



Opportunities and Challenges in the Development of Marine Renewable Energy In the Caribbean

*13th Meeting of UN Open-ended Informal Consultative Process on Oceans and Law of the Sea
New York, May 30, 2012*

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Energy Challenges in CARICOM

The key energy challenges for the CARICOM countries are routed in:

- **inadequate energy security** (*linked to affordability, availability and reliability of supplies; rooted in over-dependence on imported Pet & Pet prods for most countries of CARICOM*)
- **inadequate energy sustainability** in all countries, and
- **energy poverty** (stemming from lack of access to modern form of energy) in some territories eg Haiti, Guyana and Suriname.



CARICOM Context

CHARACTERISTICS

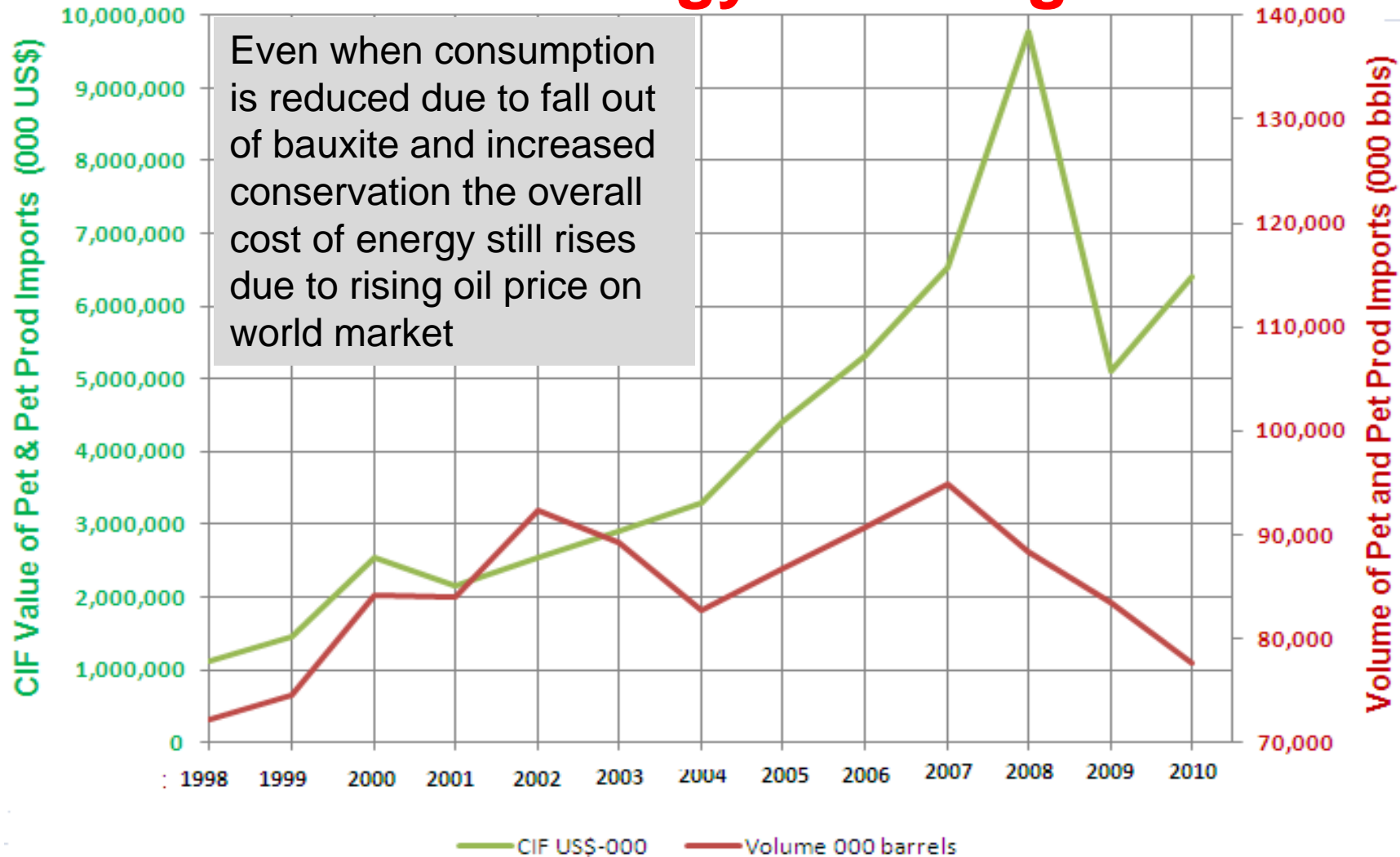
- Relatively Small Total population of approx 16 **million: From St Kitts & Nevis (48,000) to Haiti (9M)**
- Varying levels of economic indicators and development; From Haiti to Trinidad and Tobago ; Bahamas wrt GDP/Capita
- Relatively High level of In-debtedness
- Narrow resource base
- High Exposure to Natural Disasters – Hurricanes and Earthquakes
- Countries have some of **highest electricity tariffs globally** (some had tariff of over US40 cents/kWh in 2008)

Challenges of CARICOM SIDS – 6D's

- **Dots (*Small states*)**
- **Discrete (*most separated by Sea*)**
- **Diverse (*resources, structures*)**
- **Debt (*rel high indebtedness*)**
- **Disasters (*prone to natural*)**
- **Dependence on Imported Pet & Prods**



CARICOM Energy Challenge



CARICOM countries excluding Haiti;

Source CEIS



Inadequate Energy Security

Affordability Dimension

Industrial Rates (International)

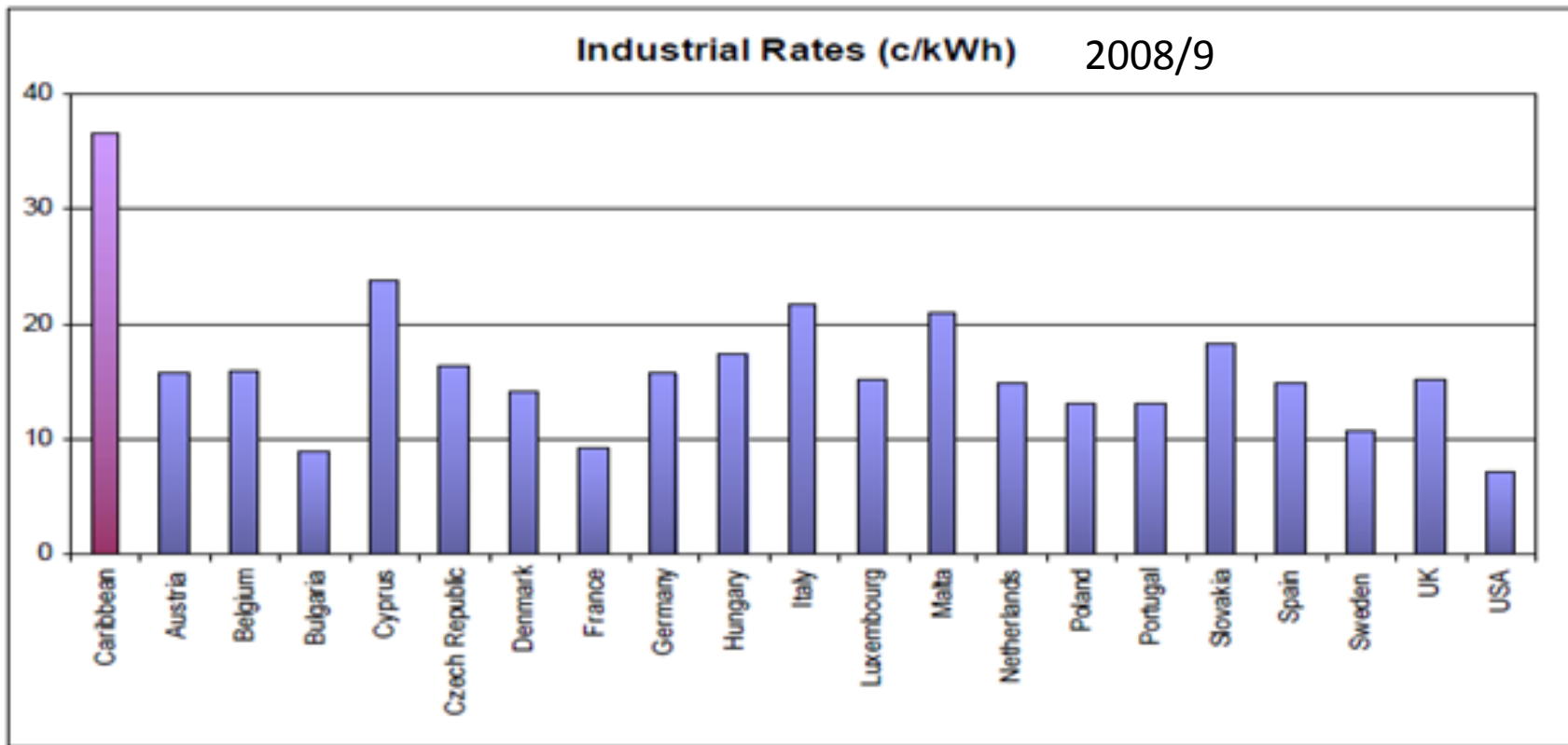


Figure Average Electricity Industrial Tariff of Caribbean compared with selected countries (Source KEMA)



Impact of Rising Price of Oil

Illustrations of Challenges

IMPLICATION FOR WAY OF LIFE AS WE KNOW IT

- Impact on social services: diminishing budget for: Education, Security, Health, as fuel bill is paid first
- *Every US\$10 rise in the price of oil results in some cases in an increase of US 3.5 cents /kWh*
- Implication for Climate Resilience – undermines the country's resources for Adaptation

EXAMPLE:

JAMAICA

- High dependence on imported oil
 - 2006 - 2008: Avg. annual import - 29.974 M bbls valued at US\$2bn; 39% of GDP, 2009
 - *Jamaica's fuel bill increased by US\$97.7-million, or a 9.1 per cent, over 2010 to 2011, after a decline in 2009. This has contributed to a US\$35.3-million deterioration of the current account deficit, to US\$947.1 million, or 6.7 per cent of gross domestic product*

GRENADA

Oil imports currently represent ~10% of GDP and are approximately 2.5 times greater than annual export earnings.



Electricity Supply Situation and Energy Access in CARICOM

CARICOM COUNTRIES	Approx Pop	% of CC	Electcy Peak Demand MW	Elec Capacity MW	% RE to Total Elec Capacity	Estimate % with Access	Population with No Access
Antigua & Bar	80,000	0.5%	50.40	74.40	< 1%	100%	0
Bahamas	320,000	2.0%	318	569.50	< 3%	99%	3,200
Barbados	270,000	1.7%	164.00	239.10	< 10	100%	0
Belize	320,000	2.0%	78.00	112.50	40%	90%	32,000
Dominica	75,000	0.5%	15.60	39.40	<25%	100%	0
Grenada	110,000	0.7%	30.50	44.30	<5%	99%	1,100
Guyana	750,000	4.7%	91.50	150.00	<5%	90%	75,000
Haiti	9,300,000	58.0%	218.00	270.00	<30%	25%	6,975,000
Jamaica	2,700,000	16.8%	644.00	860.00	< 10%	95%	135,000
Montserrat	12,000	0.1%		2.00	<1%	100%	0
St. Kitts & Nvs	48,000	0.3%	35.00	57.00	< 5%	95%	2,400
St. Lucia	160,000	1.0%	55.90	75.90	< 1%	100%	0
St. Vin & Gren	100,000	0.6%	19.90	49.00	<12%	99%	1,000
Suriname	492,000	3.1%	160.00	189.00	>50%	79%	103,320
Trin & Tobago	1,290,000	8.0%	1182.00	1605.00	< 1%	99%	12,900
Total	16,027,000			4337.10		54.2%	7,340,920

Estimated; Also based on Study by C. Wilson and Trevor Byer 2009 - 2010



Options For CARICOM Countries

1. **Energy Efficiency and conservation**
2. Explore regional and bi-lateral petroleum supply arrangements (Mexico, Venezuela - PetroCaribe, Trinidad & Tobago)
3. Explore for own hydrocarbon (petroleum and gas) resources
Jamaica, Guyana (started years now)
Bahamas, Grenada – starting
4. **Explore and Develop renewable energy resources** (All countries have options)

Renewable Energy and Energy Efficiency provide can provide a response to all three Energy challenges of CARICOM countries

- **Lack of Energy Security**
 - Increased affordability over long run by hedging against worlds oil prices; reducing impact of fluctuations
 - Addresses availability and reliability also
- **Lack of sustainability**
 - Renewable sources are clean, and environmentally friendly - sustainable; EE extend life of current resources and minimize investment for RE
- **Energy Poverty**
 - Many forms of RE are amenable to providing off grid energy supply for remote areas
- **In addition:** Can provide economic competitiveness, job creation,



Some Progress is Being Made in CARICOM towards increased use of RE

1. Landmark Caribbean RE Development Project 2004 to present
2. Establishment of the CARICOM Energy Programme 2008
3. All countries are developing or have developed national energy policy to provide focus on RE
4. Some countries making advances in installation of RE systems – Jamaica (wind, Hydro, biofuels), St kitts & Nevis (wind), Barbados SWH and PV, Grenada (PV); SVG & Dom, Belize, Guyana, Haiti, Suriname (Hydro) Guyana, Belize (Bioenergy)
5. CARICOM Heads of Government
 - identified RE as one of Regional priorities
 - Mandated development of SE roadmap and strategy



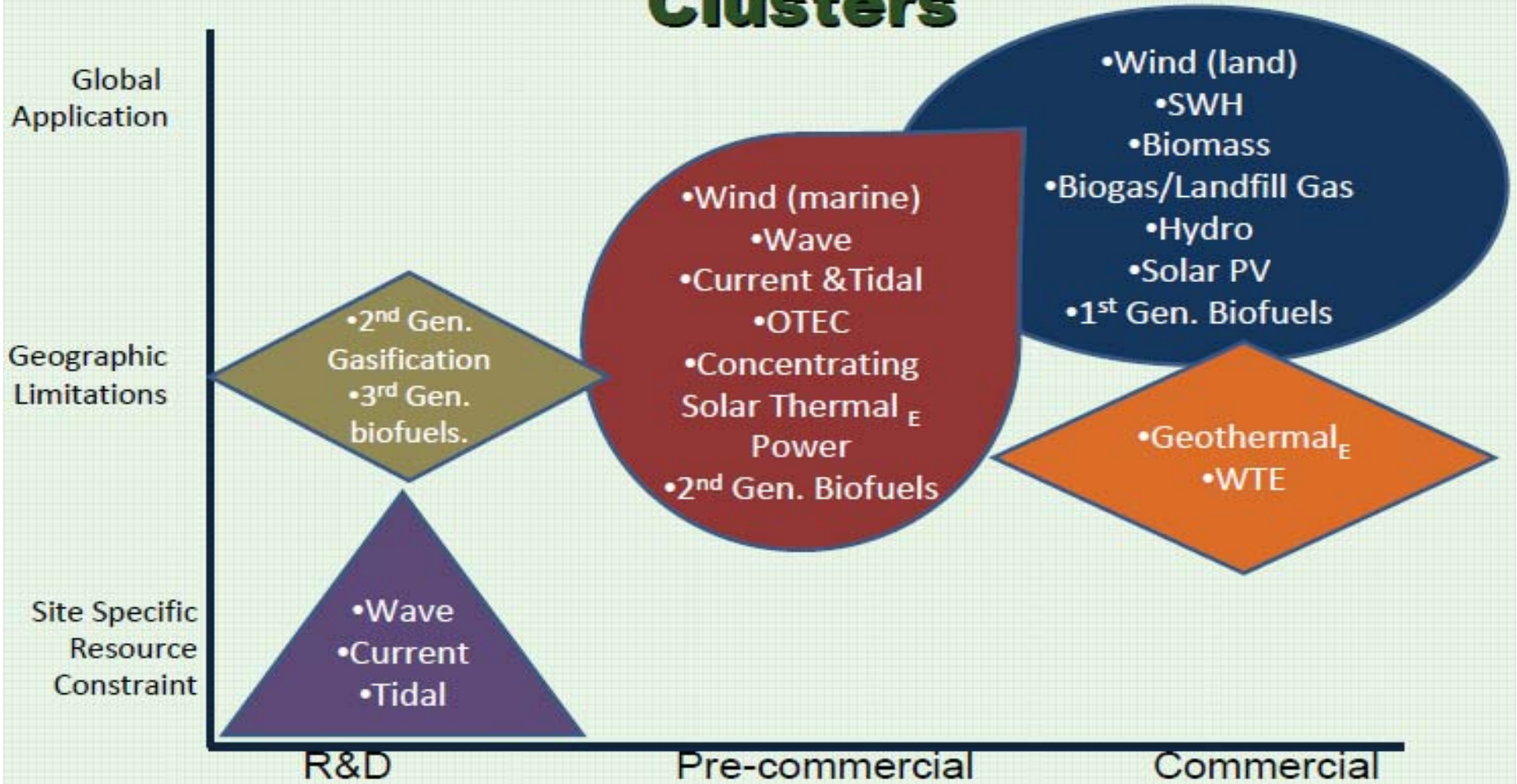
Marine Renewable Energy (MRE)

MRE considered to have potential

- MRE option to be considered by CARICOM countries in the quest for diversification towards increased security
- MRE production provides a number of side benefits (in addition to electricity and thermal) relevant to Caribbean countries
 - Potable water production
 - Job creation
 - Aquaculture
 - etc



Renewable Energy Commercial Clusters





Some Key **Opportunities** for Marine RE Development in CARICOM

1. All CARICOM States are surround by Sea or are coastal
2. The countries of Caribbean are among the countries which have the highest electricity tariff globally – economic feasibility may be easier to be established for some new technologies
3. Most load centers (cities and towns) are close to coast
4. Sea and Ocean represent vast RE Potential given the area relative to land area
5. Small states may be a good ‘test bed’ for a holistic understanding of integration issues (technical, economic, social, environmental)



Some Key **Opportunities** for Marine RE Development in CARICOM

6. Relatively small size electricity demand and capacity allow scaling up to be simple step e.g. Dominica is approx 15 MW, Nevis 5 MW
7. Relevant technologies could be developed as indigenous and with export potential
8. SIDSDOCK Mechanism for SIDS includes a focus on OTEC
9. Develop partnerships and cooperation with industrialized countries which are pursuing specific Marine RE technologies to allow for joint R&D where resource is established in Caribbean
10. Co-development rather than just technology transfer



Some Key **Challenges** for Marine RE Development in CARICOM - *Continued*

1. Many of the MRE technologies are not a commercial level – i.e. still under development
2. R&D support for RE weak in CARICOM
3. **International Development partners typically only support the deployment of proven and well established RE technologies**



Some Key **Challenges** for Marine RE Development in CARICOM - *Continued*

4. Governments don't like idea of being guinea pigs (*which is understandable especially so given the limited resources*)
5. Many marine energy potential conflict with touristic objectives
6. Policy, Legal and Regulatory frameworks for integrating and RE into grid and encouraging development of RET still generally weak, although some progress being made



Marine RE In CARICOM

- No pilot plant or installation in CARICOM (including no off shore wind power plant)
- JAMAICA – Study and design of experimental plant 1981
- The BAHAMAS – Studies supported by IDB under TC 2009
- ST LUCIA – actively considering



JAMAICA and OTEC

- In 1981, an agreement was signed between Alfa-Laval AB, SWECO, et al and the Petroleum Corporation of Jamaica (PCJ), regarding preliminary design of a 1 MWe OTEC pilot plant in Jamaica.
- After careful on-and offshore investigations at several potential sites one near Kingston was selected. A shore-based closed cycle power plant with best available state-of-the-art components was designed.



JAMAICA and OTEC

- Cross-flow plate heat exchangers and a high density polyethylene cold water pipe constitute the highlights of the design.
- In order to determine fouling conditions and appropriate countermeasures for the specific site, the Alfa-Laval mobile biofouling test rig was installed at the site in late 82.
- It is scheduled to be in operation for 18 months
- Project was later abandoned



The BAHAMAS and OTEC

In order to assess the potential of OTEC as a renewable source of energy for The Bahamas is pursuing a project supported by IDB, which has a key component to:

- *collect and analyze ocean surface temperatures and coastal bathymetry at different locations of The Bahamas*
- *determine sites where wave and tidal gages should be installed in order to collect baseline data to determine energy potential and conducting a prefeasibility study;*
-



The BAHAMAS and OTEC – cont'd

Also the Project seeks to:

- perform pre-feasibility study on identified OTEC sites for the production of power and water; and
- identify any environmental risks to the marine environment and potential mitigation measures



Current Regional Level Cooperation in Sustainable Energy

Cooperation /Agreement

1. **Government of Germany** thru GIZ (CREDP Project; Support to CCS; 5C's and climate change)
2. **US Government** - through ECAPA Initiative
3. World Bank /GEF
4. Inter American Development Bank- SECCI
5. European Union – EUCARINET, CRECS, OECS EE Standards and Labelling
6. Govt of Australia thru AusAID, for CC
7. UK thru DFID; mainly CC
8. Austrian Govt thru ADA EE and RE projects
9. Govt of Venezuela – RE and EE
10. Govt Mexico thru Ministry of Energy - EE
11. Govt of Spain thru AECID - EE
12. Govt of Japan thru JICCA
13. Govt of France – ADME – Geothermal dev
14. UNDP – EE and RE
15. EIB, KFW

Possible Inclusion of MRE

1. Focus only on proven and established RETs and EETs
2. Possibility
3. No
4. Yes
5. Yes – support R&D exchanges & networking
6. No
7. No
8. No
9. Possibly
10. No
11. No
12. No
13. No
14. No
15. No



The Way Forward

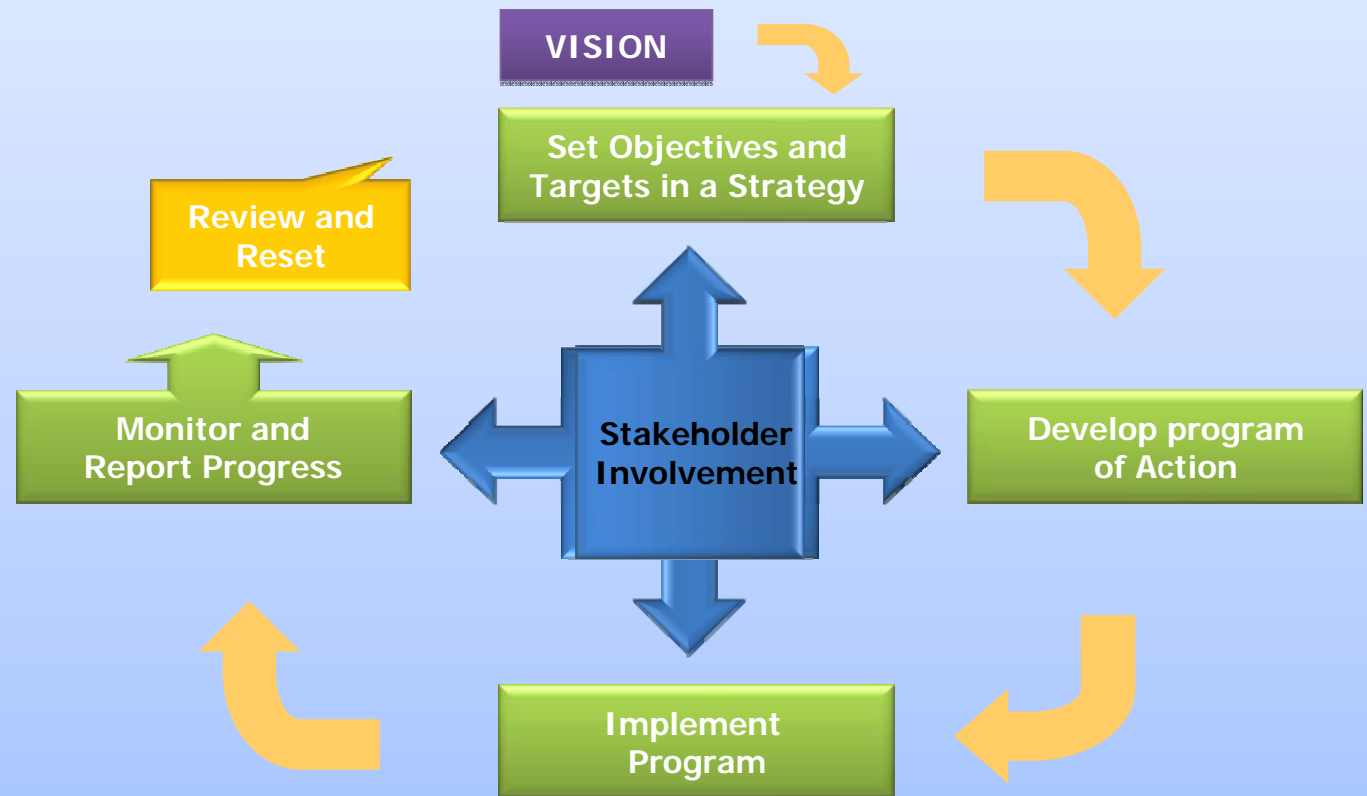
Perspective from CARICOM Energy Programme

1. Recognition of the Potential for Marine Energy, and opportunities that Caribbean countries have.
2. Explicit inclusion in regional policy and strategy
3. Development of a rational and strategic approach in context of Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS) - to include: ***Resource assessment, R&D, technology transfers, capacity building***
4. MRE to be targeted as part of the regional resource mobilization and energy sector development cooperation



More Strategic Planning and Management of the Sustainable Energy Development is Needed *(C-SERMS proposes to provide this)*

The piece-meal stop & start approach taken over the last 38 years for RE development have not yielded the desired results



Source: S. Martins - Fatum



C-SERMS

- **Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS):**
 - Is conceptualized as an updateable **sustainable energy planning mechanism** and **communication tool**;
 - to be developed by the CARICOM Energy Programme in collaboration with CARICOM Member States and other partners.
- C-SERMS will:
 - be developed in phases;
 - take the form of a ‘living’ dynamic document which will be continuously reviewed to determine relevance and periodically revised as necessary to reflect any changes in policy, markets, technologies or the priorities of Member States.



C-SERMS

Will:

- **Set regional goals and specific targets** for contribution of RE to the regional energy matrix as well as EE improvements **in a strategic and targeted manner** - over Short (3 years), Medium (3-7 years) and Long Term
- **Define pathways to achieve the set targets based on principle of subsidiarity.**
- Form the basis for **commitment on the part of each Member State** towards a Regional sustainable energy path.
- Detail the **finance and institutional capacity** necessary for formulation of strategies and attainment of targets / goals.
- Provide a **clear framework for focusing research, development and investment efforts** in RE and EE towards the achievement of the policy goals.



Components of C-SERMS

BASELINING

- Map and assess existing sustainable energy initiatives in all Member States (including efficiencies and conservation in transportation, electricity and industrial sectors).
- Review sustainable energy policies, plans, regulatory framework and legislation.
- Conduct Gap analysis of policy, capacity, awareness/awareness, financing.

TOOLS DEVELOPMENT

- Mechanism to support the development of the C-SERMS (possibly Platform comprised of multidisciplinary and multi-stakeholders)
- Regional Energy Balance Model for tracking progress, forecasting and monitoring the performance of the sector.

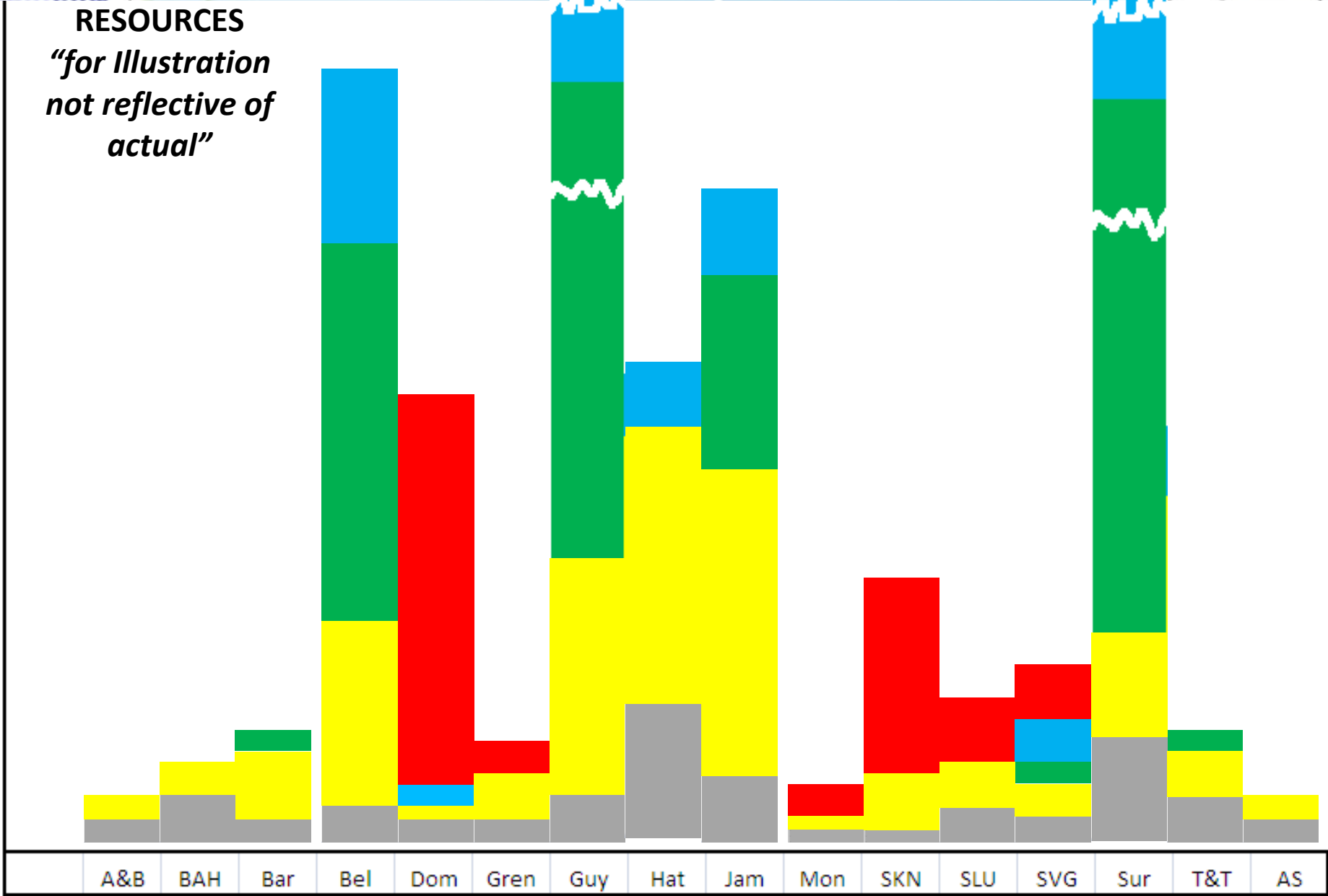
STRATEGIES AND TARGETS

- Establish short, medium and long term targets for RE, EE and BE
- Identify areas for necessary policy, regulatory and legislative reforms
- Identify areas for improvement in information and awareness, financing mechanism, R&D and innovation



CARICOM RE RESOURCES

*“for Illustration
not reflective of
actual”*



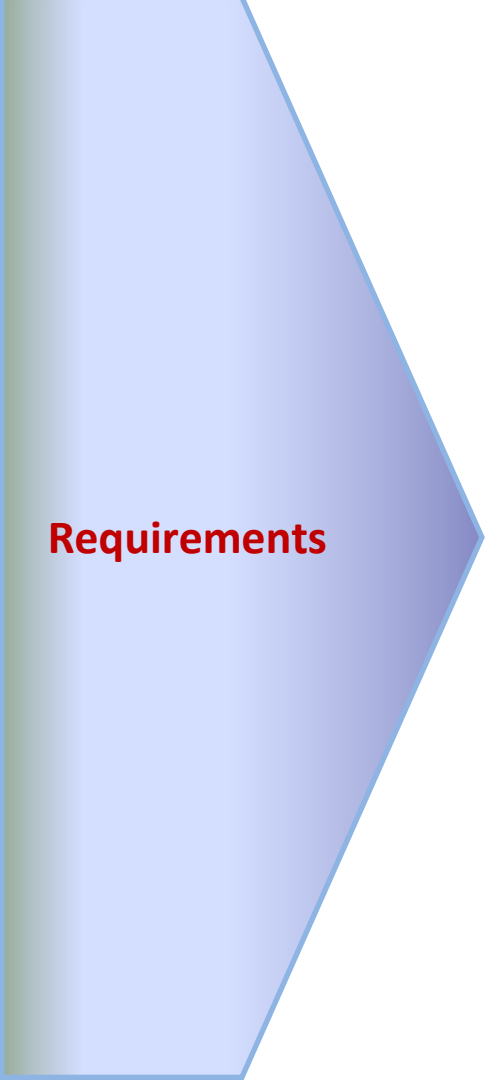
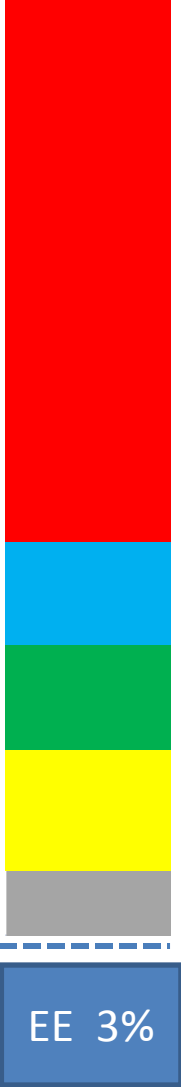
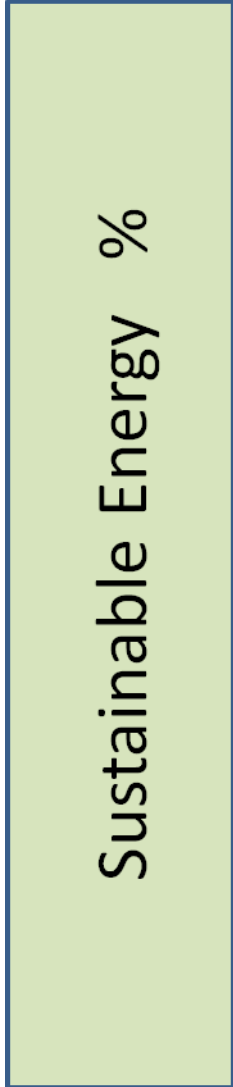


2015 TARGET

S.E SOURCES

Required

BASE-LINE ASSESSMENTS (Resources, Capacity, etc)



- Capacity**
- Awareness**
- Policy & Legal**
- Finance**
- R & D**

NEW INITIATIVES & PROJECTS (NATIONAL & REGIONAL) LOCAL OR IDP

ALL PROJECTS & INITIATIVES (Natnl or Regnl) BECOME A PART OF OVERALL STRATEGY



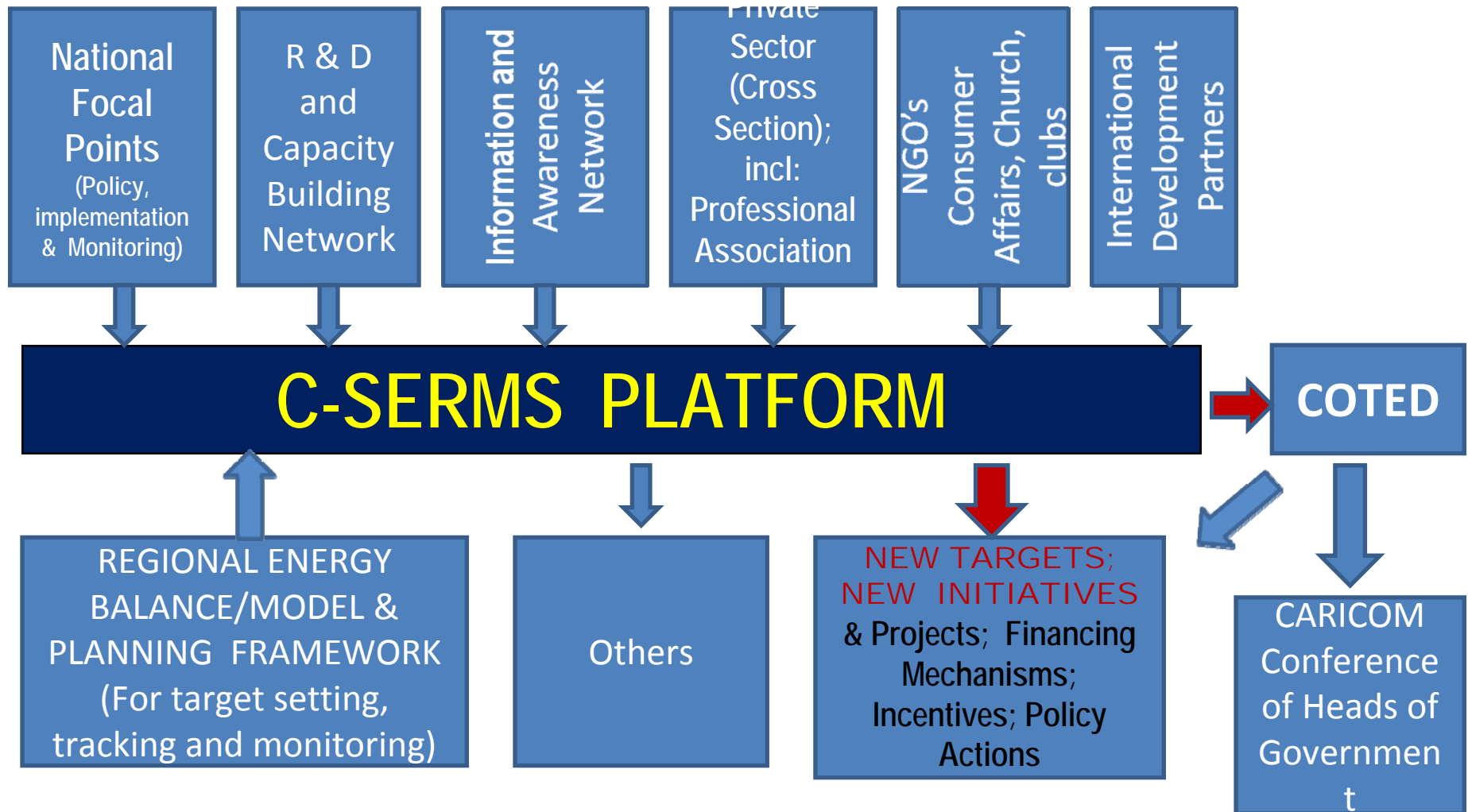
C-SERMS and MRE

C-SERMS will:

- Facilitate regional level prioritization based on resources, needs, and capacity, thereby provide requisite focus on opportunities for MRE
- Facilitate donor coordination to support prioritized RET
- Regional level prioritization, which will help to overcome the barrier for MRET ie: view that MRET's represent early stage technologies therefore don't qualify for financing
- Will facilitate incorporation of ecological social justice considerations – through broad stakeholders participation



CONCEPTUAL FRAMEWORK C-SERMS PLATFORM





THANK YOU

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