



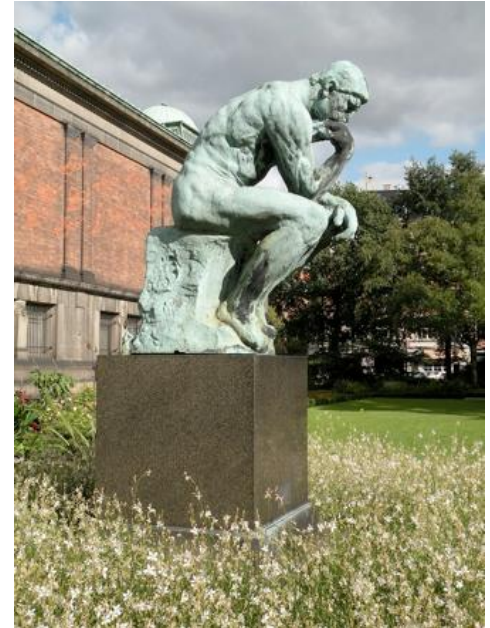
# The Grand Ethiopian Renaissance Dam

Economic Perspectives

Alan Nicol

# Introduction

- Purpose: to understand broader contexts
  - Demand – why do countries need more water in relation to economic development, political change, and shifts in global political economy
  - Supply – what is the significance of uncertainty (climate change / political change)
- Look at options and scenarios for basin-wide development and capacity for countries to overcome nationalism and embrace 'regionalism' as an approach
- The challenge of uncertain futures

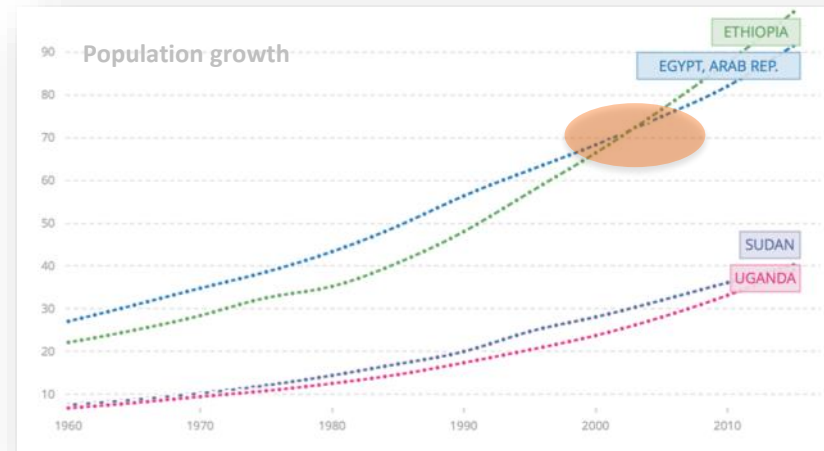


# Outline

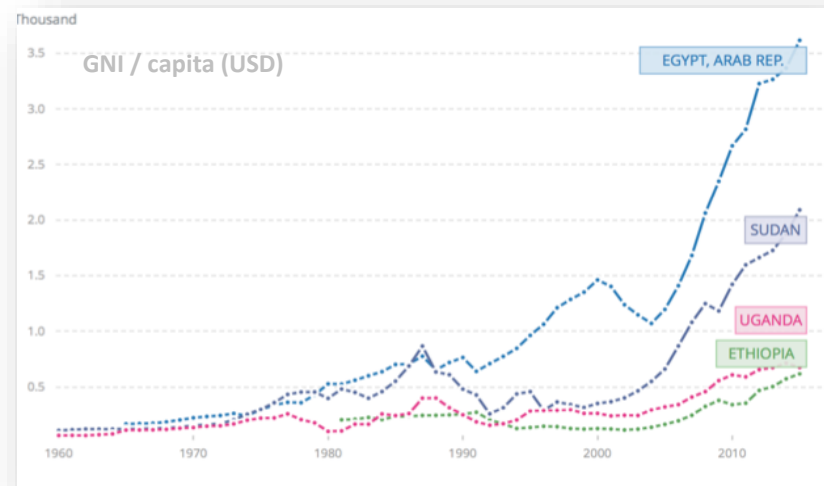
- A basin perspective: dynamics of changing pressures
- Opportunities and challenges
  - 1. GERD as a power generator for the region
  - 2. GERD as a regulator – good for food (and flood) security
- Conclusions: Prospects for regional economic development and integration

# Basin contexts

- Rapid population growth
- Substantial economic transitions including urbanization and agricultural development – wide disparities
  - Policy emphasis on achieving ‘middle income’ status, and on renewables
- Cooperation mechanism exists (NBI) but complex and slow to deal with rapid changes
- A regional approach is an imperative, but unilateral projects continue

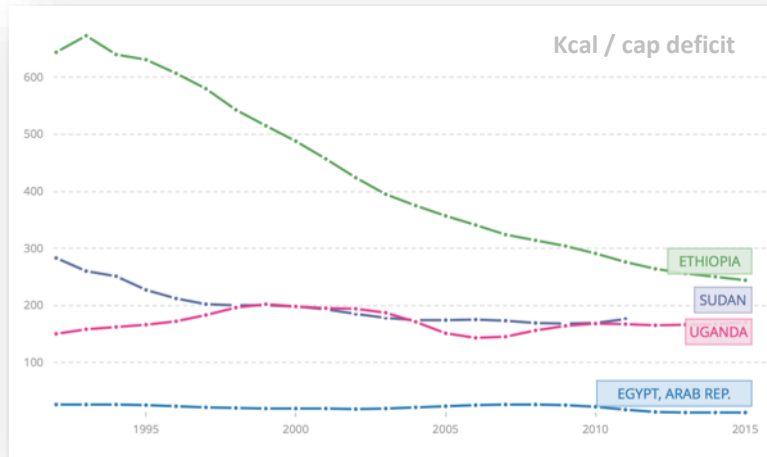


Source: World Bank Data



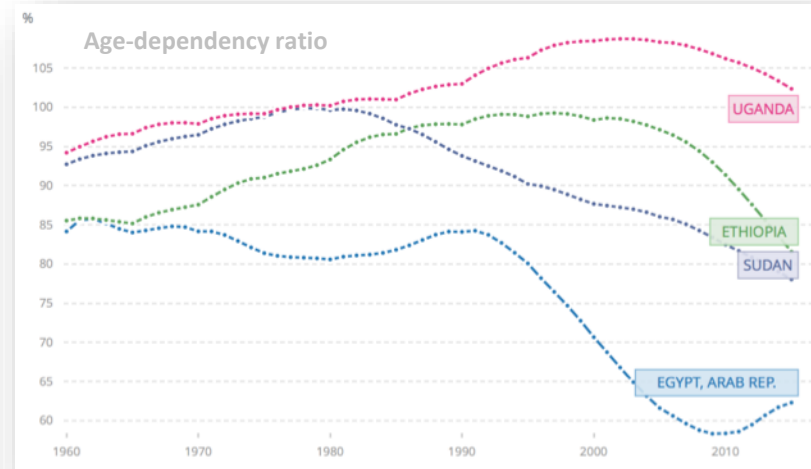
Source: World Bank Data

# Complex socio-economic transitions



Source: World Bank Data

- Rapid decline in food deficit (kcal / cap in Ethiopia); sign of significant social progress



Source: World Bank Data

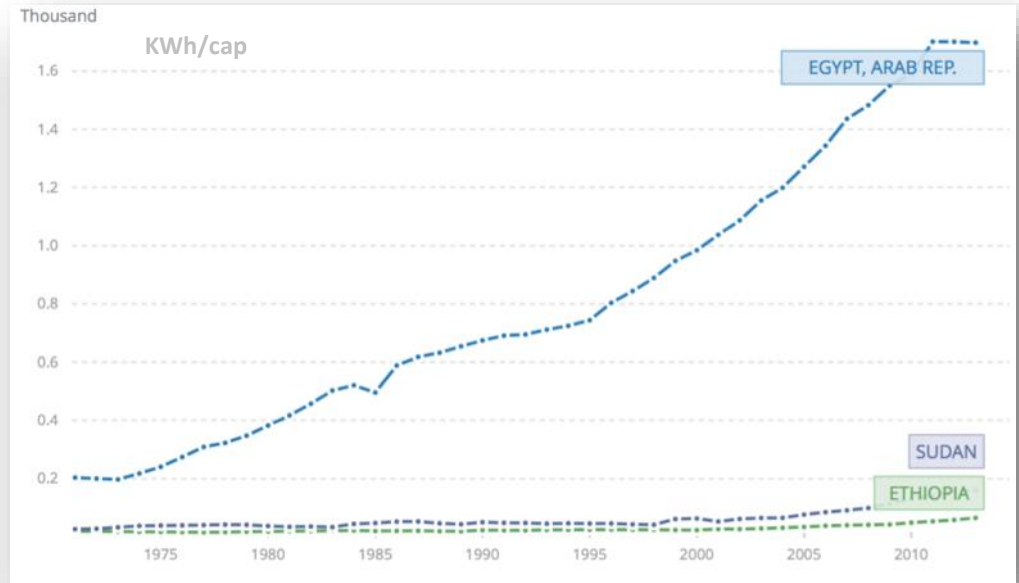
- But with growth and change comes demand for employment; complex age-dependency relationships that are key to economic futures – have to have means to generate incomes and livelihoods

# Ethiopia's water, food and energy nexus

- Growth and Transformation Plan: central role played by energy production and rural electrification (moving from subsistence to commercial production)
- Cheaper energy and rural electrification could transform small-scale agriculture, making more use of dry season cropping through groundwater development
- Central task is managing degrading watersheds in vulnerable environments
- What happens in catchments affects runoff and silt loads
- Pressures and stresses result from biomass energy consumption contributing to soil loss
- What happens in these catchments will affect downstream flows (including the estimated 500 billion cubic meters (bcm) of water that evaporates annually from surface water bodies, from the land surface, or through vegetation)



# Energy disparities

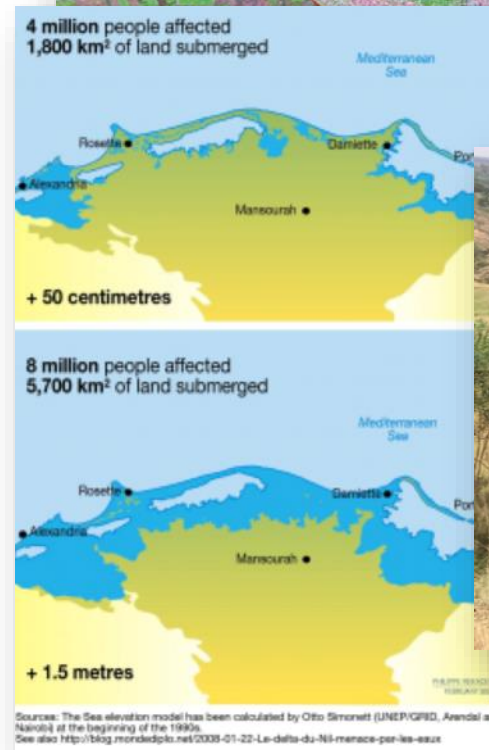


Source: World Bank Data

- Huge divergence in KWh / cap consumption
- Most of the annual 14,600 gigawatt hours (GWh) of hydropower produced in the Nile basin is generated in Egypt (12,100 GWh/yr); Sudan averages about 1,500 GWh/yr, and Ethiopia about 1,000 GWh/yr.

# External stressors

- Global warming
  - Increasing evaporation rates (by 4%?)
  - Increasing crop water requirements (by 10%?)
  - Reducing some agricultural yields (extreme temperatures)
  - Increasing pest prevalence (and associated disease vectors)
  - Change precipitation patterns
  - Induce rises in sea level -- salinization



# 1. GERD as a power generator

- Original plan for cascade of dams; larger than anticipated Border Dam under JMP; second over-year storage reservoir
- Anticipated production of 15,000 GWh / year (about 50% more than ave. generation from HAD in past 40 years)
- To perform effectively, will want to smooth peaks of flood to augment Summer low flows
- Currently annual electricity consumption in Ethiopia is approximately 2,000 GWh.
- Pressure on Ethiopia to generate power as soon as possible, and to export



**Table 1: Planned Hydropower Projects in Ethiopia**

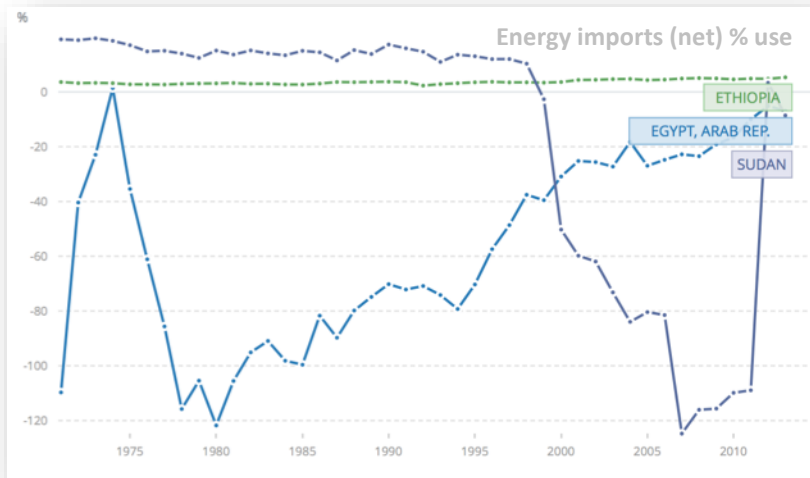
Project	Capacity (MW)	Average Energy (GWh/yr)	Commissioning Year
Fan	100	212	2011
Gibe III	1870	6400	2013
Genale 3	258	1200	2014
Halele Werabesa	422	2233	2015
Chemoga Yeda	278	1250	2015
Genale 6	256	1000	2015
Geba 1 and 2	366	1788	2015
GERD	5250*	15000	2014-2015
<b>Total</b>	<b>8800</b>	<b>29083</b>	

Source: EEPKO "Highlights on Power Sector Development Program (2010 – 2015 G.C.) Oslo 2011

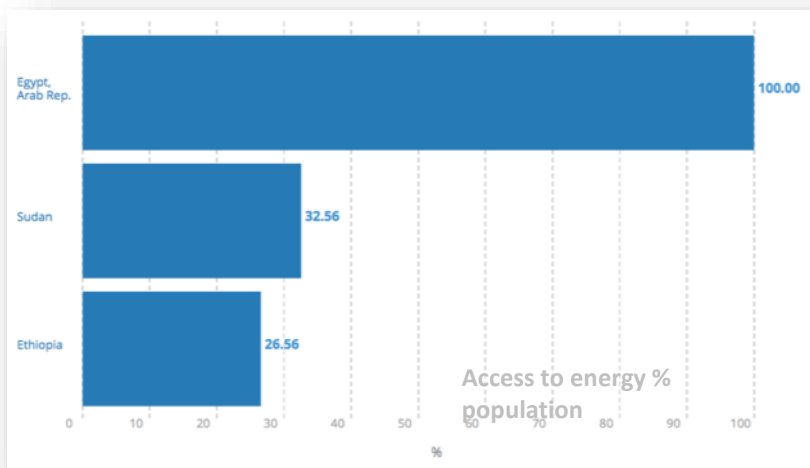
Notes:

1. Gibe III now expected to be commissioned in 2015
2. GERD capacity now reported as 6000 MW
3. GERD now expected to be commissioned in 2017

# The challenge of selling...



Source: World Bank Data

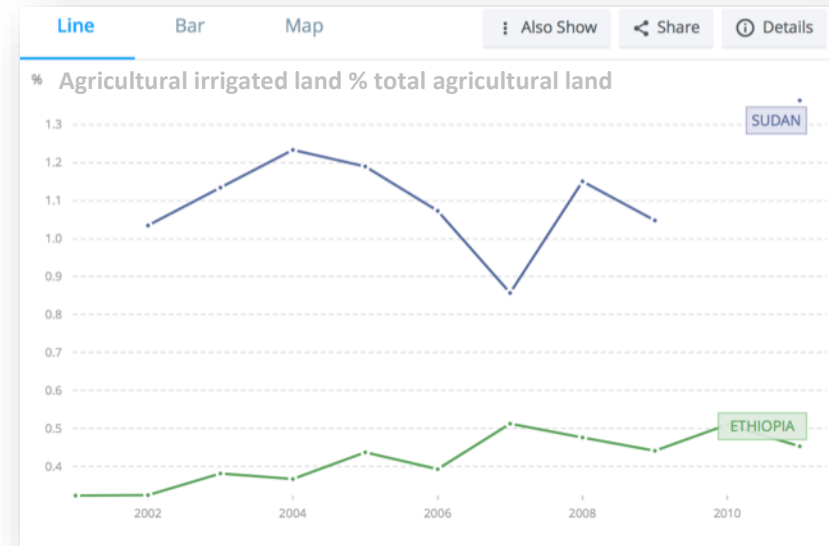


Source: World Bank Data

- If sold, significant revenue generation potential
  - 15,000 GWh for \$0.07 per KWh would bring annual revenue of some \$1 billion
  - or more if sold to meet peaking requirements (but challenges of timing)
- To be economical, need to export the power (Djibouti, Sudan and Kenya)
- Egypt could be a major consumer (about a year and half of Egypt's growth in demand)
- But regional power trade agreement required
- Potential to link Sudan and Egypt would take about 5 years

## 2. GERD as a regulator

- Regulates flows, floods and sediments
- Annual storage capacity allows irrigation expansion downstream, significance of position
- Generating capacity for summer irrigation development in Sudan and expansion in irrigation area
- Currently, difficult for Sudan to intensify or modernize cultivation in the Gezira irrigation scheme due to sedimentation at the Sennar Reservoir and an inability to better regulate Blue Nile flows (Gezira remains underutilized) asset in the Nile basin

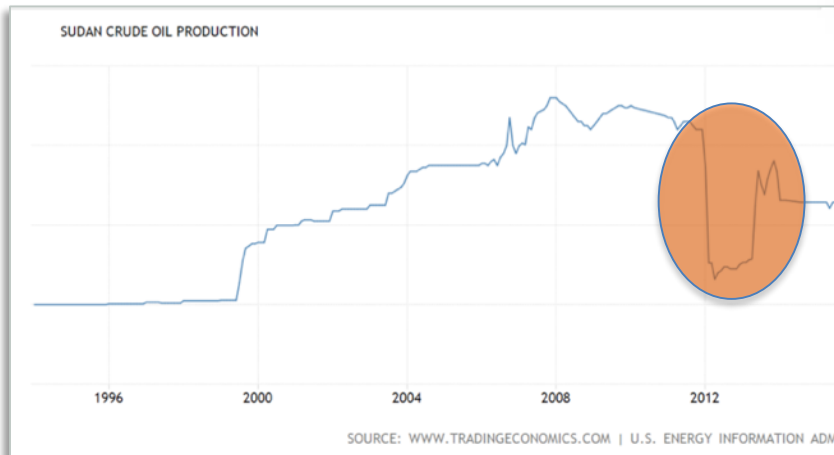
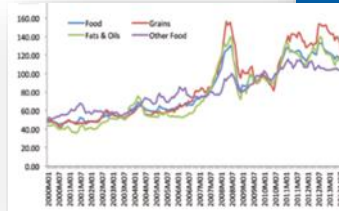


Source: World Bank Data

- Sudan: potential large-scale irrigation expansion
  - Current irrigation on 1.2-2.2 million ha; estimated 2.8m potential (FAO)
  - Harnessing of full potential requires upstream control
  - Summer pre-flood flows will increase irrigation capacity
  - Flows to HAD could be reduced

# Sudan's agricultural ambitions

- From 'oil era' to 'bread basket'
- Now there is a renewed emphasis on agricultural production
  - Expected that abstractions to increase substantially
  - New interest in hydropower – Merowe illustrated capacity for finance and development of new mega projects
- Also shifted perception of Sudan's position, given rapid move from Merowe to heightening of Roseires – irrigation goals are part of development planning



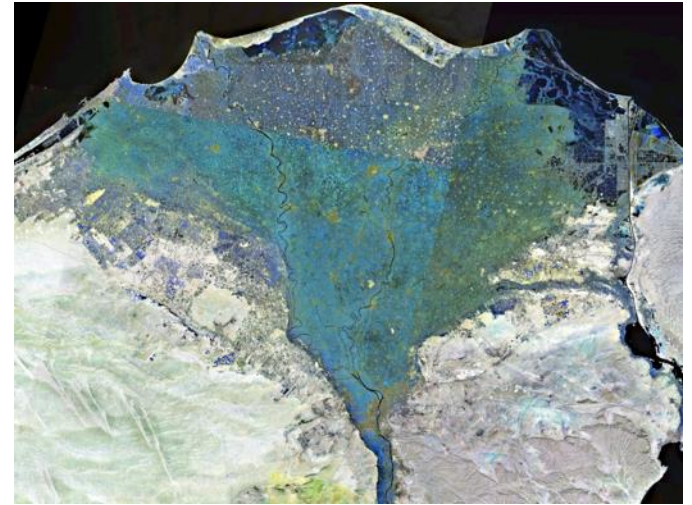
Source: World Bank Data



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# Improving water efficiency

- Most of the consumptive use of water in the Eastern Nile basin is in irrigated agriculture, and there are significant opportunities to increase water availability by improving water use efficiency
- Fundamental issue becomes how to shift perceptions of water security as storage to water security as efficiency in an era of competing and accelerating demands on the resource



Sudanese farm women learning how to use the drip irrigation system. (Photo: Dr. Imad-eldin A Ali Babiker/ARC)

# Prospects for regional integration

	Risks (of non-integration)	Benefits
Primary	Inadequate planning and consultation over infrastructure construction and operation leads to costly impacts	Agreements between countries establish basis for future cooperation on infrastructure construction and operation across range of scenarios
Secondary	Long-term adverse impacts create conditions for reduced cooperation at basin level across a range of sectors and projects	Agreements and joint operation lead to significant economic wins (e.g. peak power purchase (3-5 x more per KWh))
Tertiary	Future climate adaptation at system level inadequate and range of climate 'bads' affect overall human and economic security in the basin	Adaptation measures are implemented in time and collective management of risk enhances human and economic development across all countries sharing the river Nile