



# Implication of GERD to Sudan and Prospects of Long-Term Resolution for Conflicts Around the Eastern Nile



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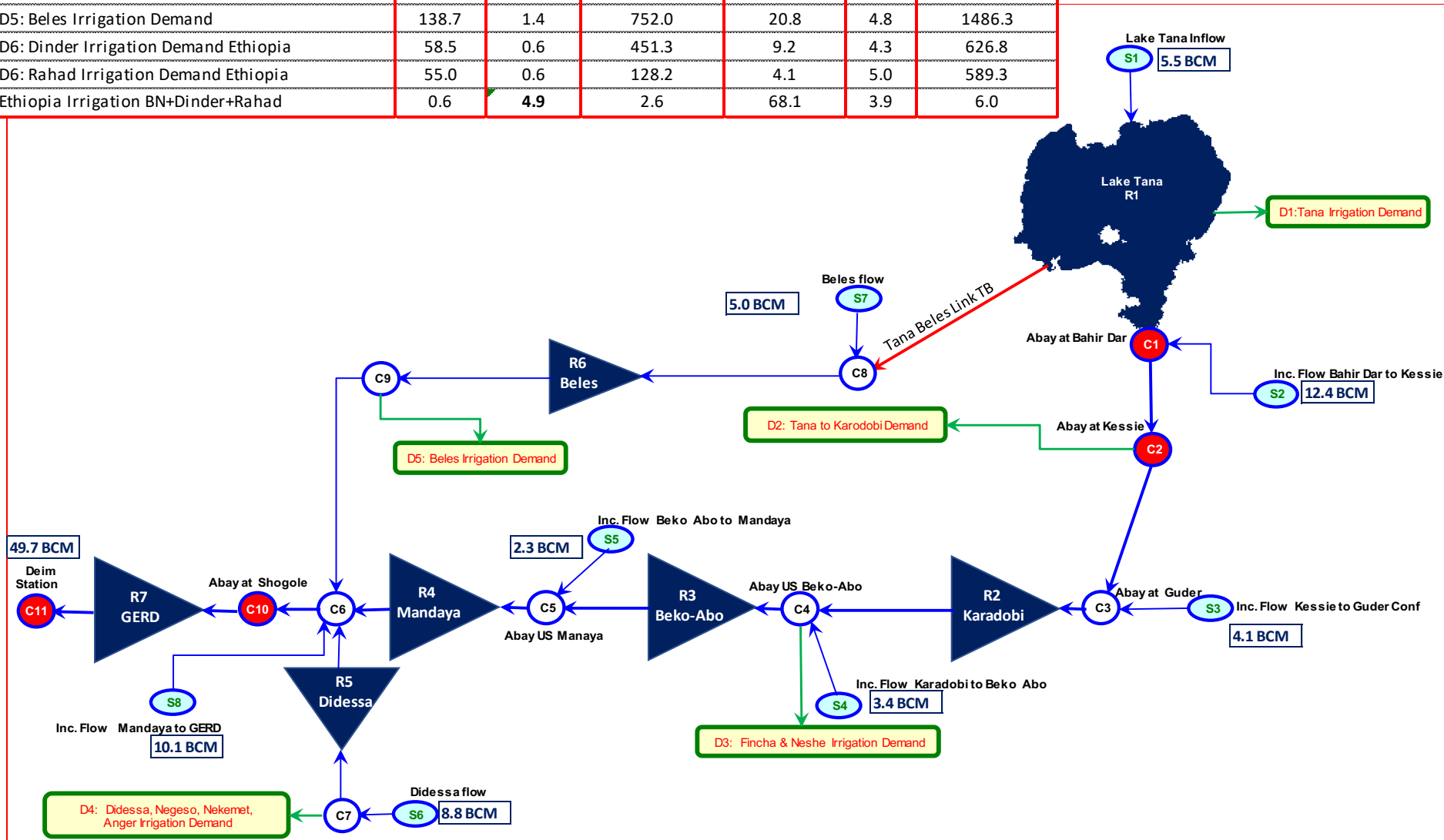
2020 International Conference on the Nile and GERD : Science Conflict Resolution and Cooperation

# Content

- ❑ Context: Exploring Ethiopia Irrigation and Hydropower Development Plans
- ❑ Options for Accommodating Ethiopia Future Water Needs and the path forward for Sharing the Nile Water
- ❑ GERD Positive and Negative Impacts to Sudan
- ❑ Key Issues that needs immediate attention

# Blue Nile: Ethiopia Irrigation Potential

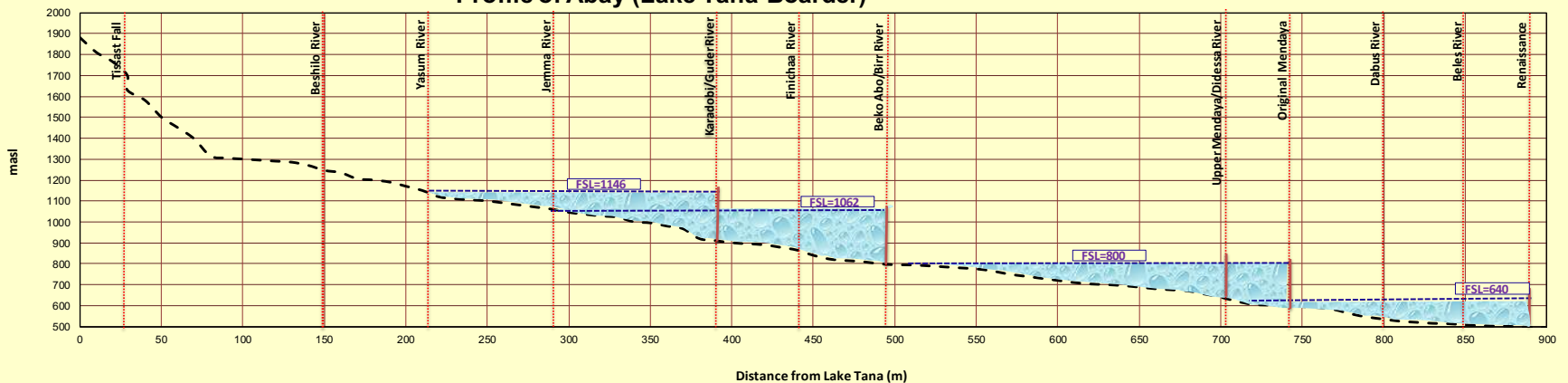
Scheme	Area (1000Ha)	GWR (BCM/Y)	Investment Cost (MUS\$)	Net Revenue (MUS\$/Year)	B/C Ratio	Employment (1000 People)
D1: Lake Tana Irrigation Demand	117.2	1.0	494.9	9.4	2.5	1255.2
D2: Irrigation Demand Lake Tana to Karadobi	69.0	0.5	156.5	5.9	1.7	739.0
D3: Fincha and Neshel Irrigation Demand	15.7	0.1	21.7	2.4	4.8	167.9
D4: Angar-Didessa-Nekemet Demand	101.4	0.6	587.3	16.3	4.1	1086.9
D5: Beles Irrigation Demand	138.7	1.4	752.0	20.8	4.8	1486.3
D6: Dinder Irrigation Demand Ethiopia	58.5	0.6	451.3	9.2	4.3	626.8
D6: Rahad Irrigation Demand Ethiopia	55.0	0.6	128.2	4.1	5.0	589.3
Ethiopia Irrigation BN+Dinder+Rahad	0.6	<b>4.9</b>	2.6	68.1	3.9	6.0



# Blue Nile: Ethiopia Power Potential

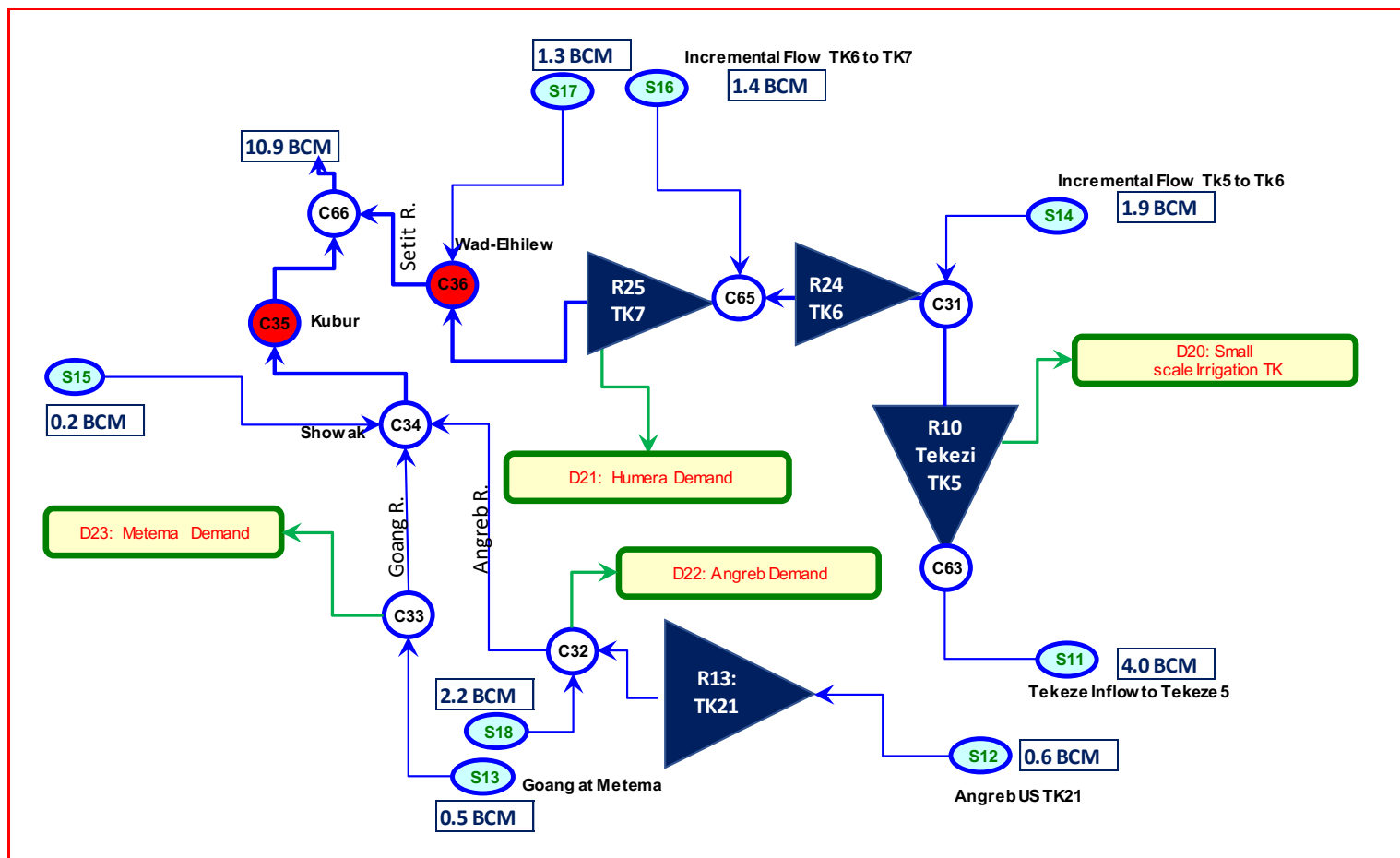
Scheme	Storage (BCM)	Evaporation (BCM/Yr)	Dam Height (m)	Total Cost (MUS\$)	Installed Capacity (MW)	Generated Energy (GWh)	Energy Tariff (USC/KWhr)	Annual Revenue (MUS\$)
R2: Karadobi Dam	40.2	0.29	260	1824	1600	8761	7.1	622
R3: Beko Abo Dam	31.7	0.31	282	2994	1940	12815	7.4	948
R4: Mendaya Dam	48.1	0.62	200	2705	2000	12119	7.4	897
R5: Didessa Dam	8.2	0.12	165	1230	550	2843	7.4	210
R7: GERD	74.0	1.53	150	4630	4800	16043	7.4	1187
Ethiopia Hydropower Blue Nile	202.2	2.9		13383	10890	52581	7.4	3864.7

Profile of Abay (Lake Tana-Boarder)

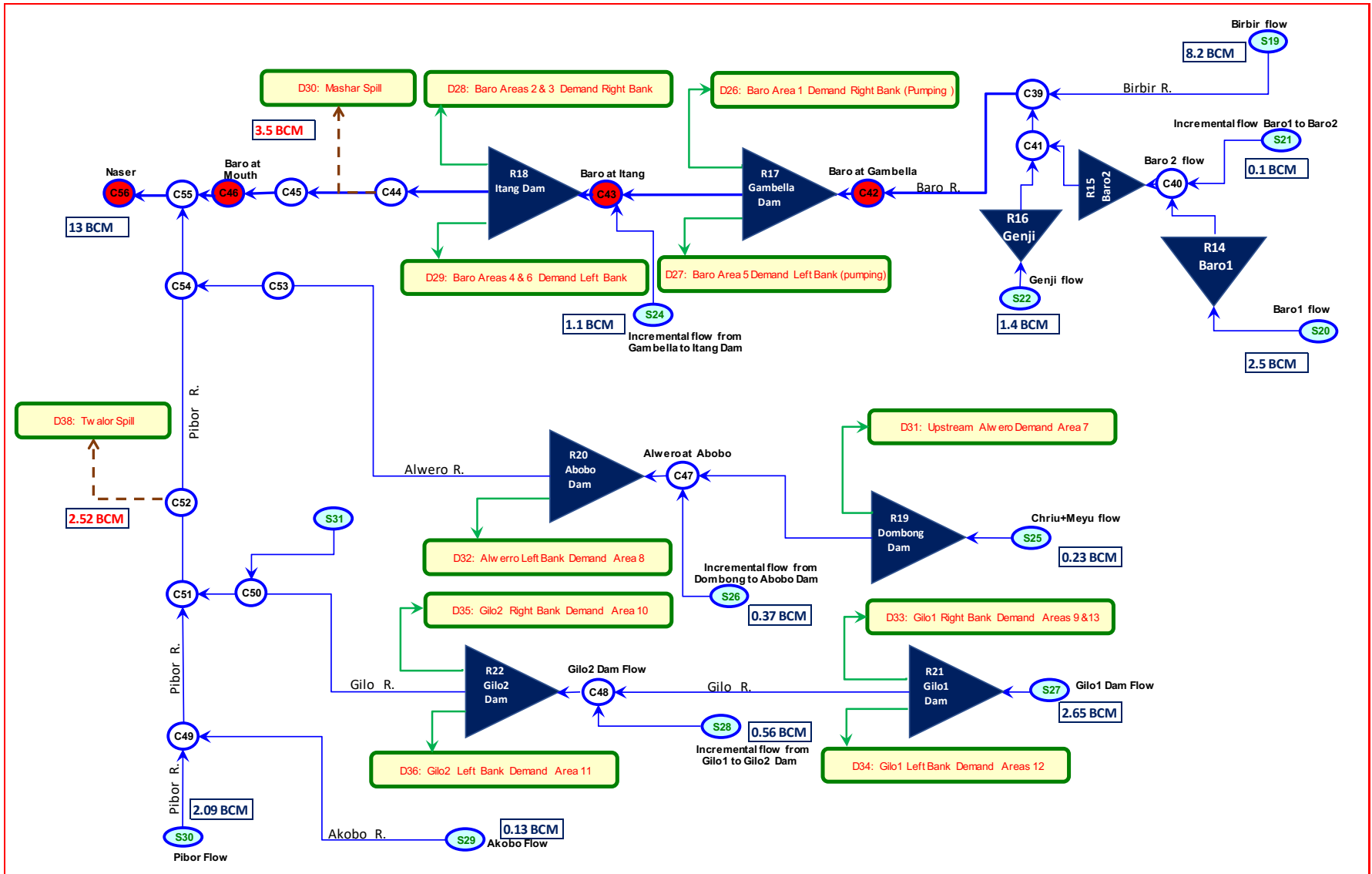


# Atbara: Ethiopia Irrigation Potential

Scheme	Area (1000Ha)	GWR (BCM/Y)	Total Investment Cost (MUS\$)	Net Revenue (MUS\$/Year)	B/C Ratio	Employment (1000 People)
D20: Small Scale Traditional Tekeze	141.5	1.5	1561.2	29.6	2.0	1516.1
D21: Humera Irrigation Demand	43.0	0.4	529.7	9.0	2.0	460.3
D22: Angreb Irrigation Demand	16.5	0.2	182.4	3.5	2.0	177.2
D23: Metema Irrigation Demand	11.6	0.1	100.2	2.4	2.0	123.9
Ethiopia Irrigation Tekeze Atbara	0.2	2.2	2.4	44.5	2.0	2.3

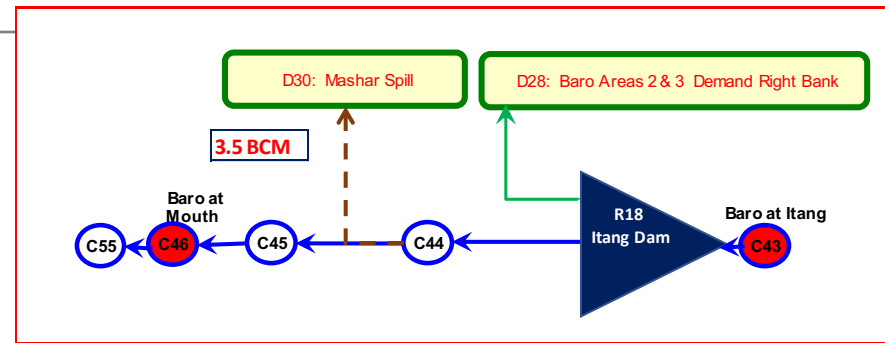
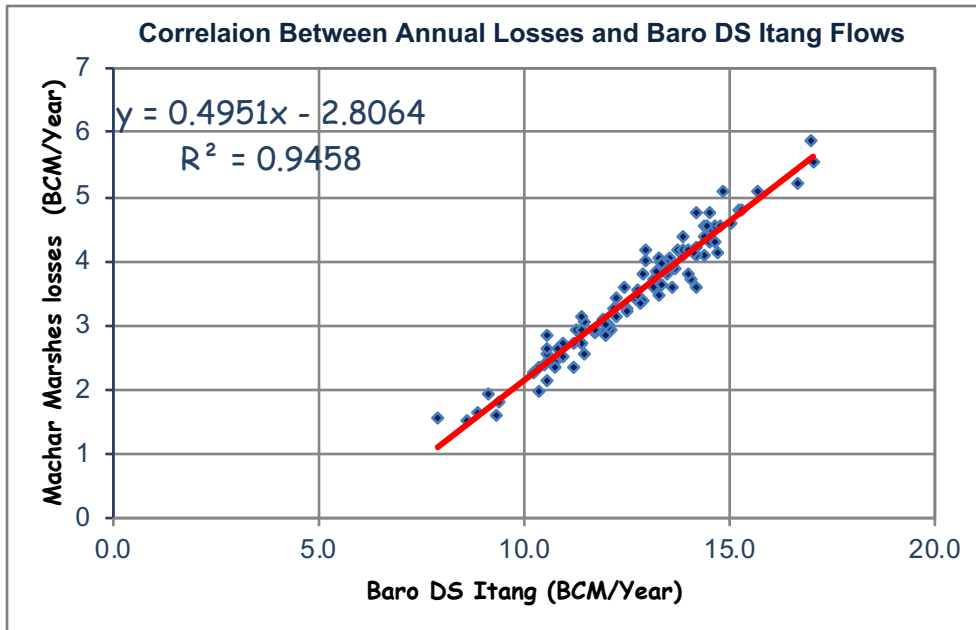


# BAS: Ethiopia Irrigation Potential



# BAS: Ethiopia Irrigation Potential Continue

Scheme	Area (1000Ha)	GWR (BCM/Y)	Total Investment Cost (MUS\$)	Net Revenue (MUS\$/Year)	B/C Ratio	Employment (1000 People)
D26: Baro from Gambella Right Bank Demand	67.8	0.7	408.1	14.9	13.2	725.9
D27: Baro from Gambella Left Bank Demand	57.0	0.6	343.5	12.5	13.2	611.0
D28: Baro from Itang Right Bank	128.5	1.4	774.3	28.3	13.2	1377.2
D29: Baro from Itang Irrigation Demand Left Bank	168.0	1.8	1012.0	36.9	13.2	1800.0
C46: Reduction in Machar Marshes Spill		-2.3				
D29: Baro from Itang Irrigation Demand Left Bank	16.0	0.2	99.3	3.2	14.0	171.4
D32: Alwero Left Bank Irrigation Demand	10.4	0.1	64.5	2.3	13.2	111.4
D33: Gilo1 Right Bank Irrigation Demand	46.9	0.5	291.0	10.3	13.2	502.5
D34: Gilo1 Left Bank Irrigation Demand	34.5	0.4	213.8	7.6	13.2	369.2
D35: Gilo2 Right Bank Irrigation Demand	61.3	0.7	380.5	13.5	13.2	657.1
D36: Gilo2 Left Bank Irrigation Demand	33.9	0.4	210.1	7.4	13.2	362.8
Ethiopia Irrigation Baro-Akobo-Sobat	0.6	<b>4.5</b>	3.8	136.9	13.3	6.7



# Summary of Ethiopia Demand

Sub-basin	Area (Million Ha)	GWR (BCM/Y)	Total Investment Cost (BUS\$)	Net Revenue (MUS\$/Year)	B/C Ratio	Employment (Million)
Blue Nile +Dinder+Rahad	0.6	4.9	2.6	68.1	3.9	6.0
Tekeze Atbara	0.2	2.2	2.4	44.5	2.0	2.3
Baro-Akobo_Sobat	0.6	4.5	3.8	136.9	13.3	6.7
Existing Uses	0.7	2.9				
Ethiopia Irrigation Needs	1.4	<b>8.7</b>	8.8	249.4	6.4	14.9

Scheme	Storage (BCM)	Evaporation (BCM/Yr)	Total Cost (MUS\$)	Installed Capacity (MW)	Generated Energy (GWh)	Annual Revenue (MUS\$)
Ethiopia Hydropower Blue Nile	202.2	2.9	13383	10890	52581	3864.7

Total Investment Portfolio= 22.183 Billion US\$

Total Irrigation Potential =1.4 Million Ha

Total Water Requirements = 8.7 BCM (Excluding Evaporation Losses)

Anticipated Net Revenue Generated = 249 (Irr.)+3865 (Hydro)=4.11 Billion/Yr

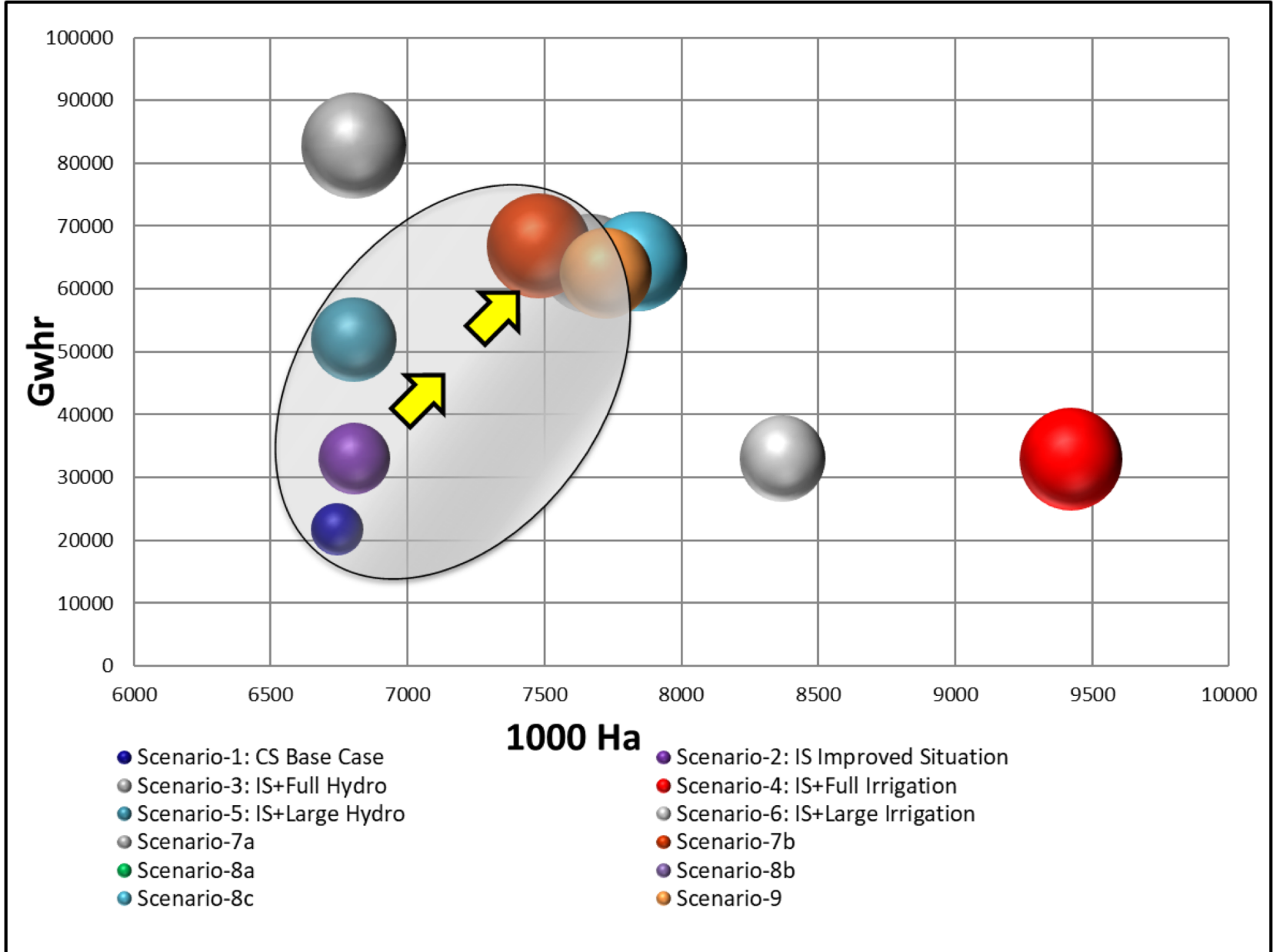
Water Value for Hydro= 1.33 US\$

Water Value for Irrigation=2.86 Cents

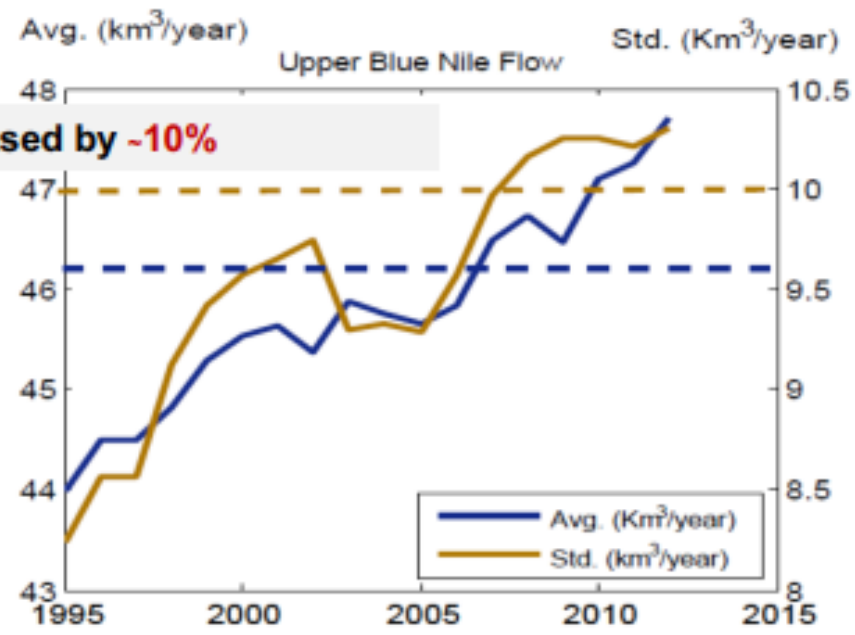
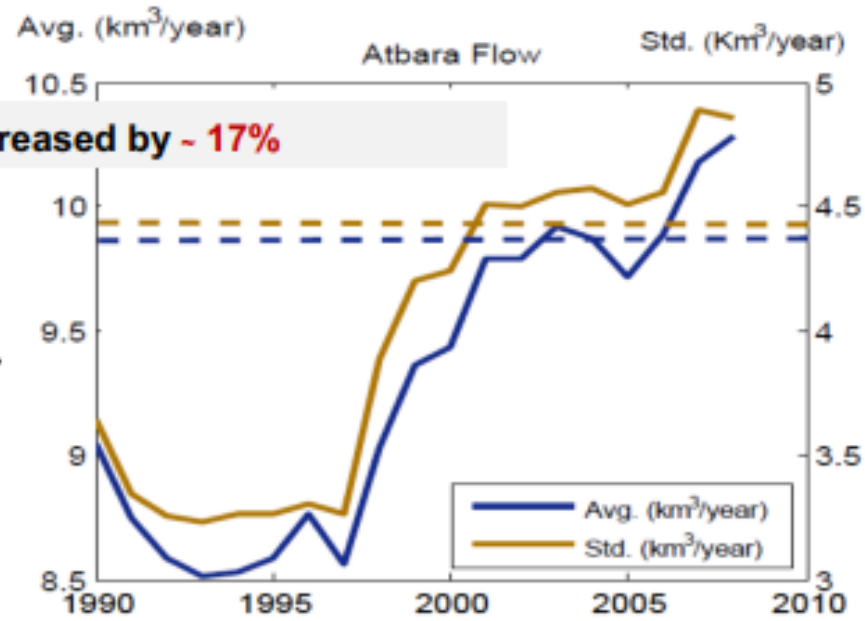
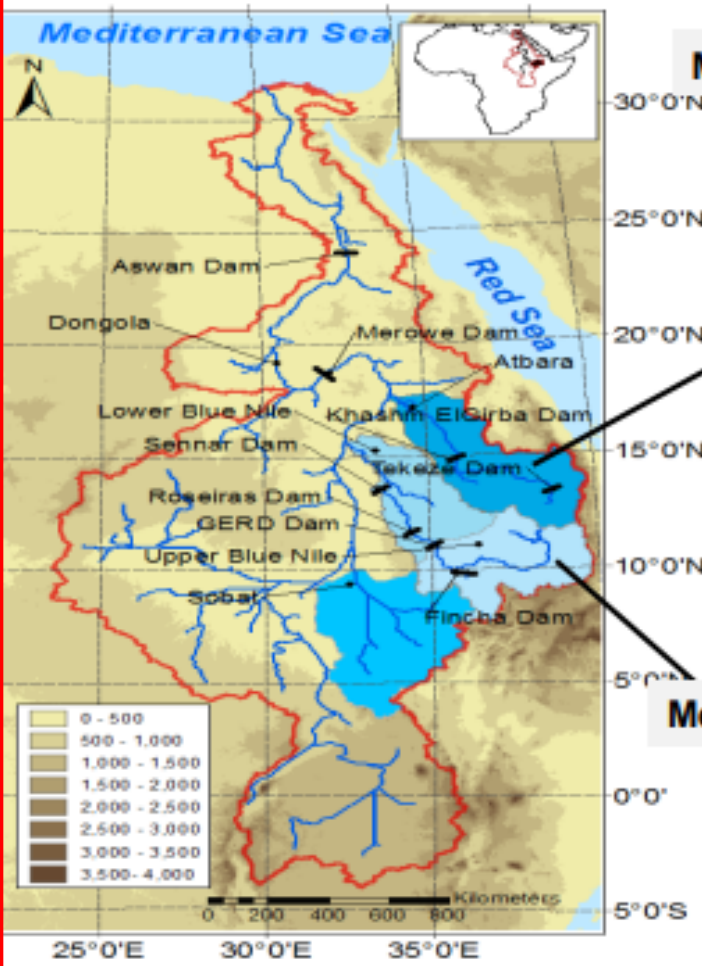
Total Employment Generated Irrigation=14.9 Billion



# Eastern Nile Multi-Sector Opportunity Analysis



# Recent Changes in the Mean flow of Nile river



Source: Siam and Eltahir, 2017, Nature Climate Change

# A PATH FORWARD FOR SHARING THE NILE WATER:

SUSTAINABLE, SMART, EQUITABLE, INCREMENTAL



BY ELFATIH A. B. ELTAHIR

WITH CONTRIBUTIONS FROM: Timothy Adams, Catherine Nikiel  
Mohamed S. Siam, Alexandre Tuel

Prospect for Long-Term Solution (Prof. Eltahir)

- Increase in Yield → 5 BCM (Blue Nile) + 2 BCM (Atbara)
- Allow Ethiopia to Fully Exploit Hydro-BN
- Allow Ethiopia to Fully Exploit Irrigation
- Incremental Basin Approach
- Start with Agreement Around BN + Atabara
- Negotiation Around BAS Shall Involve South Sudan
- Terms of Agreement Shall be based on Decadal Yield because of Large Interannual variability; i.e.
  - Egypt Measured at H.A.D=555 BCM/10-Yrs
  - Sudan Measured at H.A.D=185 BCM/10Yrs-
  - Ethiopia Measured at H.A.D= 70 BCM/10Yrs

# Potential Benefits of GERD?

## □ Regulation By Default Help in:

- ❖ Addressing flood impact
- ❖ Avail water for irrigation year around → Irrigation intensification (Facilitate Irrigation of .5 Million Ha)
- ❖ Reduce Sedimentation → Reduction in Sediment load by 85% and cost of dredging by USD 50 million/year
- ❖ Improve performance of existing hydropower plants → increase in hydropower generation will account for 2,000 GWh/Year, amount to about 23 million USD annually (Mordos et al., 2018)
- ❖ Access to clean and cheap source of energy (Thermal is no longer an option )
- ❖ Navigation

# GERD Concerns....

- ❑ Coordinated operation of the GERD to maximize benefit and minimize negative impacts →
- ❑ Impact of GERD during filling
- ❑ Reduction in soil fertility;
- ❑ Impact to Recession Agriculture
- ❑ Risk of dam failure
- ❑ Revisiting Power Trade Agreement as Part of GERD Negotiation

# Environmental and Socio-Economic Impacts

- ❑ Recession Agriculture (Social) : The Regulation of the Blue Nile will reduce the recession agri. Irrigated land by about 50%
- ❑ Brick making activities (Social)
- ❑ Sediment Reduction → Lost in soil fertility (Fertilizers)
- ❑ Loss in hydropower generation capabilities during filling
- ❑ Morphological changes (Env.)
- ❑ Changes in river water quality
- ❑ Fisheries

# Key Issues Short Term....

- ❑ Coordinated and Joint operation of GERD during both Filling and long-term operation
- ❑ Dam Safety: Reduce Risk of Failure and Demand transparency from Ethiopia to release all Reports that Pertain to Dam Safety
- ❑ Environmental Impact Study that address recession agriculture, loss in fertile land and other losses in ecosystem benefits and socio-economic benefits with options for mitigations and compensation
- ❑ Power Trade Agreement to be part of GERD Negotiations
- ❑ Have a legally binding agreement and institute some sort of mechanism for operationalization

# Key Issues: Middle to Long Term

- ❑ Sudan should have a plan to fully utilize its share of 18.5 BCM → Upgrade conveyance system for irrigation; irrigation modernization for existing schemes etc.
- ❑ Improve agriculture productivity and water use efficiency (Adoption of Technology and best practices e.g. improved use of fertilizers, advanced irrigation system)
- ❑ Work with the Egypt and Ethiopia to have long-term water sharing and Benefit sharing agreement that could potentially acknowledge legal water rights per 1959 and at the same time accommodate the development plans for Ethiopia
- ❑ Augment hydro-generation through enhancing operation of existing scheme and runoff-river hydro plants
- ❑ Horizontal expansion in irrigated agriculture



Thank You  
Questions