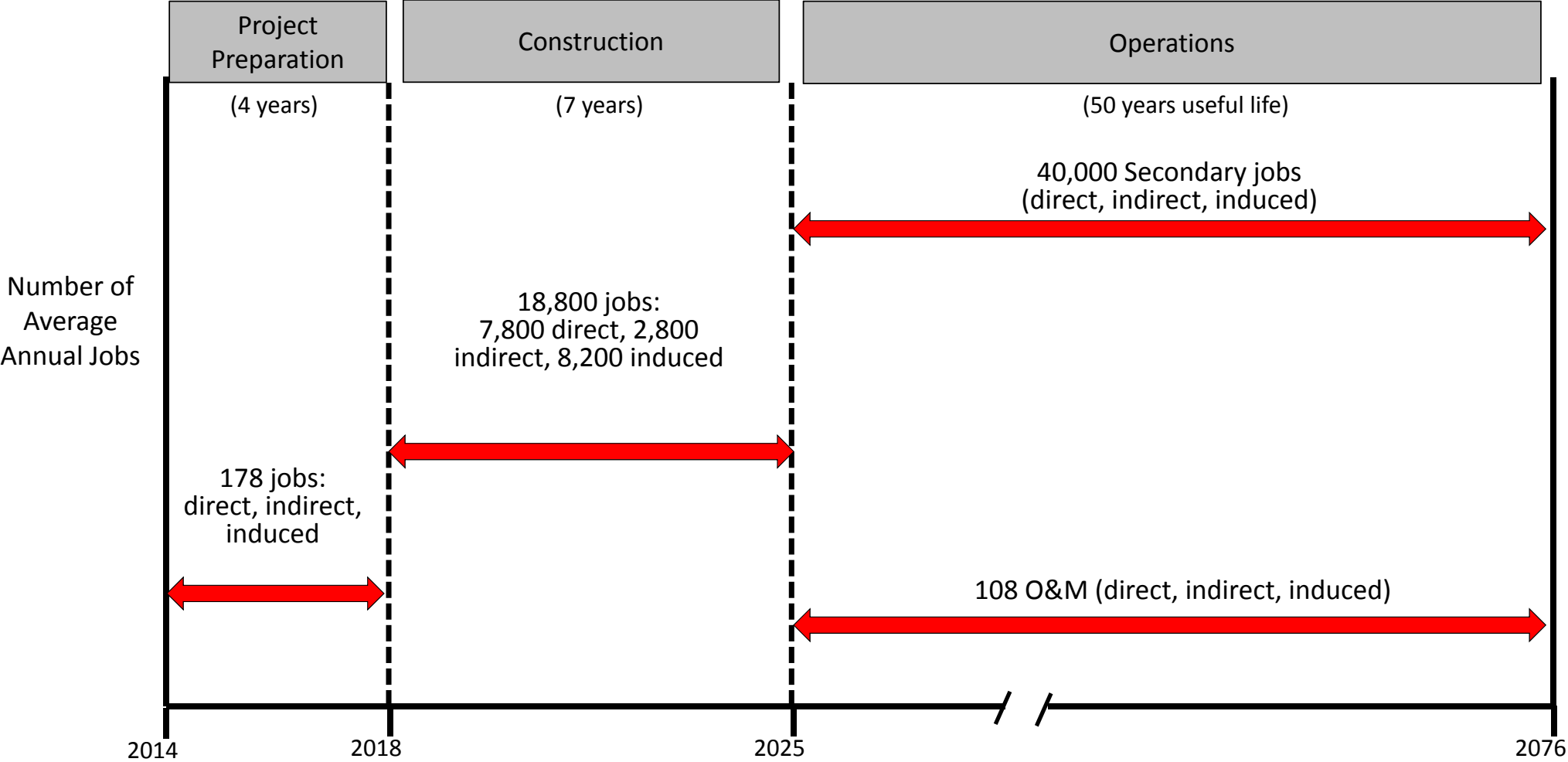
**59,000 FROM PROJECT DEVELOPMENT, CONSTRUCTION, AND OPERATION
2 MILLION JOB YEARS FROM SECONDARY SPILL OVER EFFECTS ON ECONOMY**

	Over Eleven Year Project Development Time		Annual over Project Useful Life		Total Over Project Useful Life		Total
	Project preparation	Construction	O&M	Secondary effects	O&M	Secondary effects	
Zambia	252	78,159	56	18,462	2,810	923,100	1,004,321
Zimbabwe	254	53,555	52	14,879	2,628	743,950	800,387
S. Africa	206	-	-	5,707	-	285,350	285,556
Other countries	-	-	-	905	-	45,100	45,100
Total	712	131,714	108	39,953	5,438	1,997,500	2,135,364




* Based on assumptions

BGHES Generates an Estimated 59,000 Average Annual Jobs

(BASED ON PRELIMINARY ASSUMPTIONS)

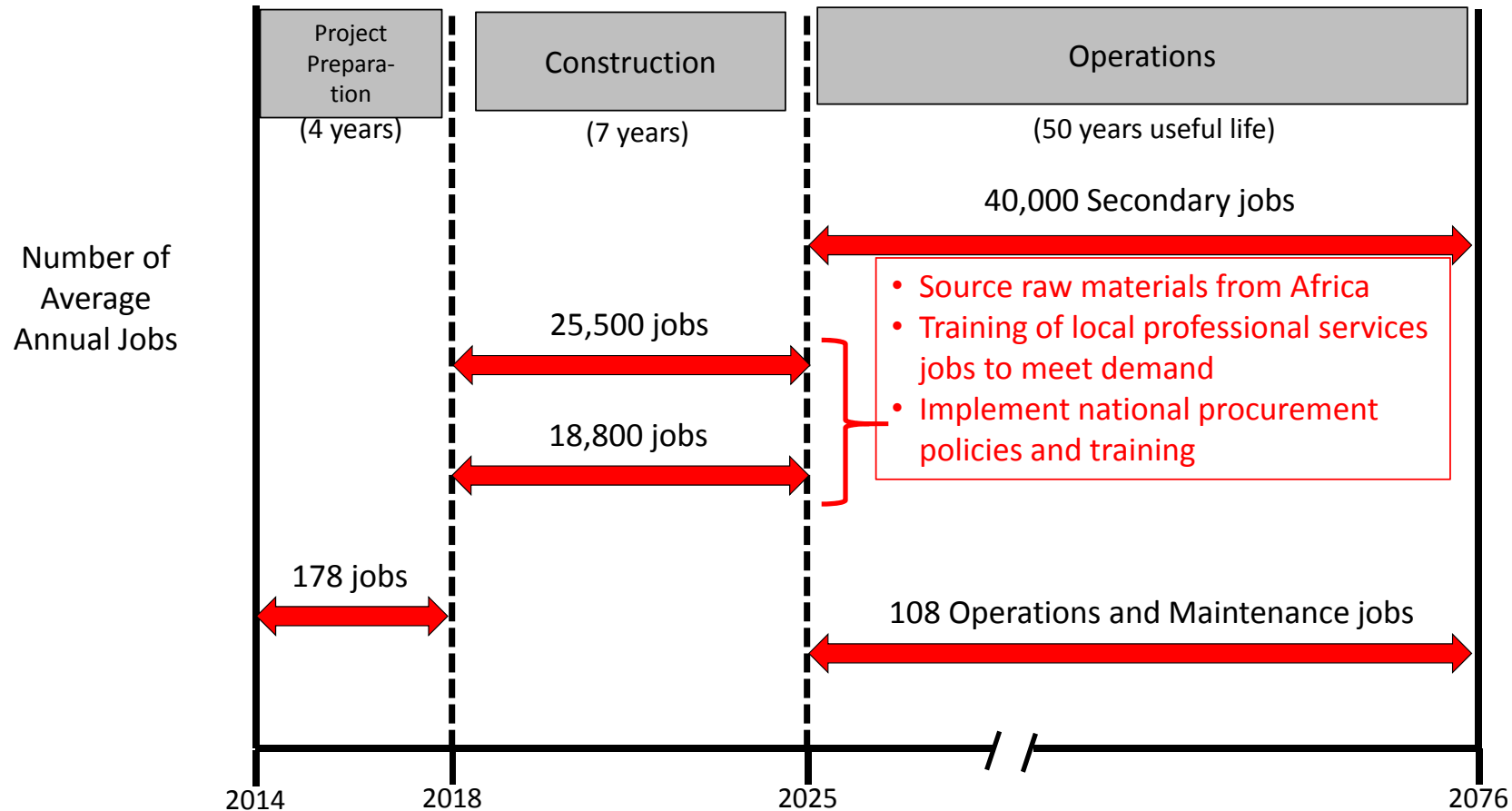


Required Job Skills & Potential Interventions to Maximize African Jobs

PROJECT PHASE	EXAMPLES OF OCCUPATIONS	EXAMPLES OF POTENTIAL INTERVENTIONS
<p>Project Preparation</p> 	<ul style="list-style-type: none"> • Project developers • Financial advisors • Engineers • Procurement experts 	<ul style="list-style-type: none"> • Require contractors to employ and train local engineers • Provide supplementary training programs with local business associations & schools
<p>Construction</p> 	<ul style="list-style-type: none"> • Construction supervisors • Engineers (design) • Procurement experts • Site safety directors 	<ul style="list-style-type: none"> • Require contractors to use local materials, labour, and partners that meet quality/price thresholds and conduct training • Provide support to local contractors (bidding, finance)
<p>Operations and Maintenance</p> 	<ul style="list-style-type: none"> • Unskilled labor • Mechanical operators • Maintenance and control engineers • Site safety specialists 	<ul style="list-style-type: none"> • Provide peer-peer training • Provide support to local contractors (bidding, finance) • Track training and employment performance by key targets (youth, gender, etc)

Possible BGHES Job Maximization Strategy

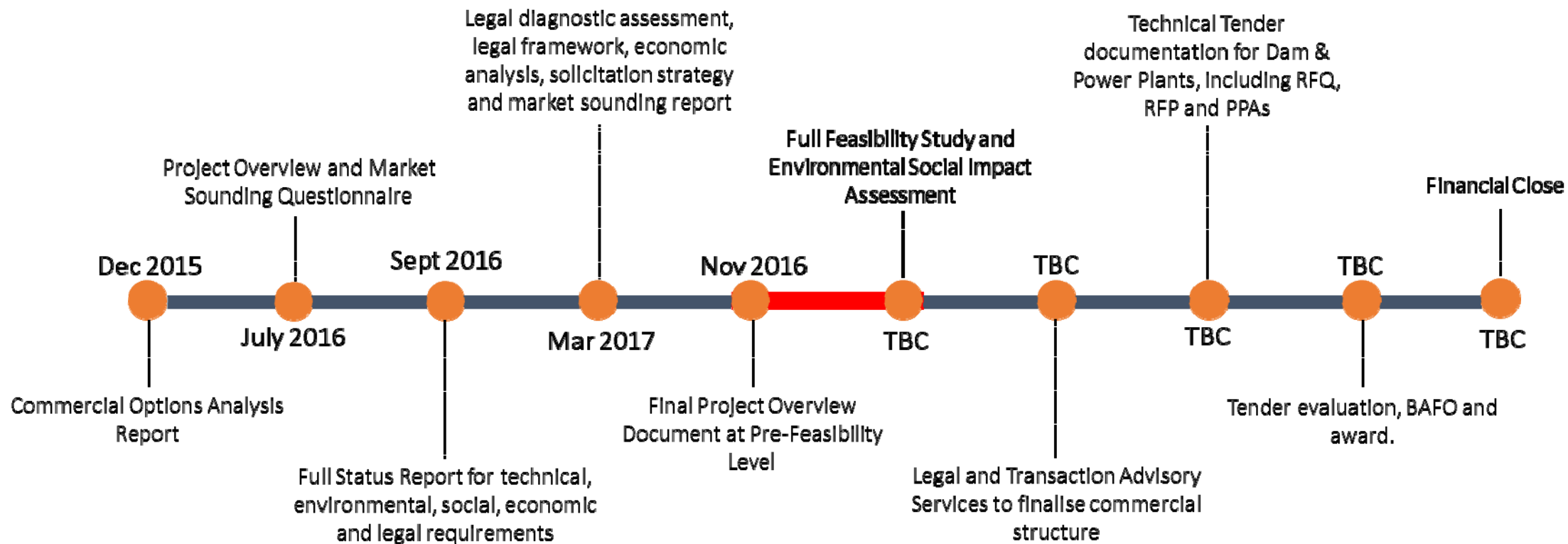
Estimated 6,700 Additional Annual Jobs Created



Note: All estimates include direct, indirect and induced jobs

Way Forward

Batoka Gorge Hydro Electric Scheme



Opportunities to unlock projects

Batoka Gorge Hydro Electric Scheme



DFIs / ICPs

- AfDB to lead debt raising for Dam.
 - Unlock climate financing (GCF guarantees/ concessionary loans/grants)
 - Extend concessionary loans to Dam
 - Guarantee debt
-



Institutional Investors
Commercial Banks
& Developers

- Provide equity for IPPs
 - Invest in project bonds (if applicable)
 - Provide debt funding to IPPs
-



Governments

- Complete Full Feasibility Study and ESIA
 - Guarantee Debt for Dam
 - Enter into PPAs and PxAs
-

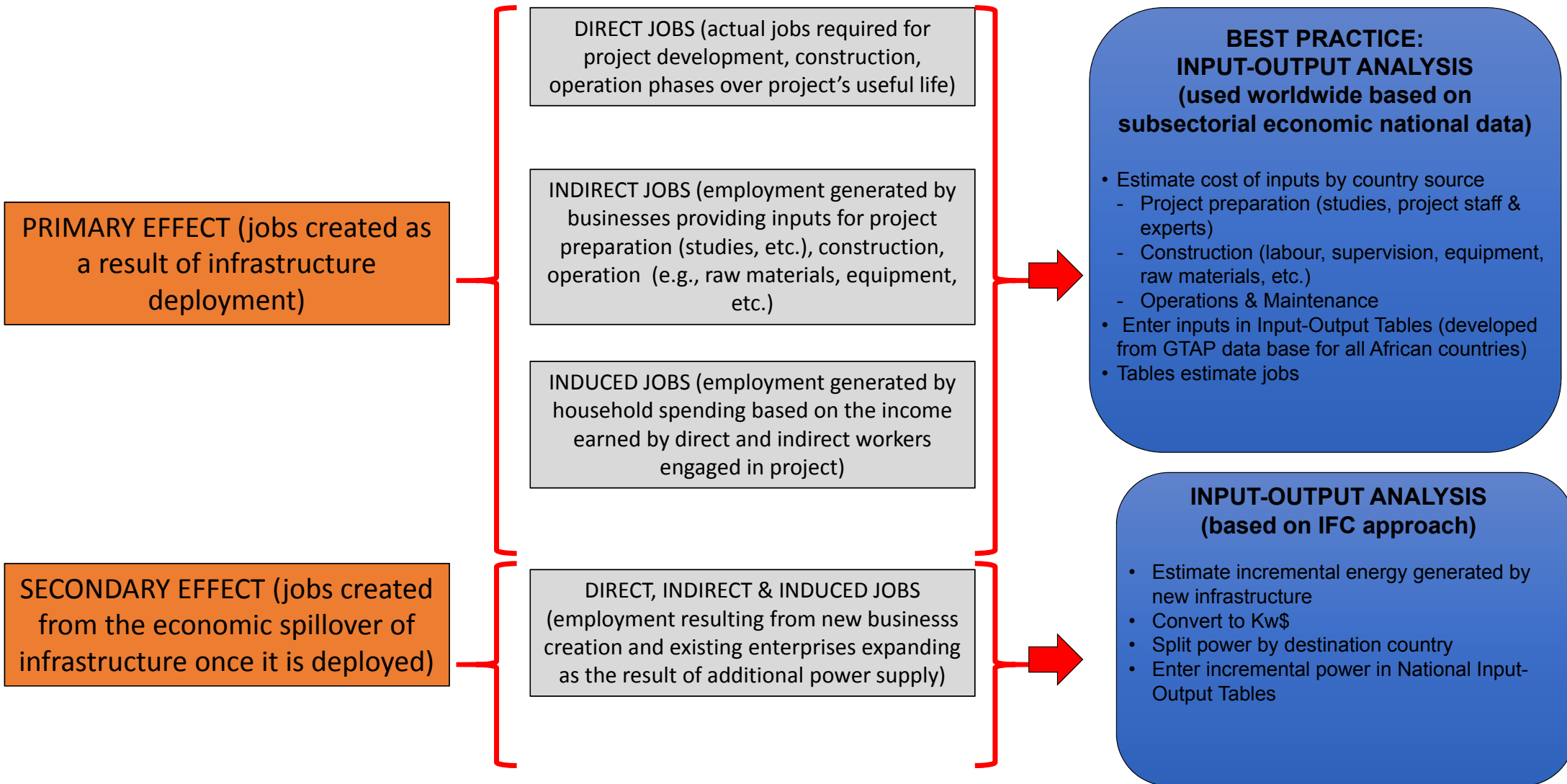


NEPAD/RECs

- Coordinate technical teams between countries
- Market projects to funders
- Provide political support

JOB CREATION ANNEX

Methodology for Estimating Job Creation IN ELECTRICITY GENERATION AND TRANSMISSION INFRASTRUCTURE



To Generate The Data Required For Estimating Jobs, Major Assumptions Were Made

Phase	Assumptions	Impact
Project preparation	While project preparation started in 1972, project preparation costs were compiled starting in 2014 when development started at a renewed pace	Lower estimation of project preparation jobs
	While no mention is made of ZRA and/or utilities staff assigned to project preparation, it was assumed a base of \$300,000 (a funding request to AfDB mentions part-time staff); Sourcing of studies was based on the nationality of firm (Estudio Pietrangelli conducting the Engineering feasibility was E-U, EY conducting the Transaction Advisory was South Africa, etc.)	Lack of data could result in under/over estimation of jobs
Construction	Sourcing of inputs assumptions based on transaction advisory report that mentions that all equipment and most materials (including cement and steel) might be sourced from China and India; All professional jobs assumed to be outside Africa. All construction labor assumed to be provided by the two host countries 50/50. Financing costs (interest, reserve fund, etc.) were included as part of the costs of construction, although the sources of funds are not yet defined; for the time being assumed to be from countries outside Africa	This is a net reduction of job creation potential
	Cost of raw materials (steel, cement, etc.) was not provided in documents; it was assumed to be 30% of total construction costs (sources: International Renewable Energy Agency: <i>“Energy Environmental Economics: Capital Cost Review of Power Generation Technologies”</i> (2014); IFC: <i>“Hydroelectric Power – A Guide for Developers”</i> (2015))	Given potential sourcing strategy (see below), this could affect negatively job creation potential in “as is” scenario
O&M	EY Transaction Advisory report estimates 80 O&M jobs by role; these were based on prior Zambian hydro experience, and therefore, proven reliable; Zambian and Zimbabwean utilities will share in O&M equally so job estimates were allocated 50/50	If not correct, wil impact O&M job creation estimates