Enabling Energy Transition in Africa from a Policy Perspective:
What are the determining socio-economic factors?

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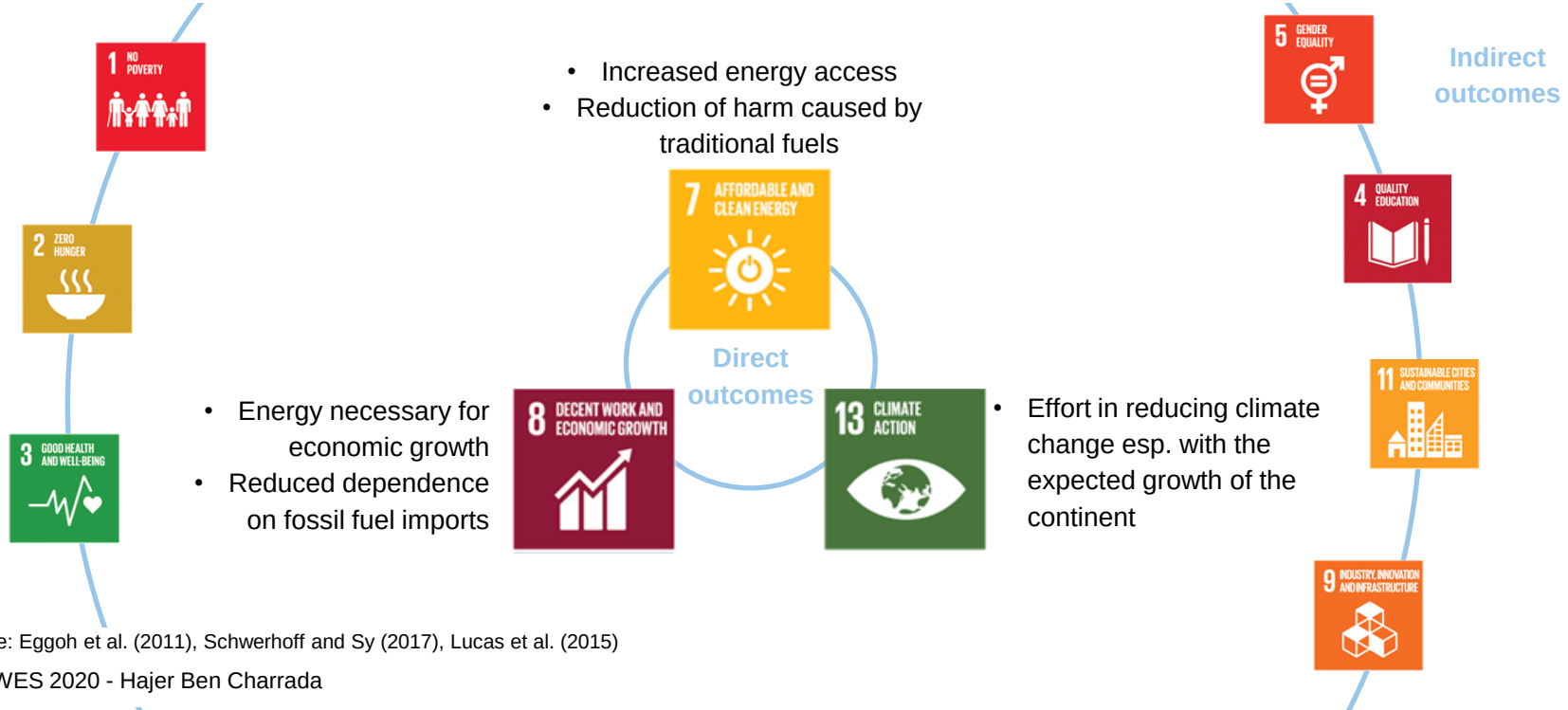
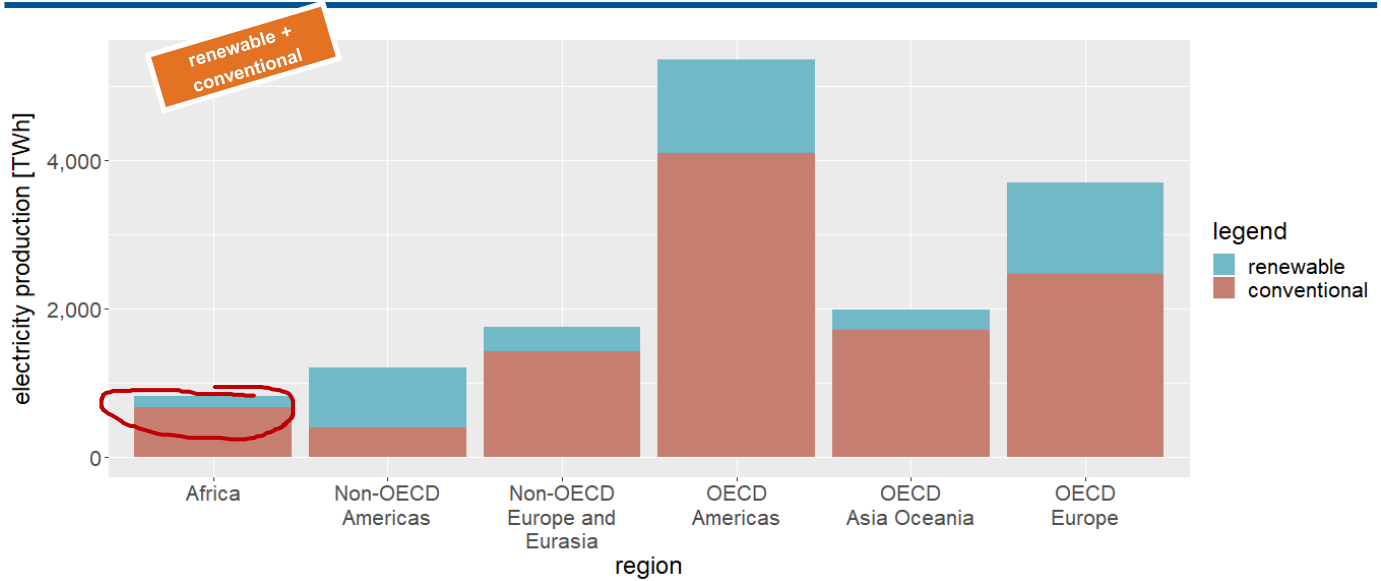
From a development perspective, renewable energy in Africa has many synergies with the SDGs



Source: Eggoh et al. (2011), Schwerhoff and Sy (2017), Lucas et al. (2015)

Africa has the lowest electricity production in the world and it is expected to grow

Electricity production mix in world regions in 2017



Comments

- Lowest value of electricity production in Africa → expected **growth** potential
- Main sources of energy in Africa are **coal**, **natural gas** and **hydro**
- Share of renewable energy in Africa in 2017 amounts to **18.5%**

Source: International Energy Agency (2017), own visualization

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Hence the research question…

What are the drivers of renewable energy deployment in African countries from a socio-economic and policy perspective?

Six hypotheses along three categories developed

Research hypotheses

Political drivers	Macroeconomic drivers	Structural drivers
H_{Pol1} Democracy	H_{Econ1} Domestic savings	H_{Struc1} Manufacturing (local)
H_{Pol2} Government efficiency	H_{Econ2} Foreign investments	
	H_{Econ3} Aid	

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Hypotheses are tested via a linear regression model

Intercept

Regression coefficients

Time fixed effect

$$Y_{it} = \beta_0 + \beta_1 \cdot X_{1,it} + \cdots + \beta_n \cdot X_{n,it} + \delta_t + \varepsilon_{it}$$

Residual

Dependent variable:
Hydro/ Non-hydro renewable energy production per capita

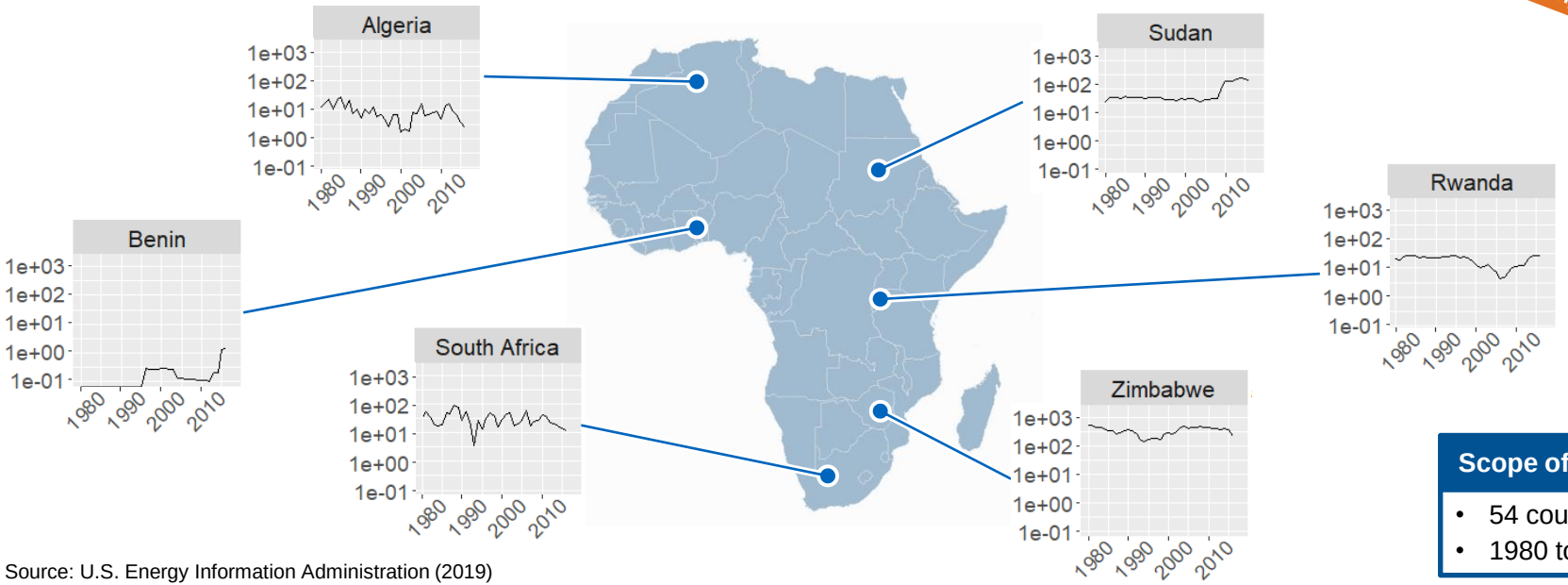
Independent variables:

- $\mathbf{H_{Pol1}}$: Democracy index
- $\mathbf{H_{Pol2}}$: Public institution efficiency index
- $\mathbf{H_{Econ1}}$: Domestic savings
- $\mathbf{H_{Econ2}}$: Foreign Direct Investments
- $\mathbf{H_{Econ3}}$: Received aids
- $\mathbf{H_{Struc1}}$: Manufacturing value add

Two sets of dependent variables considered: Hydro and non-hydro renewables production per capita (1/2)

Selected visualization of the dependent variable: Hydro renewables per capita [kWh] (log scale)

Hydro



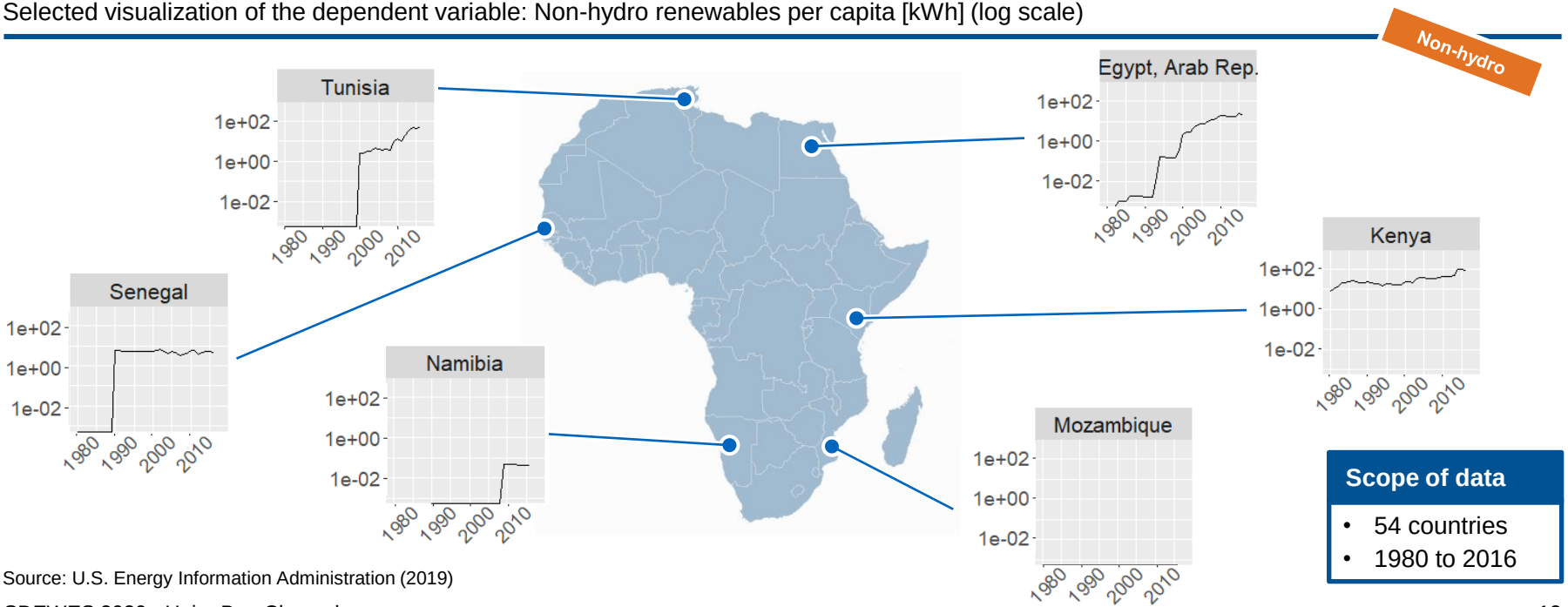
Scope of data

- 54 countries
- 1980 to 2016

Source: U.S. Energy Information Administration (2019)

Two sets of dependent variables considered: Hydro and non-hydro renewables production per capita (2/2)

Selected visualization of the dependent variable: Non-hydro renewables per capita [kWh] (log scale)



Scope of data

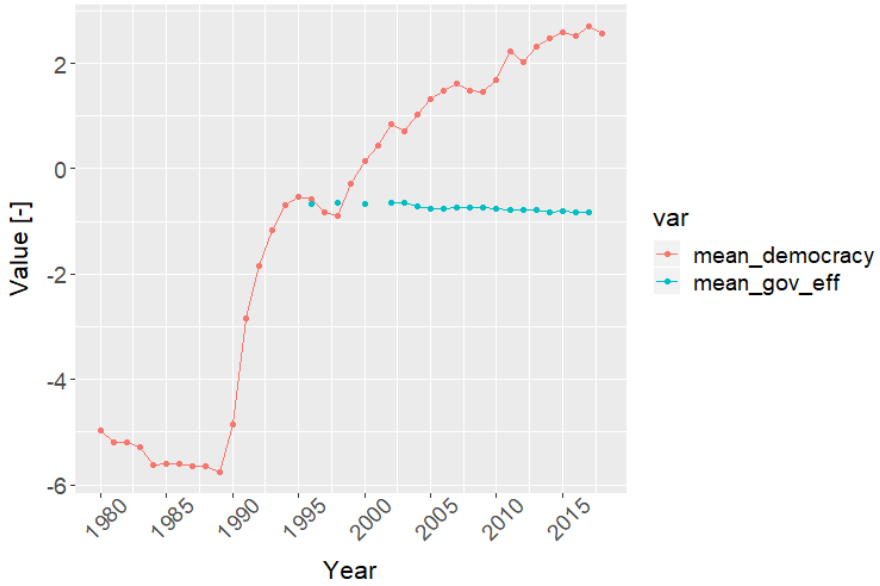
- 54 countries
- 1980 to 2016

Source: U.S. Energy Information Administration (2019)

The different hypotheses are modeled by a set of independent variables (1/2)

Summary statistics and averaged values of the independent variables through the analyzed time scope

	Variable	Obs.	Mean	Std. Dev.	Range
H_{Pol1}	Democracy	1973	-0.90 [-]	5.92 [-]	-10 – 10 [-]
H_{Pol2}	Government efficiency	1013	0.74 [-]	0.63 [-]	-2.48 – 1.05 [-]

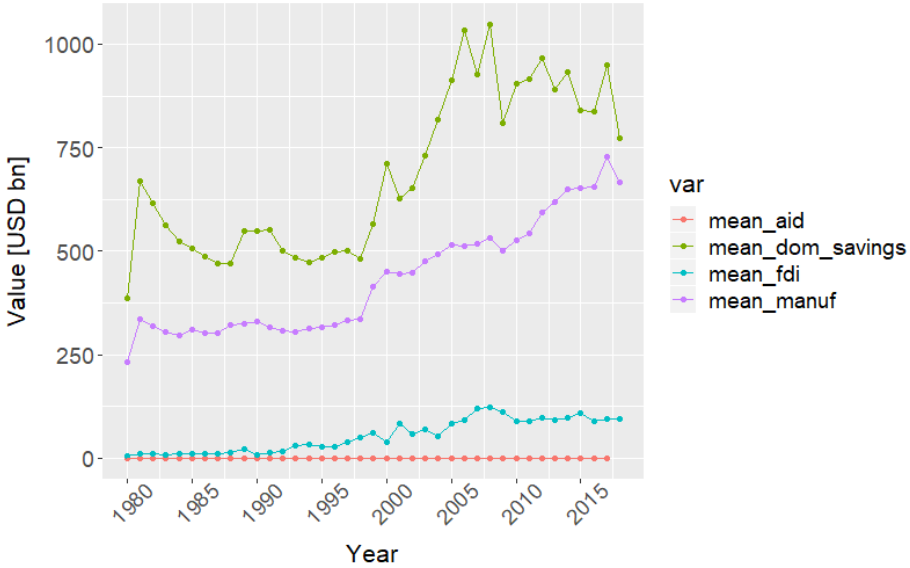


Source: Marshall and Jaggers (2019), Kaufmann et al. (2010)

The different hypotheses are modeled by a set of independent variables (2/2)

Summary statistics and averaged values of the independent variables through the analyzed time scope

	Variable	Obs.	Mean	Std. Dev.	Range
H_{Econ1}	Domestic savings	1672	697 [$ bn]	1,724 [$ bn]	-237 – 12,744 [$ bn]
H_{Econ2}	Foreign investment	1843	57 [$ bn]	148 [$ bn]	-616 – 1,647 [$ bn]
H_{Econ3}	Aid	1996	590 [$ m]	761 [$ m]	-170 – 11,278 [$ m]
H_{Struc1}	Manufacturing	1582	444 [$ bn]	1,129 [$ bn]	0 – 7,972 [$ bn]



Source: World Bank (2019)

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Government efficiency and foreign investment are significantly correlated with hydro production

Hydro

H_{Pol1}
H_{Pol2}
H_{Econ1}
H_{Econ2}
H_{Econ3}
H_{Struc1}
Control

	Dependent variable: Hydro per capita					
	Model (1.1)	**Model (1.2)**	**Model (1.3)**	**Model (1.4)**	**Model (1.5)**	**Model (1.6)**
Democracy	0.118	1.442			1.371	1.087
Government efficiency		**67.030*** **				**104.197*** **
Domestic savings			-1.316e-11***		-3.848e-12*	1.833e-12
Foreign investment			**8.737e-11*** **		**8.975e-11*** **	**8.975e-11*** **
Aid			-6.758e-09		-8.156e-09	-2.306e-08**
Manufacturing				-2.243e-11	-2.118e-11***	-2.118e-11***
Hydro capability	0.075***	0.112***	0.125***	0.045*	0.120***	2.547**
Constant	-1,126.630	-2,469.588	-2,401.626**	-387.328	-1,446.766	-4,879.355**
Observations	1,469	719	1,242	1,198	1,082	609

Note: OLS with heteroskedasticity-robust standard errors. Time fixed effects are included but not shown.
*** significant at 1%, two tailed tests.
** significant at 5%, two tailed tests.
* significant at 10%, two tailed tests.

Democracy and government efficiency are significantly correlated with non-hydro renewables production

Non-hydro

		Dependent variable: Non-hydro renewables per capita					
		Model (2.1)	Model (2.2)	Model (2.3)	Model (2.4)	Model (2.5)	Model (2.6)
H_{Pol1}	**Democracy**	**1.296*** **	**1.371*** **			**1.732*** **	**1.560*** **
H_{Pol2}	**Government efficiency**		**29.018*** **				**36.609*** **
H_{Econ1}	Domestic savings			-3.060e-13		-1.448e-12***	1.123e-12
H_{Econ2}	Foreign investment			-3.532e-12		-3.732e-12	-9.498e-12
H_{Econ3}	Aid			-2.871e-09**		-2.775e-09**	-4.870e-09**
H_{Struc1}	Manufacturing				-4.471e-13	1.430e-12**	-4.885e-12**
	Constant	-306.920***	-1,612.611***	-1,209.428***	-1,176.992***	-439.668**	-2,140.815***
	Observations	1,862	916	1,537	1,496	1,299	737

Note: OLS with heteroskedasticity-robust standard errors. Time fixed effects are included but not shown.
*** significant at 1%, two tailed tests.
** significant at 5%, two tailed tests.
* significant at 10%, two tailed tests.

Key insights are synthesized from interviews

Political drivers

- **Communities** can be instrumental in **influencing** energy policy, given democracy
- **Transparency** and **participatory decision-making** are key in making good energy policies
- There are **four main public institutions** which are responsible for a good implementation for energy policies: Ministry/department of energy, the parliament, the public utility, and the power regulator

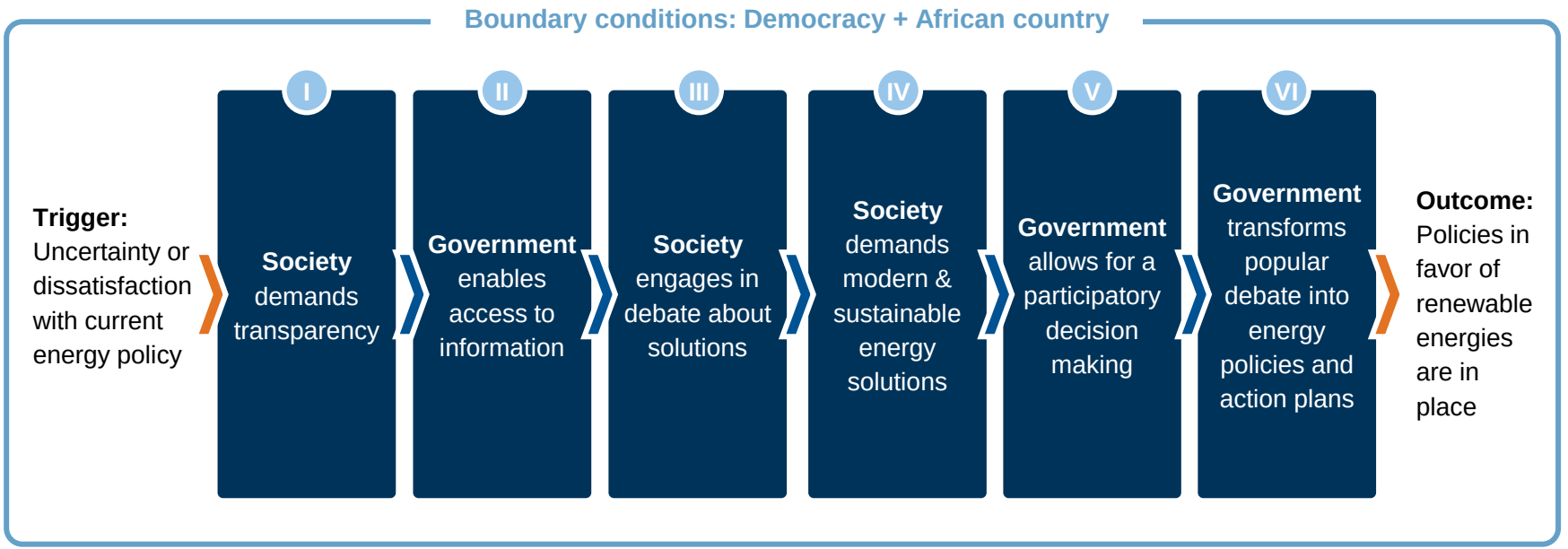
Macro-economic drivers

- Governments **cannot afford** the costs of renewable energy projects
- **International capital** is available, but it needs good guarantees to invest
- **Favorable energy policies** in place would reduce risks and attract capital

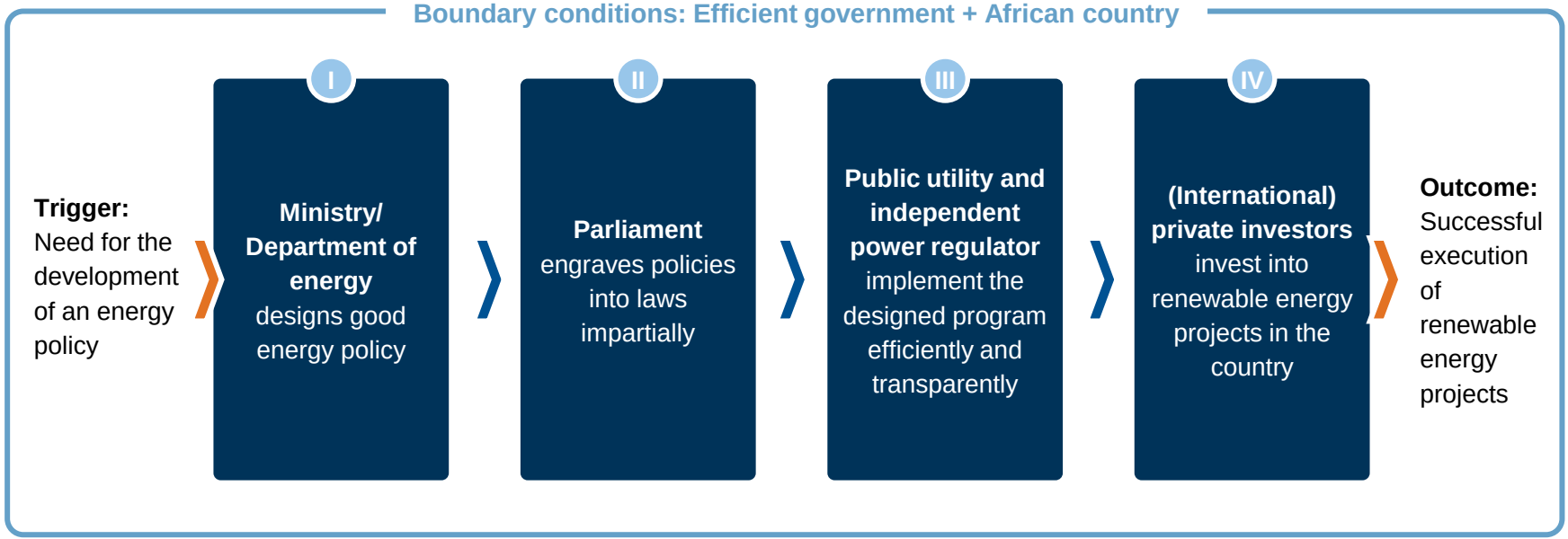
Structural drivers

- When the business opportunity is there, **skill and know-how** can be made available, but come with costs

Causal mechanism: Democracy as a driver of renewable energy



Causal mechanism: Government efficiency as a driver of renewable energy



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Conclusion

Implications

- **Democratic** conditions and an **efficient government** do drive renewable energy development in Africa
- When energy policy is favorable for renewable energy, **international capital** will flow into RE projects in Africa

Policy recommendations

In order to drive renewable energy in Africa

- **International organizations and development agencies should focus on:**
  - Supporting democratic decision making and good governance
  - Building capacities in energy policy development
- **Regional African bodies should focus on:**
  - Enabling democracy
  - Sharing expertise and best practices in energy policy development and deployment