

SEASONAL ASSESSMENT OF THE ENERGETIC POTENTIAL ASSOCIATED WITH SALINITY GRADIENT: CHAMPOTON RIVER, MEXICO

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INTRODUCTION

The current environmental problems have been affected, among other aspects, by the excessive use of fossil fuels, which has generated the need to increase the percentage of energy obtained from alternative and clean sources. Within this group is the energy associated with the ocean, where salinity gradient is included, this type of energy is considered as clean energy for the environment, free of CO₂ and greenhouse gases (Álvarez, 2016). The Coastal Processes area of the EPOMEX-UAC Institute, within the project Mexican Center for Innovation in Ocean Energy, CEMIE-Ocean characterized, for the climatic seasons of 2018, the salinity gradient energetic potential of the Champoton river, Campeche. Field campaigns were carried out for the dry season (February to May), rains (June to October) and Nortes (November to January)

METHODOLOGY

To obtain the energetic potential of the Champoton River, the behavior of the physicochemical parameters were evaluated for the climatic periods that occur in the state of Campeche, dry, rain and "nortes", Agraz et al 2015. Two study sections were located, a section cross-section, of length 102 m, parallel to the vehicular bridge of highway 180, which was divided into sections of 10 m, the second section was longitudinal to the axis of the river, starting at the mouth and culminating 1.2 km upstream, this section was composed of seven sampling points.

For each sampling section, the physicochemical parameters (conductivity, temperature and pressure) were obtained at different depths, in the same way, the flow velocity in the cross section was measured. The equipment to take data of conductivity, temperature and pressure was a set of CTD Hobo of the Onset brand, for the speed and direction of the water a Sontek Argonaut was used. The data were taken every hour for the cross-section and every two hours for the longitudinal section. In the office, the data were processed and the salinity and flow for the cross section were calculated. For the calculation of the energy potential associated with salinity gradient, the Gibbs free energy formula was used, described by Veerman et al., 2016.

RESULTS

Figure 1 represents the salinity of the cross section, for 18:00 of October 29, 2018, at this time, the greatest differential was observed, for the upper part where fresh water is, 8.01 ppm, for the lower part which corresponds to seawater, 30.79 ppm. The average temperature recorded is 29.91 ° C for the same time and section. The highest energy potential of all measurements was presented for this very moment. With the temperature and salinity data, considering a flow rate of 1.0 m³/s, the energy potential was calculated, 592,678 J. In Figure 2, the energy potentials obtained in the campaigns are presented, with the October results in green, June in blue, March in orange and January in black. In general, the highest potential was presented in the month of October, and the lowest in the month of January, with minimum potential of 49.313.44 J.

CONCLUSIONS

The maximum potential calculated for energy production by salinity gradient was presented in October (end of the rainy season), this was 11 times higher than the potential of the month of January (northern season); this is due to the greater contribution of fresh water by the river. With the collected data it was obtained that 1.30 m³/s of fresh water mixed with an equal amount of salt water, will produce energy to supply electricity to 10,000 homes, the average consumption of 200 kWh/month per house, all the houses in the downtown of Champoton. Regarding the

measurements made, the freshwater layer varies in a range of 1 m to 2.5 m depth. This depth would limit location to take fresh water for an energy plant.

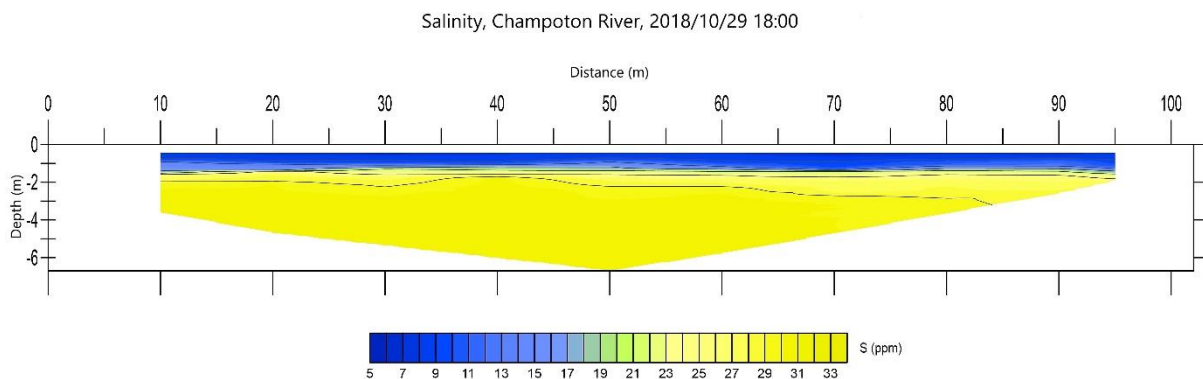


Figure 1. Salinity, Champoton River, 2018/10/29, 18:00:00 h.

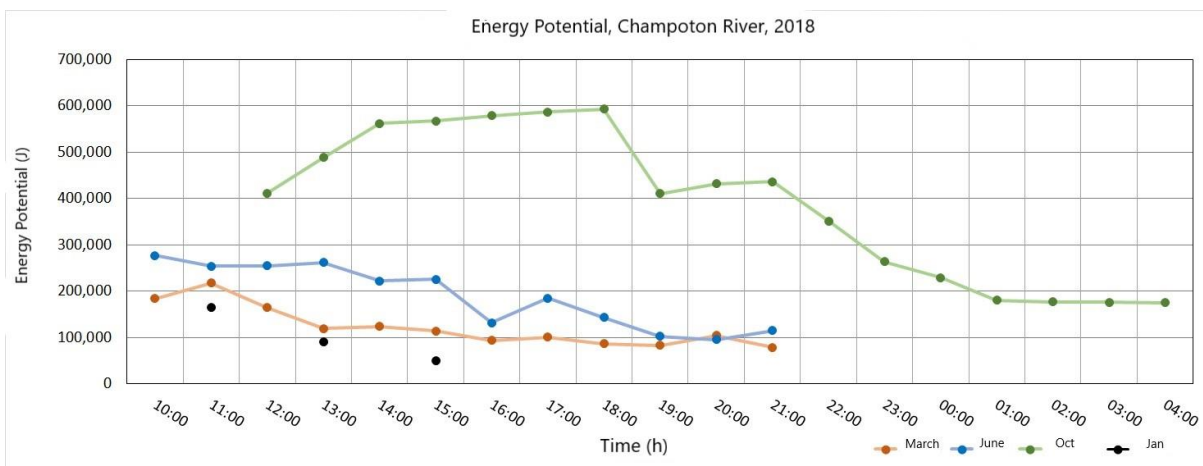


Figure 2. Energy Potential, Champoton River, Campeche, 2018

ACKNOWLEDGMENTS

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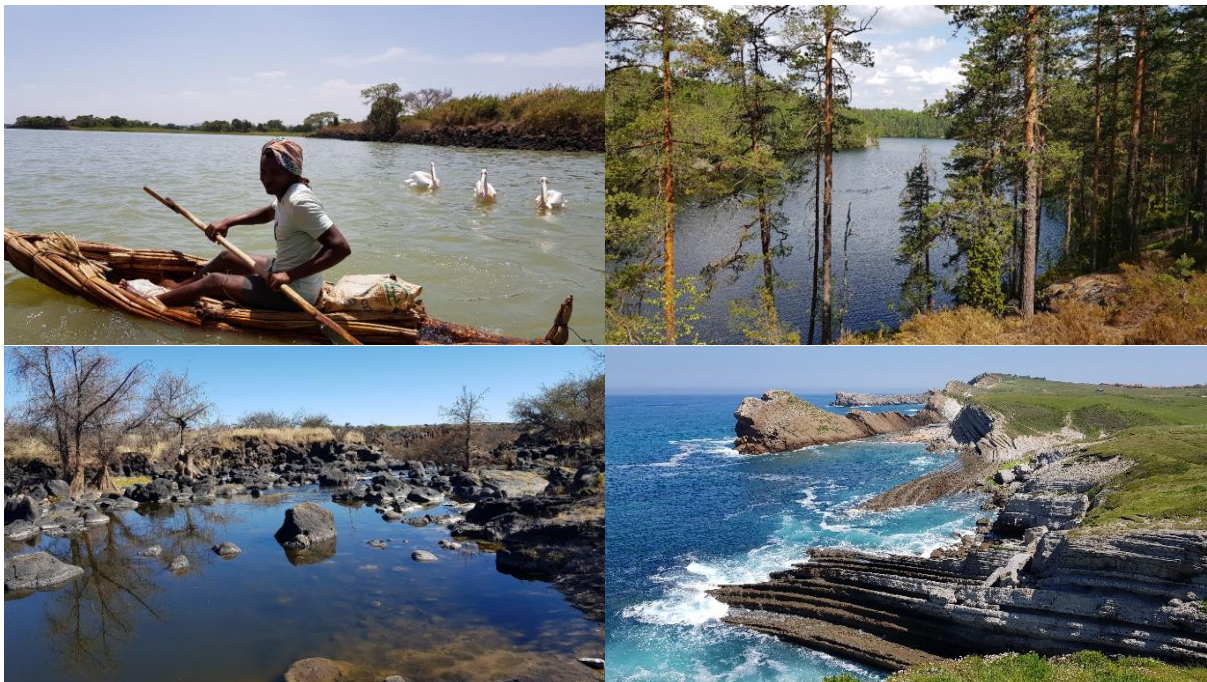
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EXCEED - SWINDON Conference 2019

THE FUTURE OF WATER RESOURCES

October 13th - 16th, Mérida, Mexico



Programme and Book of Abstracts

PROGRAMME

Sunday, 13 th		Arrival	
19:00	-	21:00	Welcome cocktail

Monday, 14 th		Conference Day 1	
08:30	-	09:00	Registration
09:00	-	09:30	Opening Ceremony <ul style="list-style-type: none"> • Norbert Dichtl • Andreas Haarstrick • Rodolfo Silva • Local authority
09:30	-	10:00	Keynote speech <ul style="list-style-type: none"> • Norbert Dichtl
10:00	-	10:10	Break
Session 1: The impact/performance/role of SDGs Chairman: Valeria Chávez			
10:10	-	10:30	Exploring some ocean energy possibilities in Latin America (Jassiel Hernández)
10:30	-	10:50	Water energy nexus in the MENA region (Abbas Al-Omari)
10:50	-	11:10	Ocean energy and marine biodiversity affectations: a life cycle assessment review (Dora Ruiz-Méndez)
11:10	-	11:40	Coffee Break
Session 2: Water-Energy-Nexus (I) Chairman: Dwi Andreas Santosa			
11:40	-	12:00	Wastewater/waste to energy in MENA region: A review for opportunities (Zeinab Abou Elnaga)
12:00	-	12:20	Water-energy nexus in a wastewater treatment plant: Energy efficiency and recovery (Wang Hongtao)
12:20	-	12:40	From wastewater treatment plants to a resources recovery facility (Marcelo Nolasco)
12:40	-	13:00	Seasonal assessment of the energetic potential associated with salinity gradient: Champoton River, Mexico (Gregorio Posada Vanegas)
13:00	-	14:30	Lunch
Session 3: Water, ecosystem and socio-economic integrating aspects (I) Chairman: Germán Rivillas			
14:30	-	14:50	Decolourization and mineralization of acid green 25 dye through single and catalytic ozonation (Liliana Amaral Féris)

14:50	-	15:10	Adsorption of naphtholate-as dye in wastewater of batik industry using green synthesized zn layered hydroxyl salts (Sri Juari Santosa)
15:10	-	15:30	Adsorption of hexavalent chromium in coal beneficiation tailing in fixed bed column (Liliana Amaral Féris)
15:30	-	15:50	Kinetics of the adsorption of anionic and cationic dyes in aqueous solution by low-cost activated carbons prepared from sea cake and cotton cake (Ibrahim Tchakala)
15:50	-	16:10	Distribution of microplastics in water and sediment in a Biosphere Reserve (Cecilia Enriquez)
16:10	-	16:30	Evaluation of microplastics contamination in the margins of the Patos Lagoon in south of Brazil (Eduardo Saldanha Vogelmann)
16:30	-	17:00	Coffee Break
Session 4: Water, ecosystem and socio-economic integrating aspects (II) Chairman: Rodolfo Silva			
17:00	-	17:20	Hydrodynamic modelling of the Huave Lagoon System, Oaxaca (María Fernanda González Amador)
17:20	-	17:40	Impact effects of hard infrastructure in Salamanca Natural Park (Juan Carlos Caez-Perez)
17:40	-	18:00	The decision-making in face to coastal squeeze, analysis between social and economic impacts: Case study of Campeche, Mexico (Debora L. Ramírez-Vargas)
18:00	-	18:30	Keynote speech • Elvis Carissimi
20:00			Dinner

Tuesday, 15th		Conference Day 2	
Session 5: Water, ecosystem and socio-economic integrating aspects (III) Chairman: Arwa Naser Damen Hamaideh			
09:00	-	09:20	Dispersion of submarine groundwater discharges in reef lagoons and associated environmental effects (Arlett Rosado Torres)
09:20	-	09:40	Salt intrusions into a freshwater spring in a tropical coastal lagoon, Yucatán, Mexico (Xaní Malagón)
09:40	-	10:00	Variability of the saline gradient in a hypersaline coastal lagoon (Brenda Natalia Fitch Geymonat)
10:00	-	10:20	Sedimentation and water quality status of lake Tana, the headwaters of the Blue Nile, Ethiopia (Seifu A Tilahun)
10:20	-	10:40	An innovative approach to mitigate risks on the existing iron tailings dams in Brazil (Jose Araruna)

10:40	-	11:00	Urban sustainable water management and water efficiency improvement for buildings – a case study for Istanbul (Ahmet Baban)
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11:00	-	11:30	Coffee Break
Session 6: Water-Energy-Nexus (II) Chairman: Eduardo Saldanha Vogelmann			
11:30	-	11:50	Reverse electrodialysis for energy and water: coupled systems based in salinity gradients (Mateo Roldan-Carvajal)
11:50	-	12:10	Development of graphene oxide membranes for its use in reverse electrodialysis systems (Eddie López Honorato)
12:10	-	12:30	Development of graphene oxide based materials for water treatment (Ana Cecilia Reynosa Martinez)
12:30	-	12:50	Laboratory experiences on marine energy conversion devices for supplying electricity demand of remote coastal communities (Jassiel Hernández)
12:50	-	13:10	Plate type obstacles used for coastal protection and power generation (Luis Eduardo Pérez Paez)
13:10	-	14:40	Lunch
Session 7: Water, ecosystem and socio-economic integrating aspects (IV) Chairman: Thi Thanh Van Ngo			
14:40	-	15:00	Evaluating combinatorial water treatment by locally available materials (Chrispin Kowenje)
15:00	-	15:20	Desalination by capacitive deionization as a tool to provide drinkable water to small communities in the Brazilian semiarid (Luis Augusto Martins Ruotolo)
15:20	-	15:40	Fluoride ions removal from groundwater by alumina adsorption (Elvis Carissimi)
15:40	-	16:00	Bio-refineries: A new concept towards green energy production from agroindustrial wastewater (Víctor Alcaraz)
16:00	-	16:20	The importance of water and nutrients management in paddy fields as an effort to increase crop yields and producing an electrical energy through microbial fuel cells (Dwi Andreas Santosa)
16:20	-	16:50	Coffee Break
16:50	-	17:20	Keynote speech • Klaus Fricke
16:50	-	18:00	Panel discussion Moderators: Edmilson Santos de Lima and Norbert Dichtl
20:00			Gala dinner