3rd International Energy Fair

Renewables and Energy Efficiency

ACHIEVING A JUST ENERGY TRANSITION IN AN INCREASINGLY COMPLEX WORLD:

INTEGRATING SUSTAINABLE ENERGY TECHNOLOGIES INTO “ISLAND” POWER GRIDS WITHIN THE CARIBEEAN

Devon Gardner
Caribbean Centre for Renewable Energy and Energy Efficiency

2024.09.18 Havana, Cuba

CCREEE
CARIBBEAN CENTRE FOR RENEWABLE ENERGY & ENERGY EFFICIENCY

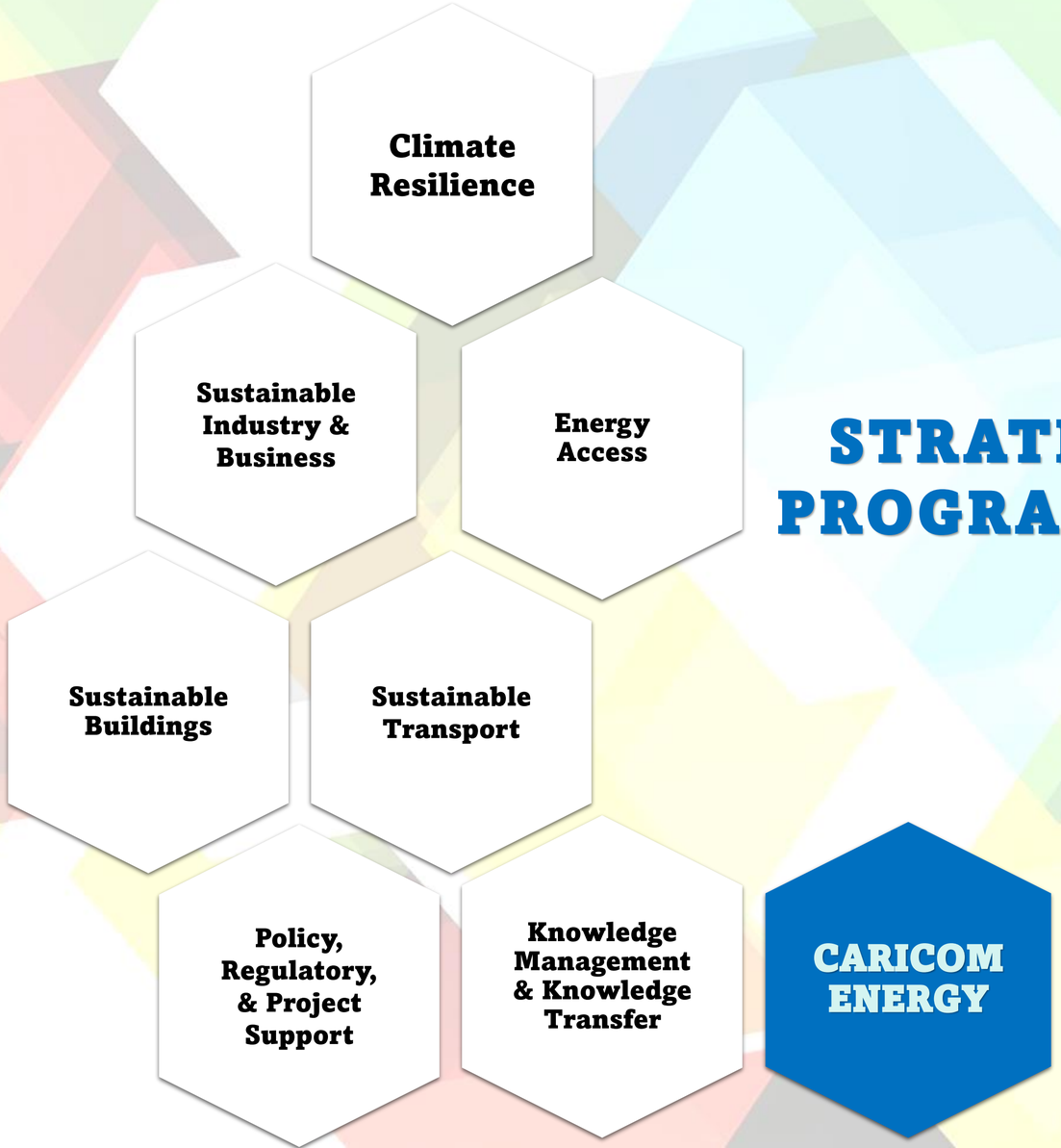
CARICOM

CCREEE
CARIBBEAN CENTRE FOR RENEWABLE ENERGY & ENERGY EFFICIENCY

CARICOM

Territories Served:

- Anguilla
- **Antigua and Barbuda**
- **The Bahamas**
- **Barbados**
- **Belize**
- Bermuda
- British Virgin Islands
- Cayman Islands
- **Dominica**
- Grenada
- **Guyana**
- Haiti
- **Jamaica**
- **Montserrat**
- **St. Kitts and Nevis**
- **Saint Lucia**
- **St. Vincent and the Grenadines**
- **Suriname**
- Trinidad and Tobago
- **Turks and Caicos Islands**



STRATEGIC PROGRAMMES

SYSTEM PILLARS

ENERGY IMPORT SITUATION, CARICOM [2022]

Country	Dependence on imports, %	Imported energy resources
Antigua and Barbuda	100% (2022)	Refined petroleum products
The Bahamas	98% (2022)	Refined petroleum products
Barbados	90% (2022)	*Small amounts of petroleum exported*, and Refined petroleum products imported, LNG
Belize	63% (2022)	Refined petroleum products, Electricity (Mexico)
Dominica	92% (2022)	Refined petroleum products
Grenada	93% (2022)	Refined petroleum products
Guyana	0% (2022)	***Petroleum exported***, and Refined petroleum products imported
Haiti	85% (2019)	Refined petroleum products
Jamaica	91% (2022)	Petroleum, Refined petroleum products, LNG
Montserrat	100% (2022)	Refined petroleum products
St. Kitts and Nevis	98% (2022)	Refined petroleum products
Saint Lucia	95% (2022)	Refined petroleum products
St. Vincent and the Grenadines	87% (2022)	Refined petroleum products
Suriname	Less than 5% (2021)	Petroleum
Trinidad and Tobago	0% (2022)	***Petroleum exported***, and refined petroleum products imported

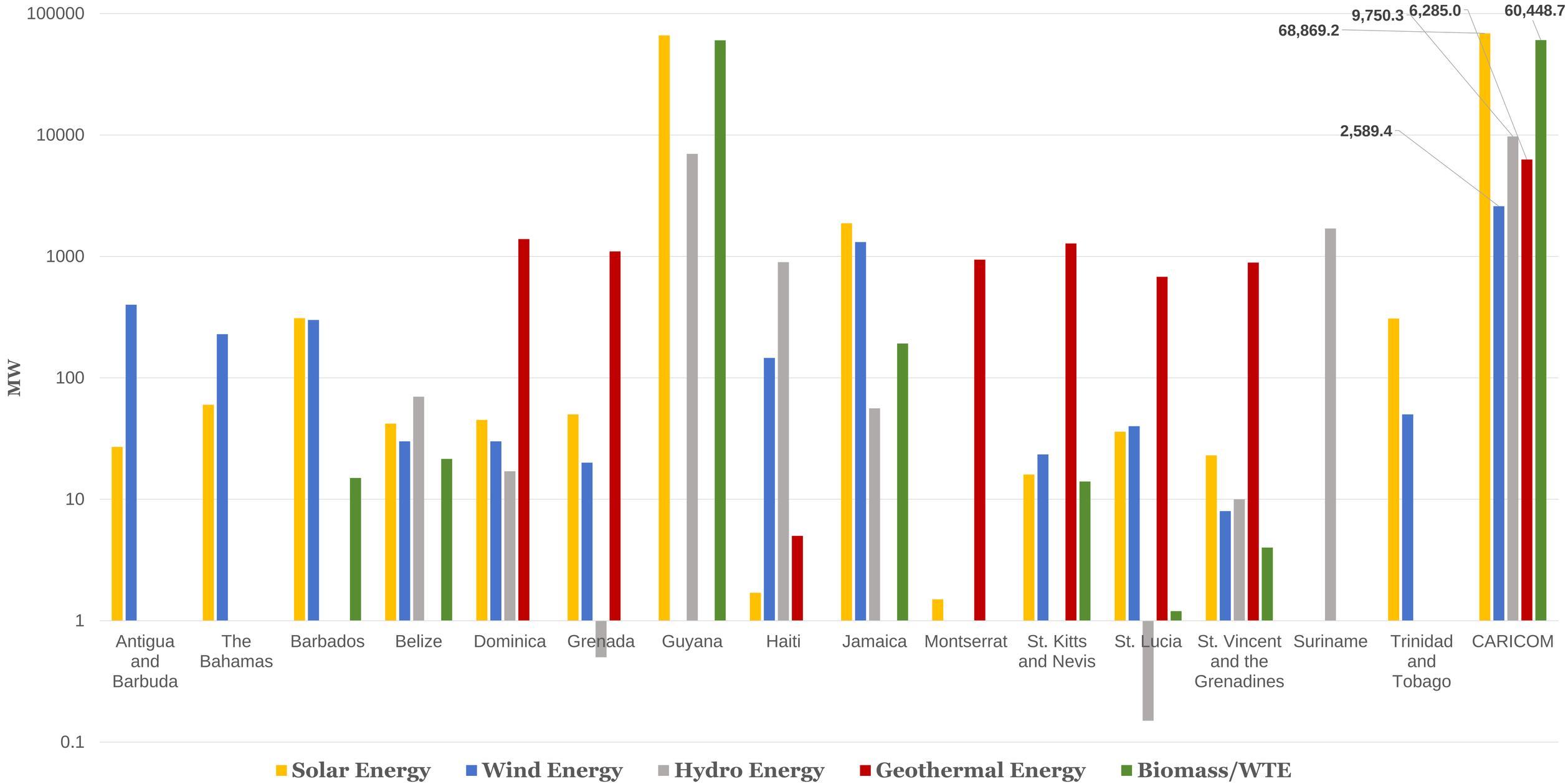
CARICOM Average
88%

Global Average
21%

APPROPRIATE RE OPTIONS, CARICOM

Technology **Countries**	SOLAR PV	Wind	HYDRO Run-of-river	GEO Binary	BIOMASS Gasification	BIOMASS Anaerobic	BIOMASS Liquid biofuels	OTEC/SWAC	OCEAN Current
Antigua & Barbuda	■	■			■	■		■	■
Bahamas	■	■			■			■	■
Barbados	■	■			■	■		■	■
Belize	■	■	■		■	■	■		
Dominica	■	■	■	■	■	■		■	■
Grenada	■	■	■	■	■	■		■	■
Guyana	■	■	■		■	■	■		
Jamaica	■	■	■		■	■	■	■	■
St. Kitts & Nevis	■	■		■	■	■		■	■
St. Lucia	■	■	■	■	■	■		■	■
St. Vincent & the Grenadines	■	■	■	■	■	■		■	■
Suriname	■	■	■		■	■	■		
Trinidad & Tobago	■	■	■		■	■		■	

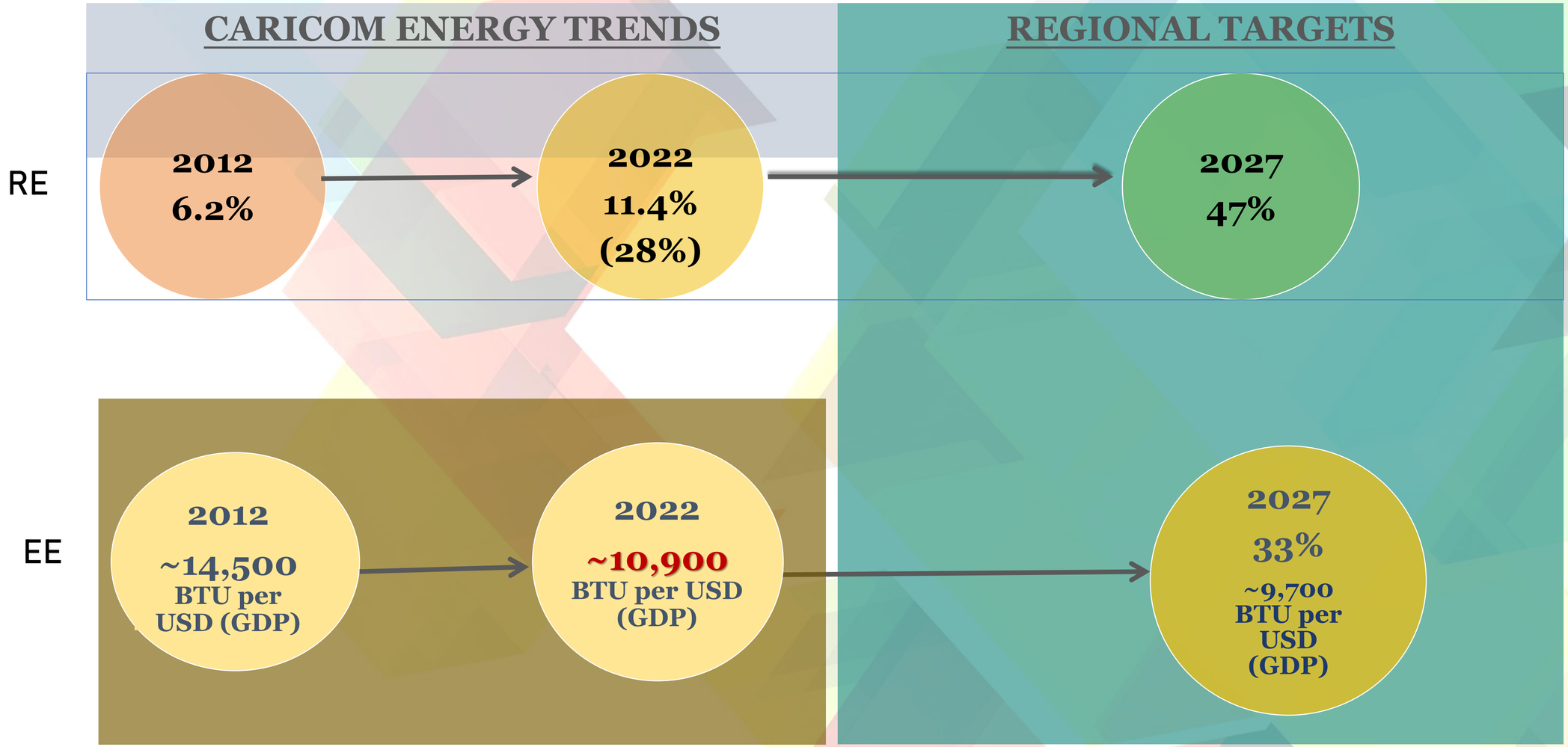
RE POTENTIAL, CARICOM



OSW POTENTIAL, CARICOM [2022]

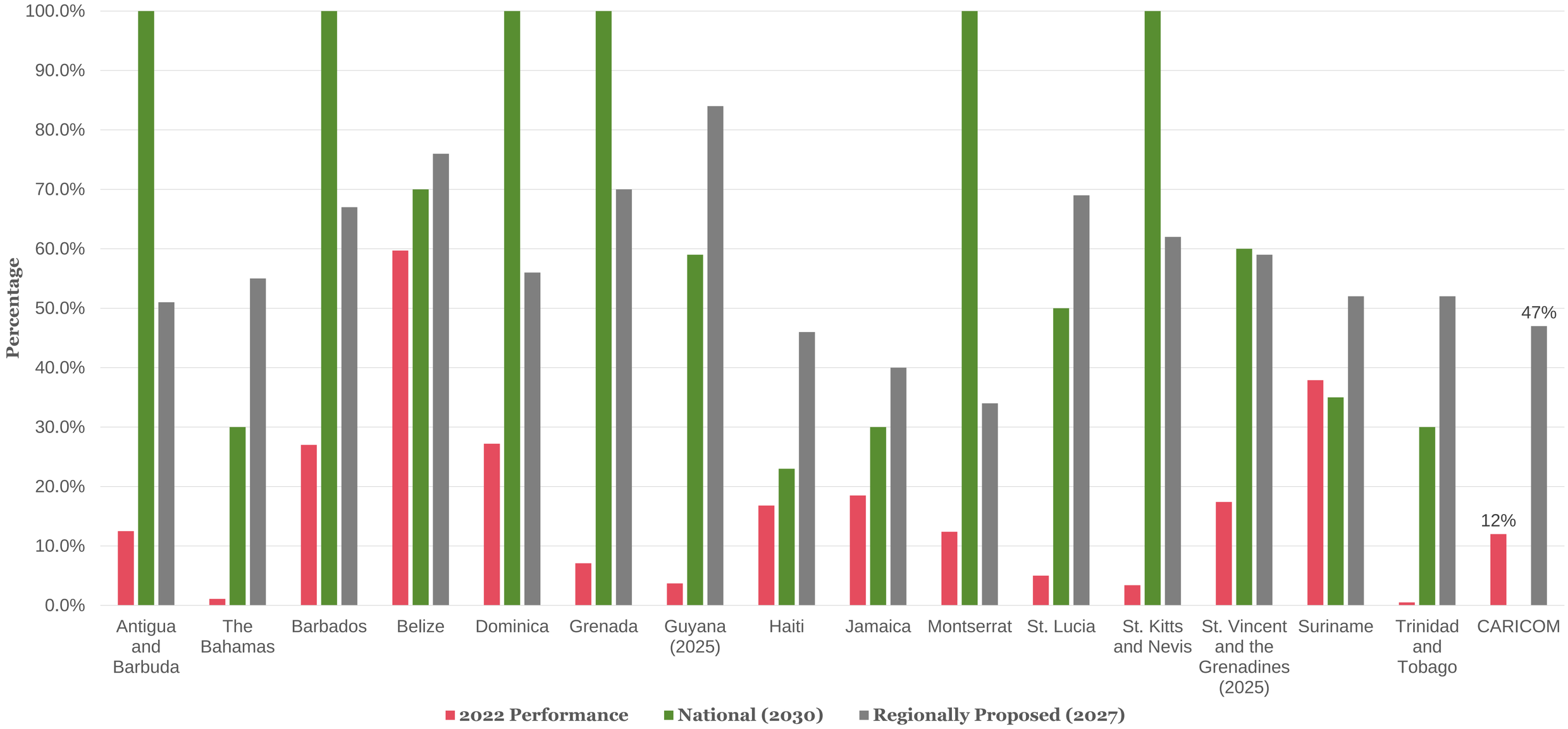
Country	"Exploitable" OSW Potential/ GW			
	Fixed	Conventional Floating	Deepsea Floating	Total
Antigua & Barbuda	**4.9**	1.48	11.8	18.18
The Bahamas	**10.9**	6.32	16.7	33.92
Barbados		0.11	7.1	7.21
Grenada	**2.6**	0.48	7.2	10.28
Jamaica	**1.21**	1.85	9.7	12.76
St. Kitts & Nevis	**0.4**	0.96	9.2	10.56
Saint Lucia	**0.1**	0.22	4.02	4.34
St. Vincent & the Grenadines	**3.23**	0.39	3.0	6.62
Trinidad & Tobago	**16.6**	12.5	4.96	34.06
TOTAL	**39.94**	24.31	73.68	**137.9**

AGGREGATED CARICOM PERFORMANCE, AT A GLANCE

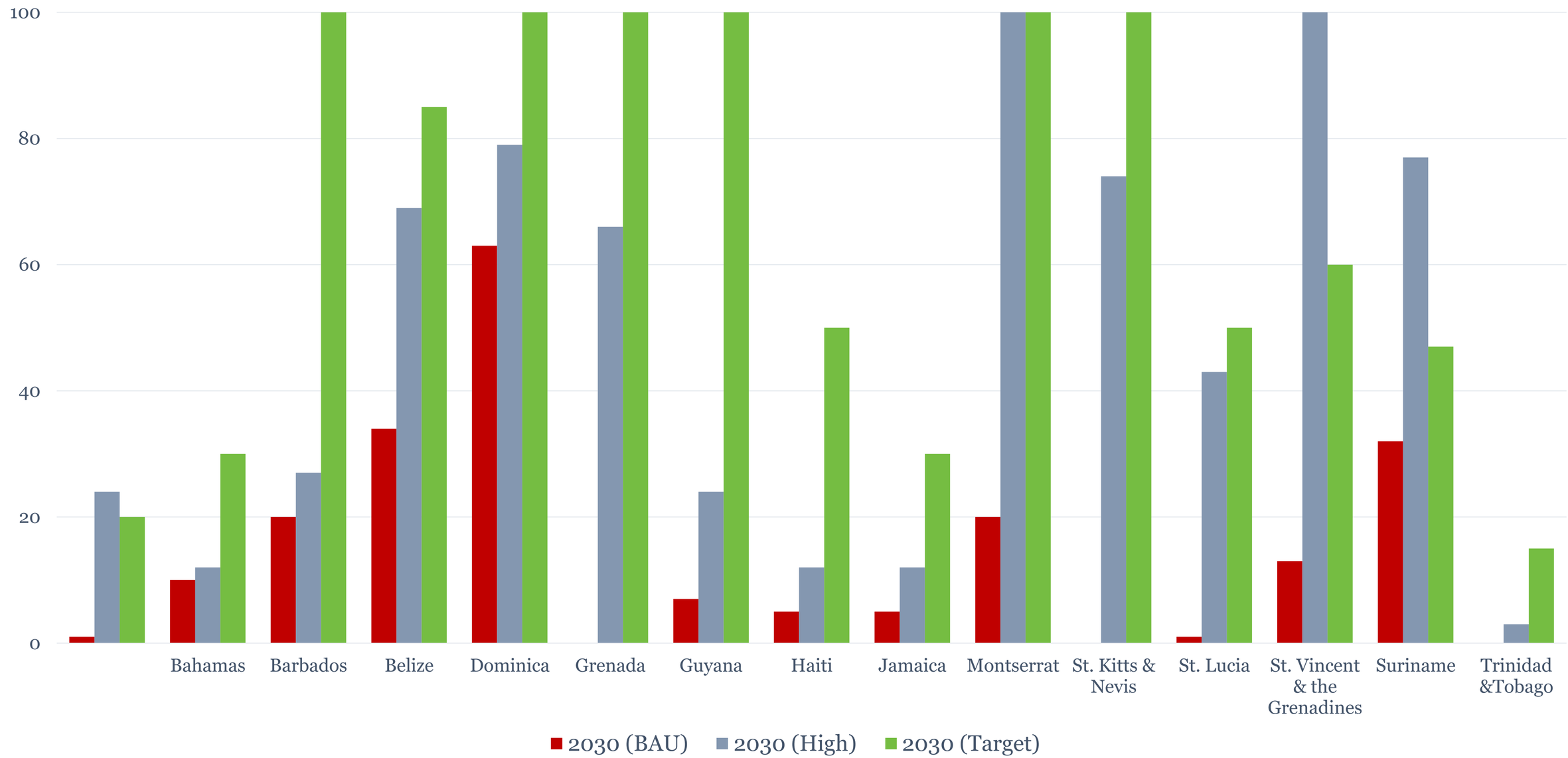


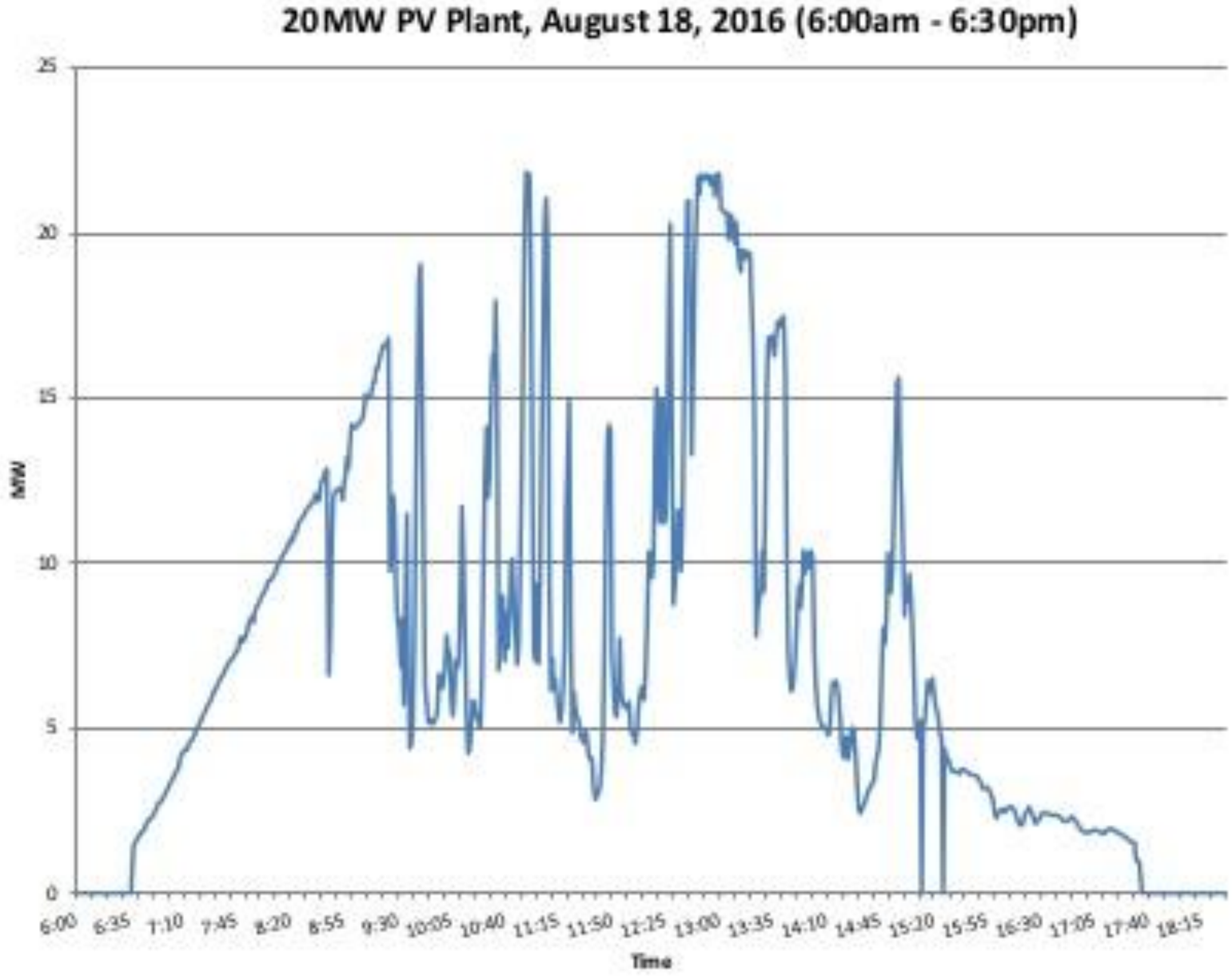
CURRENT PERFORMANCE AGAINST TARGETS

Electricity Generated from Renewable Sources (2022)



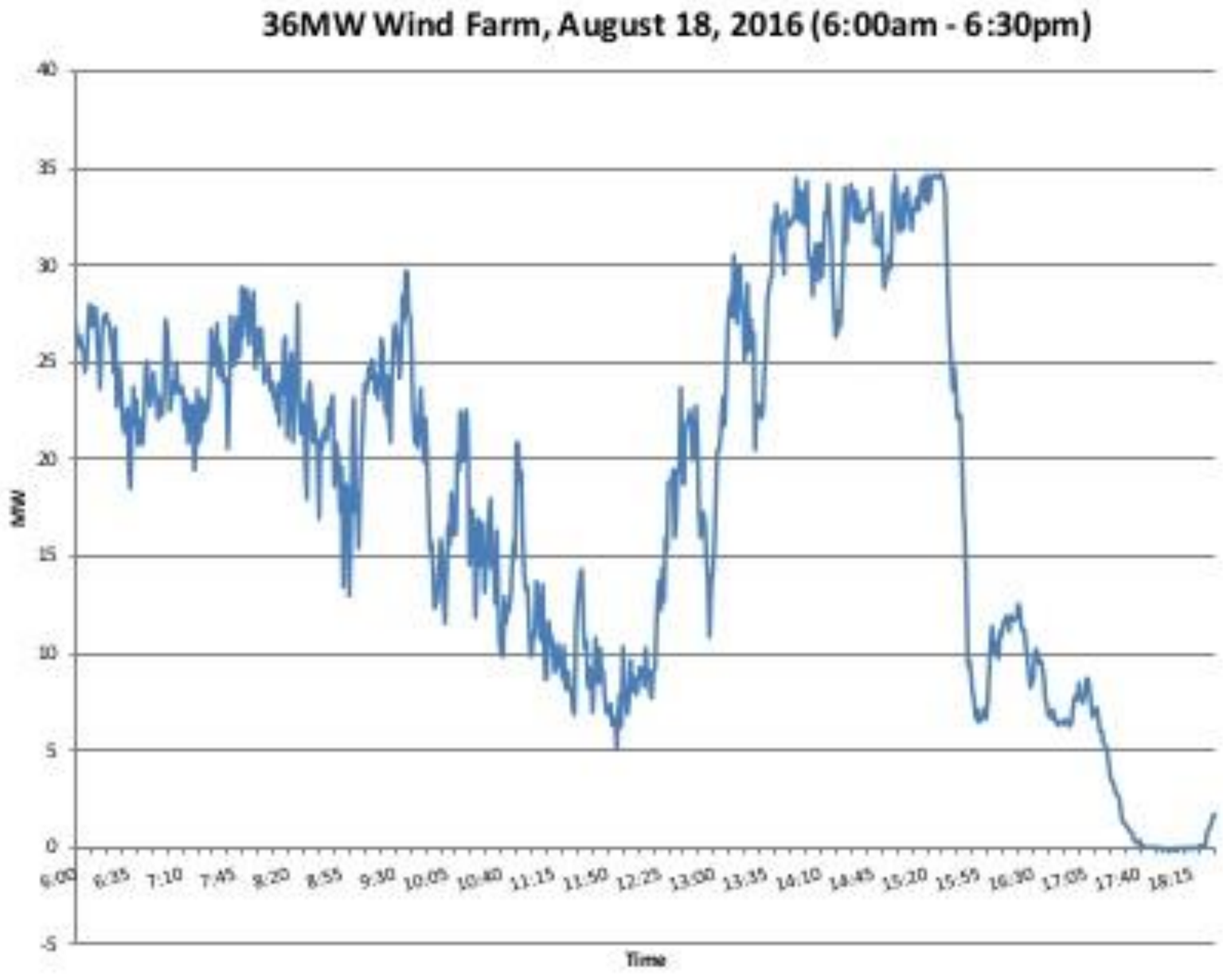
2030 PROJECTIONS FOR ELECTRICITY GENERATED FROM RE SOURCES (2022)





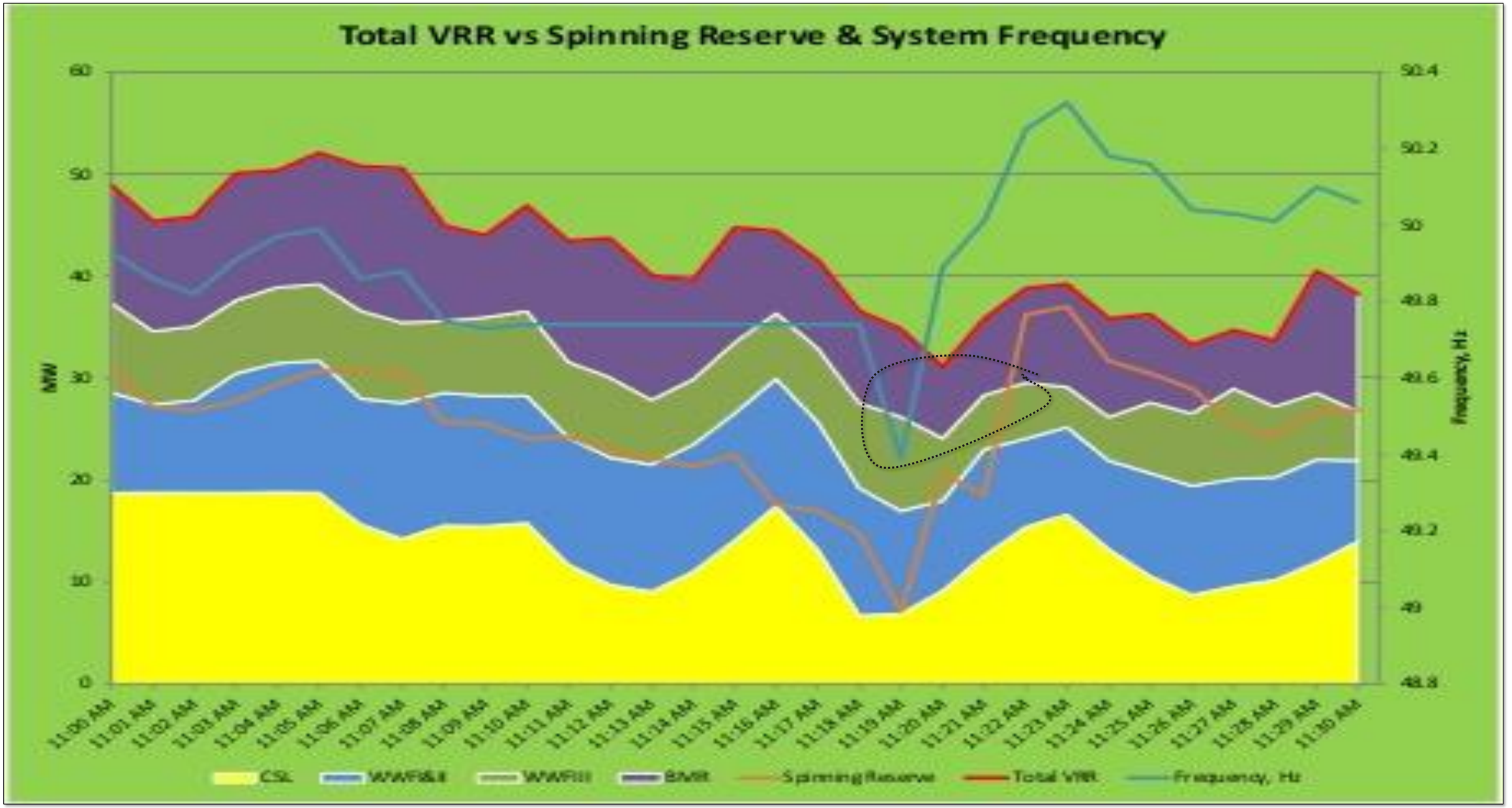
Content Solar PV Power

18 August 2016

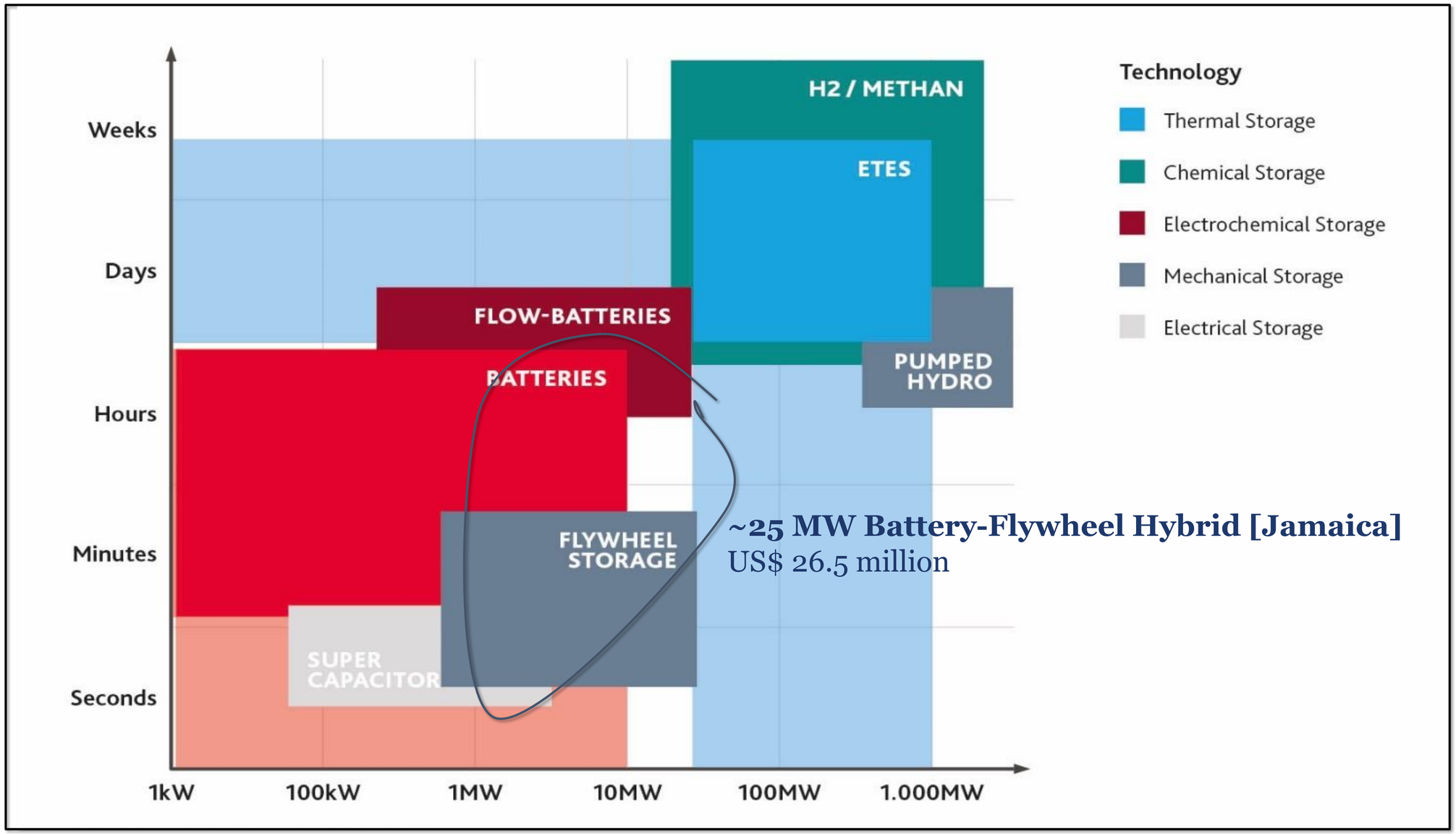


BMR Wind Power
18 August 2016

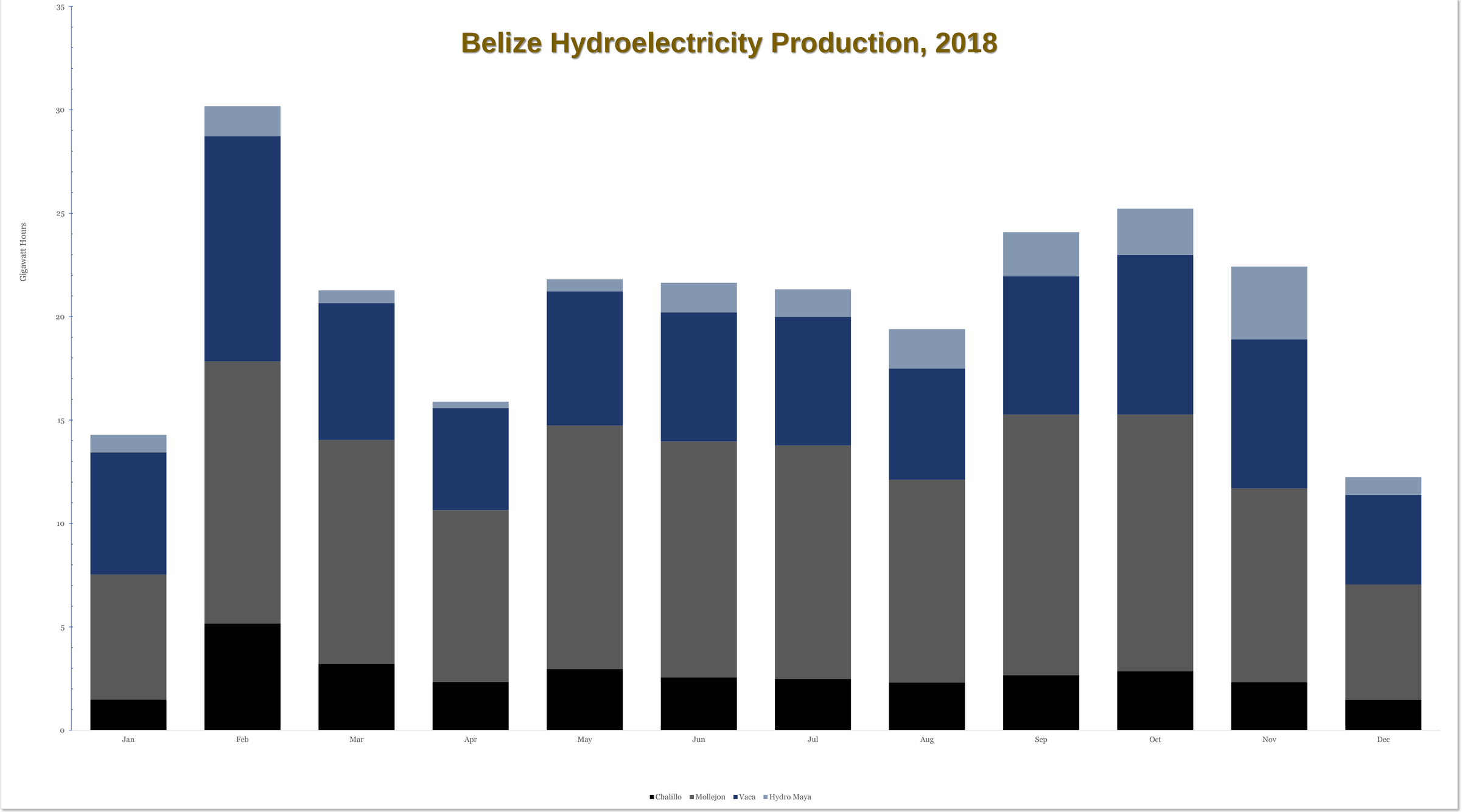
TOTAL SYSTEM, JAMAICA [2016]



UTILITY-SCALE ENERGY STORAGE SYSTEM, JAMAICA



Belize Hydroelectricity Production, 2018



St. Thomas, U.S. Virgin Islands
September 2017

Puerto Rico
September 2017

Suriname
June 2022

Freeport, Grand Bahamas

October 2016

Central Trinidad, Trinidad & Tobago

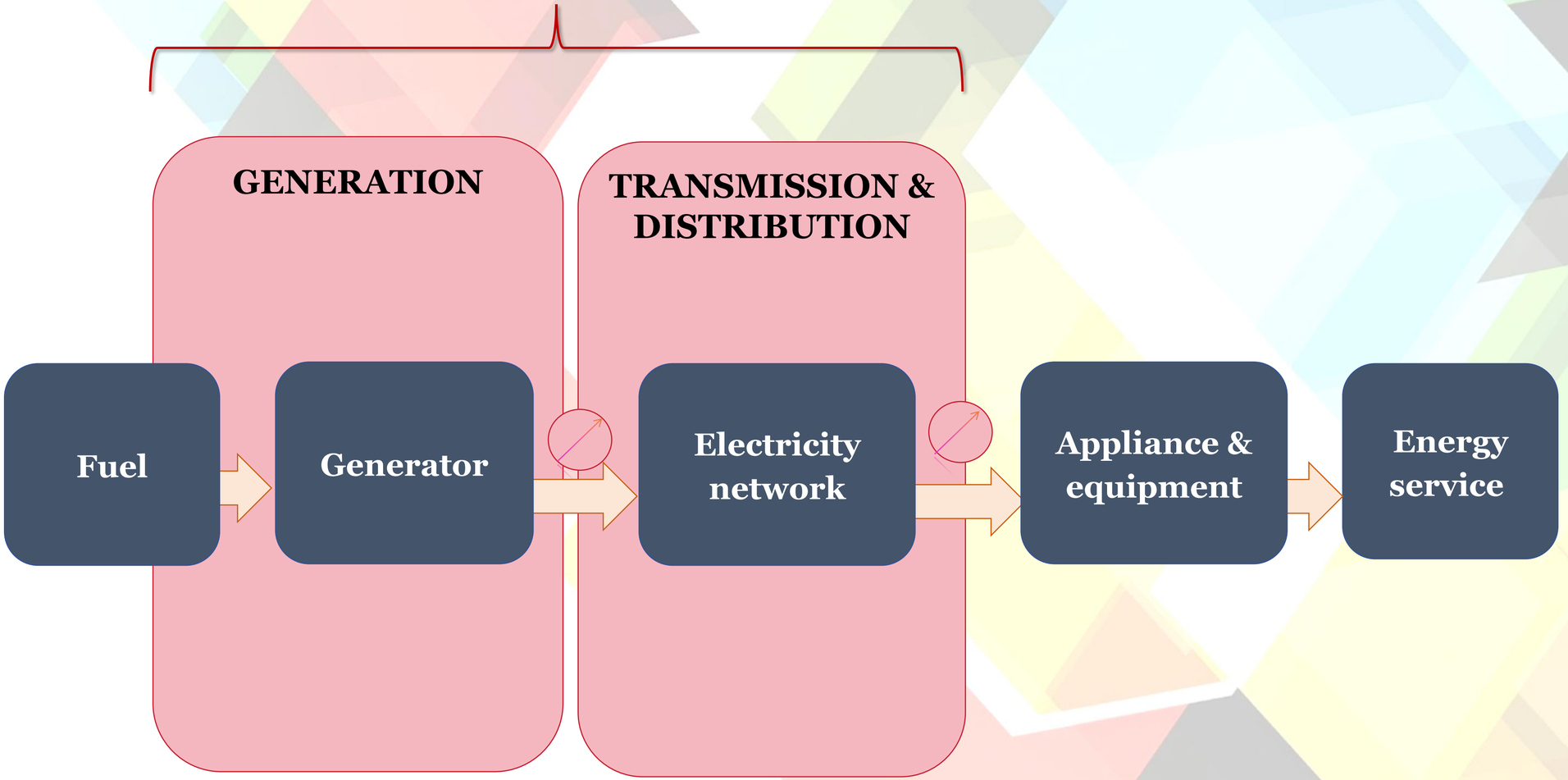
October 2018

Roseau, Dominica
September 2017

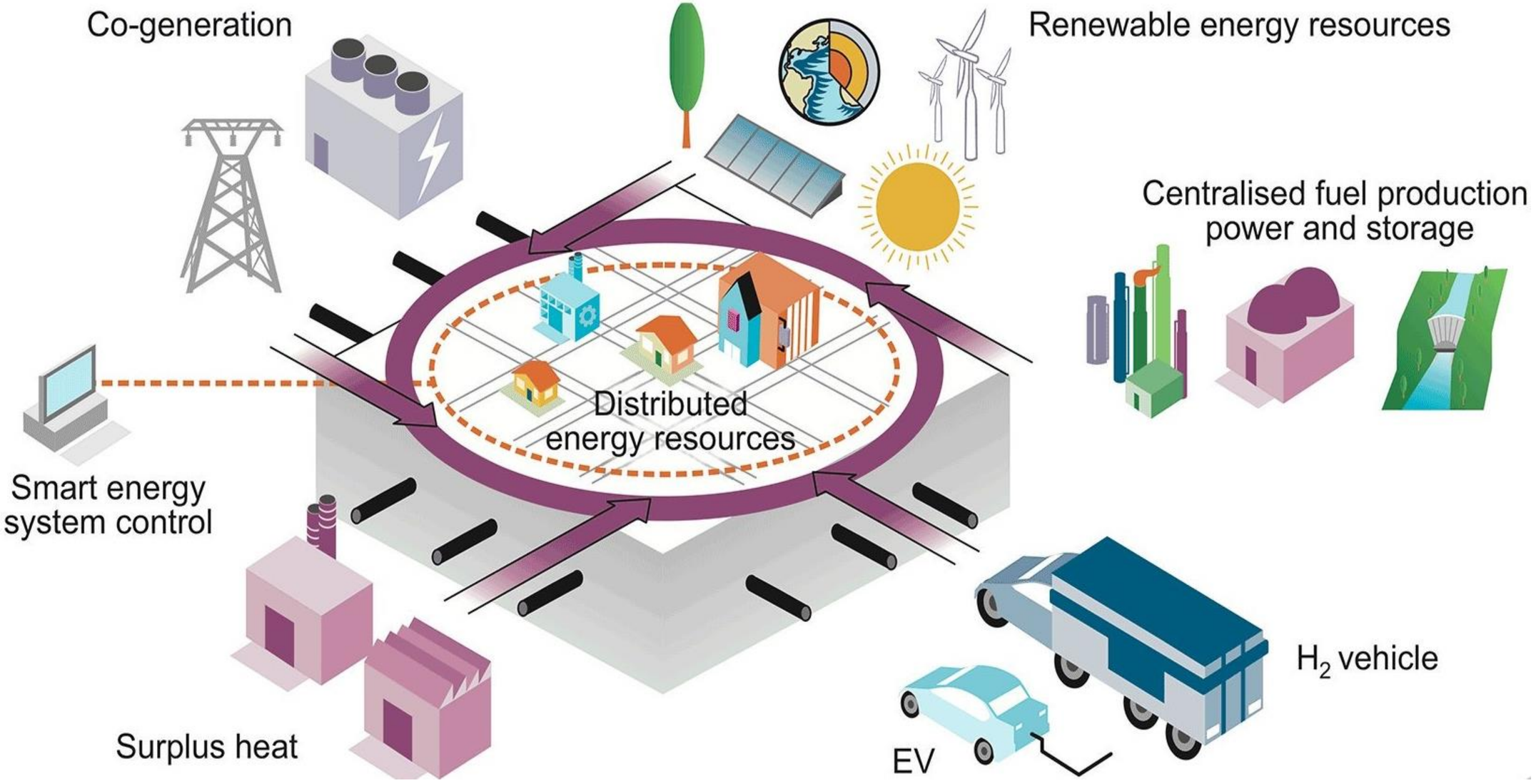
A TYPICAL ELECTRIC GRID

THE TRADITIONAL POWER SECTOR ARCHITECTURE

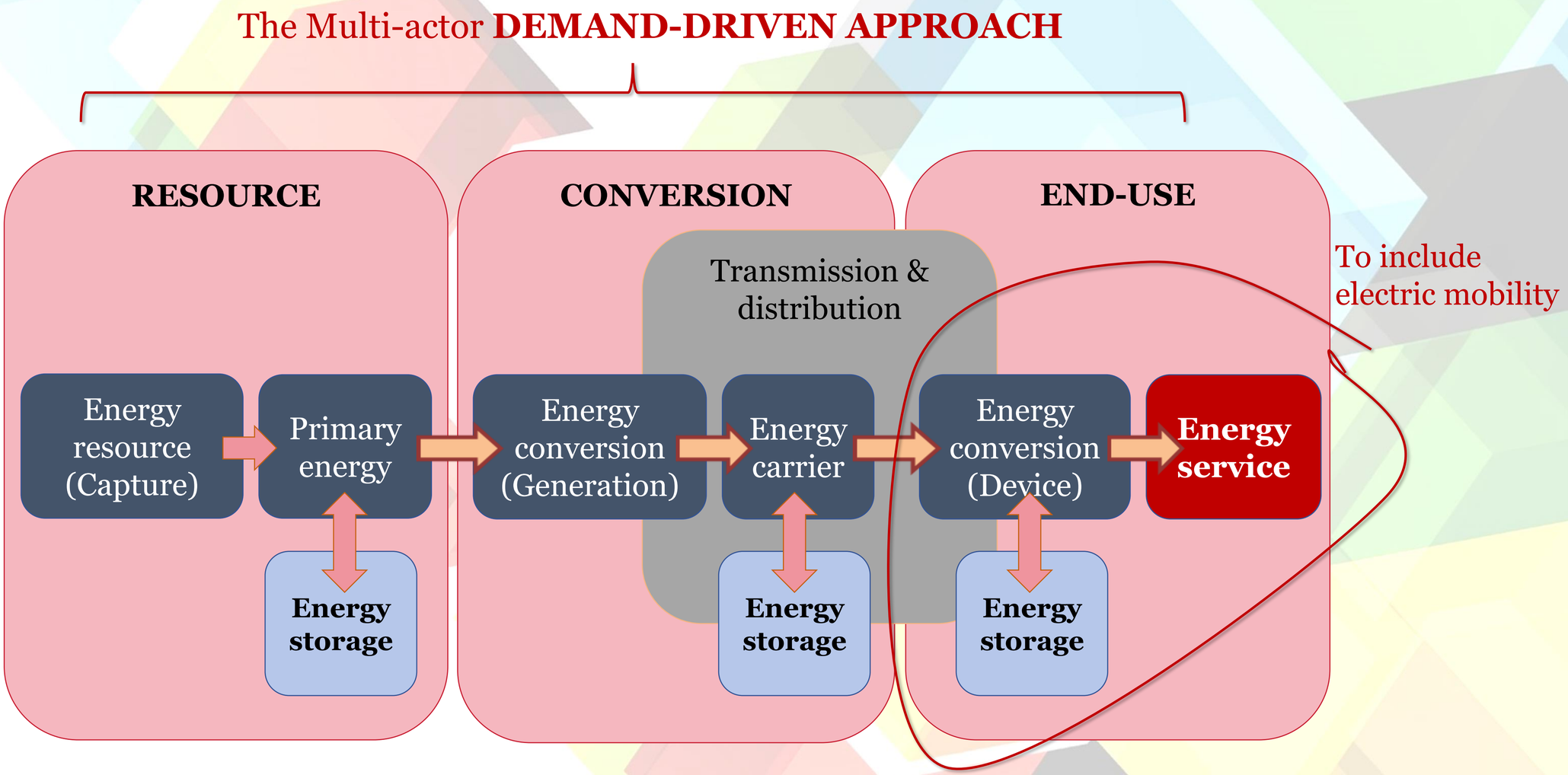
The "Utility-centric" **SUPPLY APPROACH**



THE FUTURE ELECTRIC GRID



THE EMERGING POWER SECTOR ARCHITECTURE



SELECT SOCIOECONOMIC INDICATORS, CARICOM [2022]

Country	Population	GDP Per Capita/ USD	Debt to GDP Ratio
Antigua and Barbuda	100,967	14,466	79%
The Bahamas	399,314	32,299	90%
Barbados	267,800	42,463	123%
Belize	441,471	6,585	46%
Dominica	74,289	8,580	104%
Grenada	114,272	10,428	65%
Guyana	775,800	18,330	24.6%
Haiti	11,584,996	1,748	100%
Jamaica	2,738,100	6,049	84%
Montserrat	4,433	42,256	N.A.
St. Kitts and Nevis	50,287	19,355	60%
Saint Lucia	183,251	12,719	70%
St. Vincent and the Grenadines	110,872	8,666	88%
Suriname	624,900	5,597	122%
Trinidad and Tobago	1,365,805	22,005	66%

High-income
USD 14,005

High-debt
67%

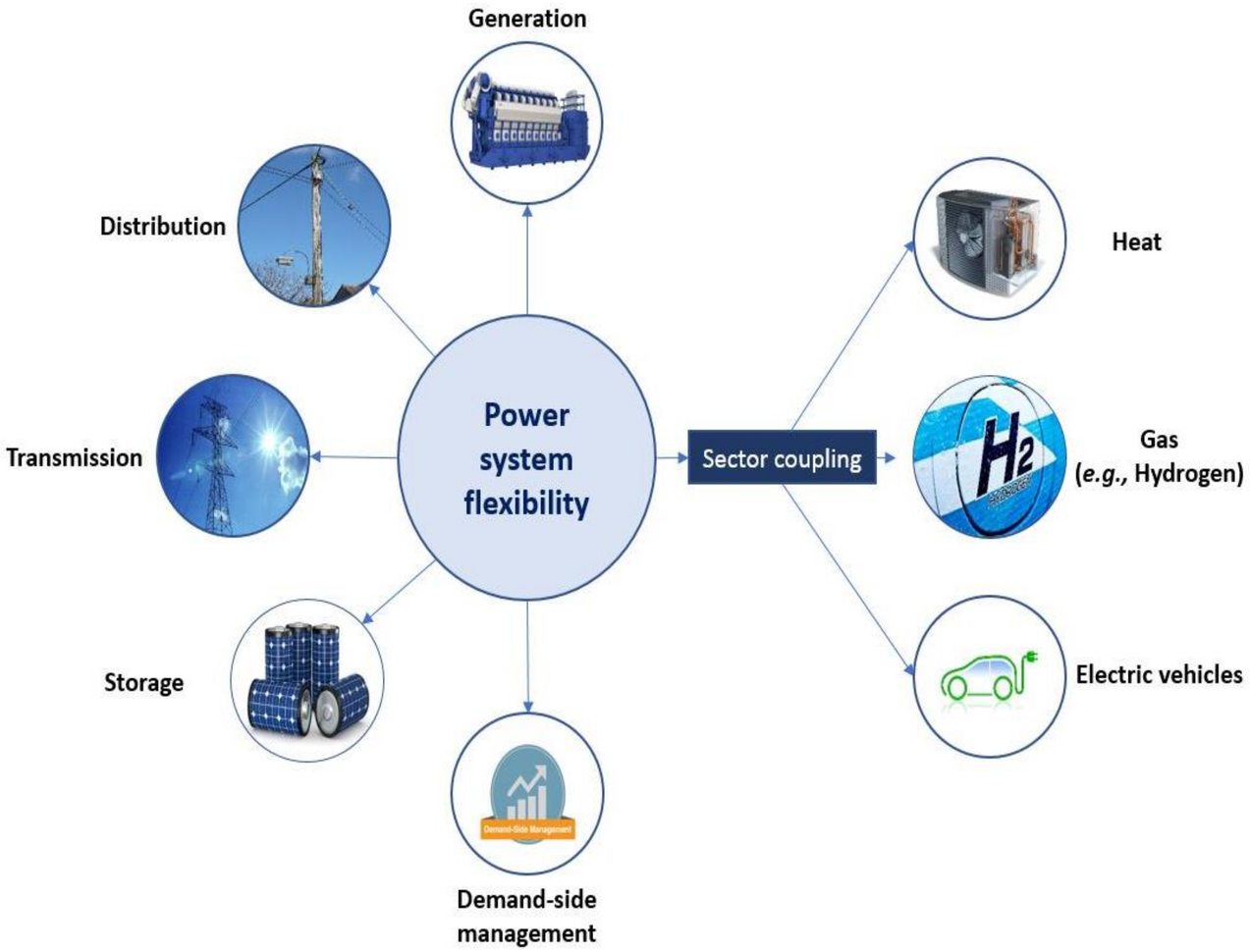
World Bank Definitions

THE “GREEN HYDROGEN” STRATEGY

Hydrogen could become the major differentiator for **CARICOM’s economy**, supplying energy for the regional power, transport and industrial sectors and with *substantial export potential*.

1. Building a **Hydrogen Economy**
2. Hydrogen for a **resilient energy system**
3. Hydrogen for **Industrial Processes**
4. Hydrogen for **Decarbonization of Gas**
5. Hydrogen for **Mobility**
6. Hydrogen for **Export**
7. HYDROGEN VISION

SECTOR COUPLING

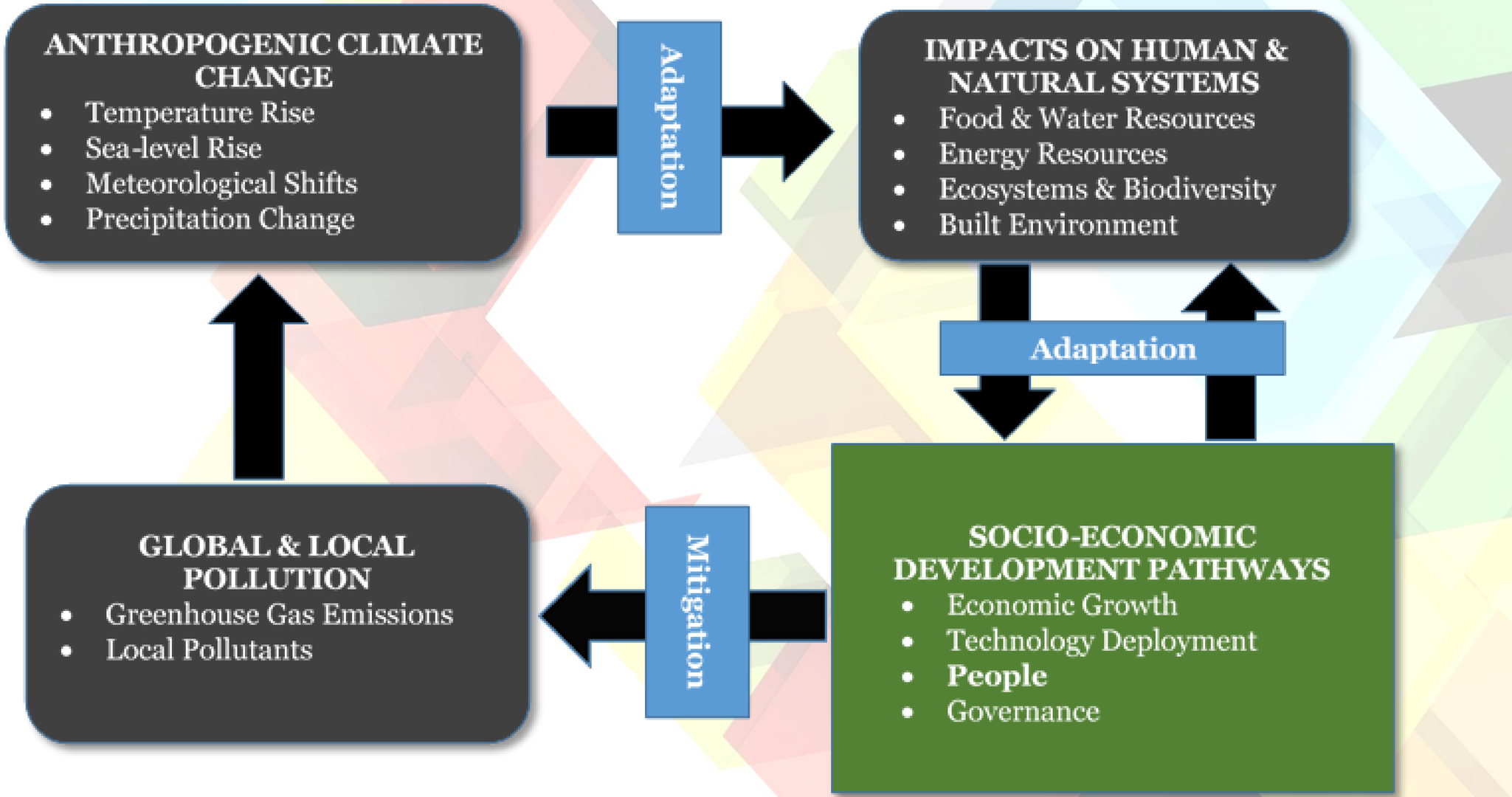


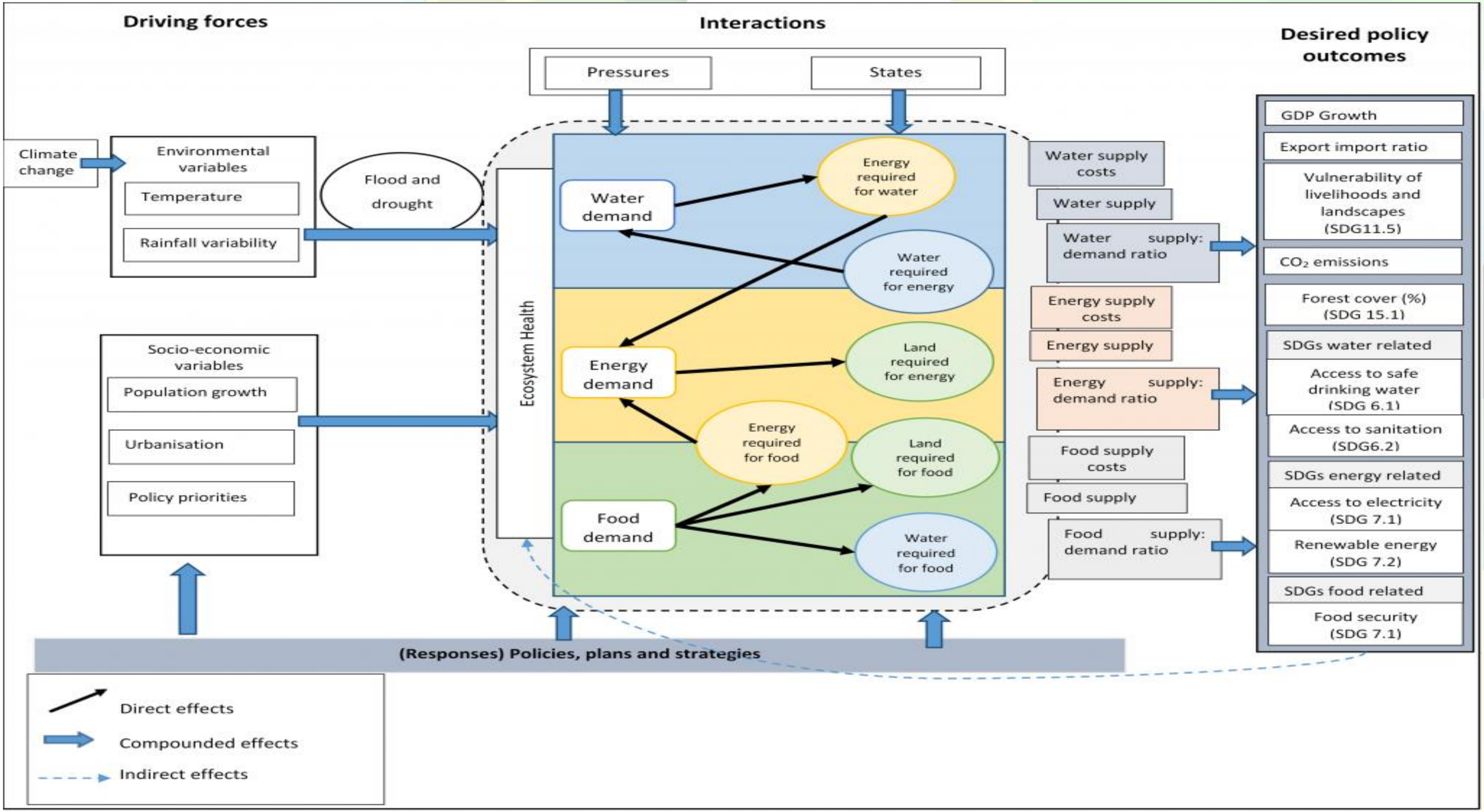
The development of energy as an economic sector, in its own right

- **Clear and present opportunities for electrification in the heating sector and electrification within the transport sector.**

- **Emerging opportunities from Power-to-Gas systems that convert renewable electricity into hydrogen by electrolysis.**
  - *Chemical processes could change molecular hydrogen into to green fuels such as ammonia, methane, "quasi" natural gas, or even liquid energy carriers such as methanol.*

STRENGTHENING THE NEXUS




Driving forces
Interactions
Desired policy outcomes
Pressures
States
Climate change
Environmental variables
Temperature
Rainfall variability
Flood and drought
Socio-economic variables
Population growth
Urbanisation
Policy priorities
Ecosystem Health
Water demand
Energy demand
Food demand
Energy required for water
Water required for energy
Land required for energy
Energy required for food
Land required for food
Water required for food
Water supply costs
Water supply
Water supply: demand ratio
Energy supply costs
Energy supply
Energy supply: demand ratio
Food supply costs
Food supply
Food supply: demand ratio
GDP Growth
Export import ratio
Vulnerability of livelihoods and landscapes (SDG11.5)
CO_2 emissions
Forest cover (%) (SDG 15.1)
SDGs water related
Access to safe drinking water (SDG 6.1)
Access to sanitation (SDG6.2)
SDGs energy related
Access to electricity (SDG 7.1)
Renewable energy (SDG 7.2)
SDGs food related
Food security (SDG 7.1)
(Responses) Policies, plans and strategies
Direct effects
Compounded effects
Indirect effects

“For the things we have to learn
before we can do them,
we learn by doing them”

-Aristotle

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