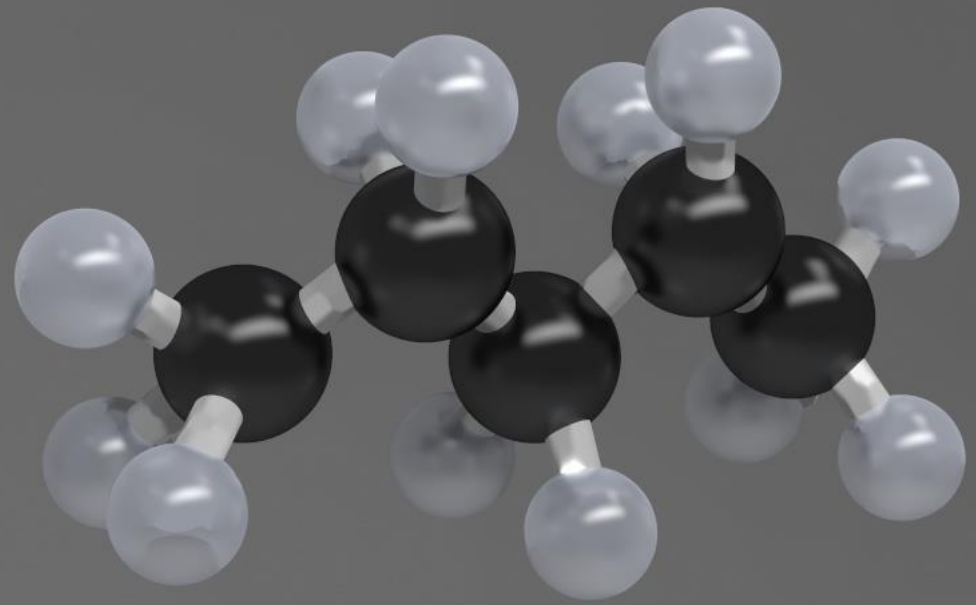
REEC
RACIONAL ENERGY AND ENVIRONMENT CO.

REFINING PROCESS IMPROVEMENT PROPOSAL
CATALYTIC PYROLYSIS - HPS



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(CP) CATALYTIC PYROLYSIS PROCESS DESCRIPTION

BULLETS

- WHAT IS ? H° vs H_2

  - THE **REEC´S** PROCESS GENERATES AND REACTS ATOMIC HYDROGEN H°. MOST INDUSTRIAL PROCESSES DEPEND ON MOLECULAR HYDROGEN H_2

- FOR WHAT DO WE PRODUCE IT ? H°

  - ATOMIC HYDROGEN IS HIPER REACTIVE, DOES NOT REQUIRE PRESSURE TO REACT.
  - REACT WITH HETEROATOMS, REMOVING THEM FROM THE ORIGINAL MOLECULES
  - SATURATING NEW AND SHORTER MOLECULES, AVOIDING FURTHER CRACKING.

  - IONIZE MOLECULES PARTICULARLY HYDROGEN H^{+}

- IONIZED MOLECULES USES ? H^{+}

  - IONIZED MOLECULES ARE ENERGY CARRIERS PROMOTING REACTIONS IN SUBSEQUENT PROCESSES, SUCH AS DISTILLATION, FCC, HDS, ETC. THIS TYPE OF ENERGY IS DIFFERENT THAT THERMAL OR PRESSURE-VACUUM ENERGY.

  - INCREASES DISTILLATES YIELD AND IMPROVE QUALITY, COKE AND GASES GENERATION REDUCING SIGNIFICANTLY.

- HOW DO WE ACHIEVE IT?

  - WE USE OUR OWN CATALYSTS AND WATER, TO MAKE AN EMULSION.
  - WE ATOMIZE THIS EMULSION TO IMPROVE PROCESS SPEED AND OVER ALL EFFICIENCY.
  - **CP REEC** IS AN INTEGRATED PROCESS ON WICH GENERATES AND REACTS H° WITH NO PRESSURE DEPENDENCE.

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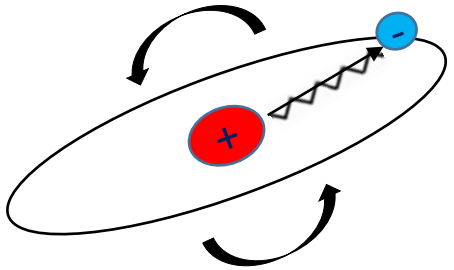
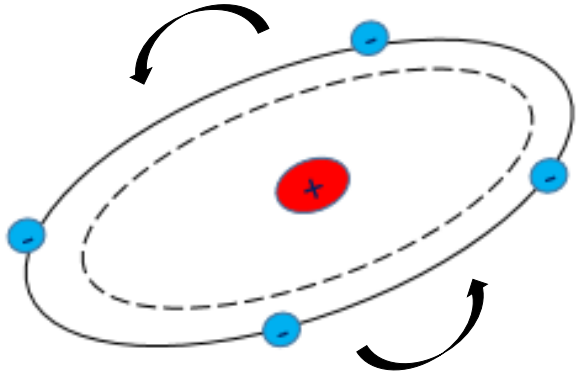
HOW THE REEC PROCESS WITH HPS WORKS

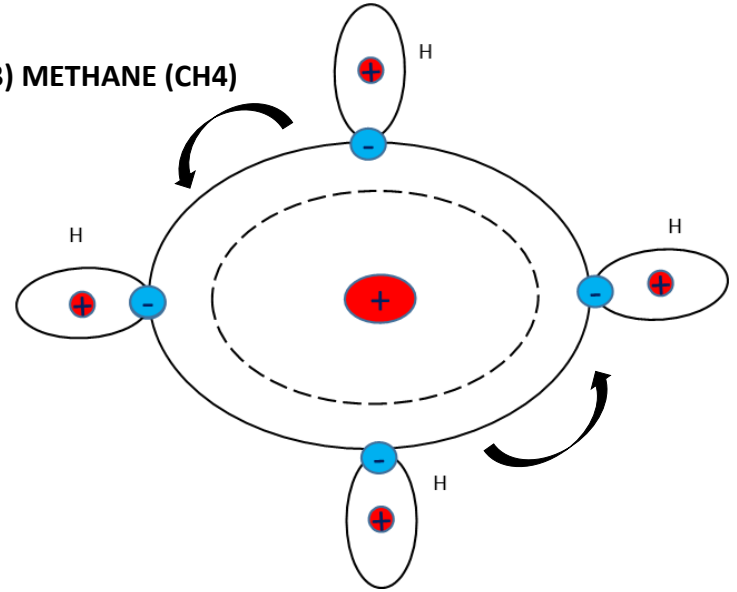
1 ATOMIC HYDROGEN (H°)



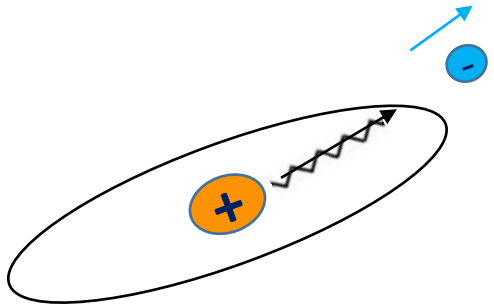
2) CARBON (C)



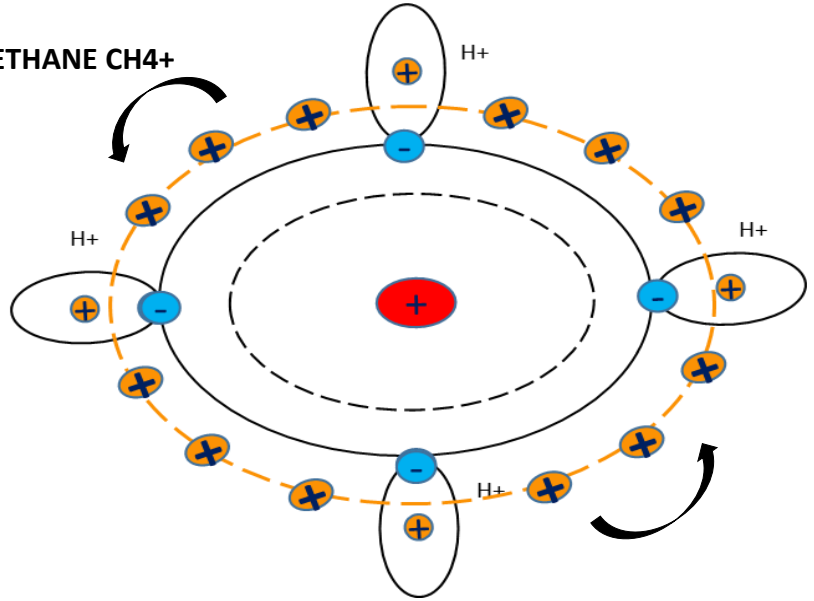
3) METHANE (CH4)



4) HYDROGEN ION (H+)



5) IONIZED METHANE CH4+



(CP) CATALYTIC PYROLYSIS PROCESS DESCRIPTION (HPS PRODUCTION)

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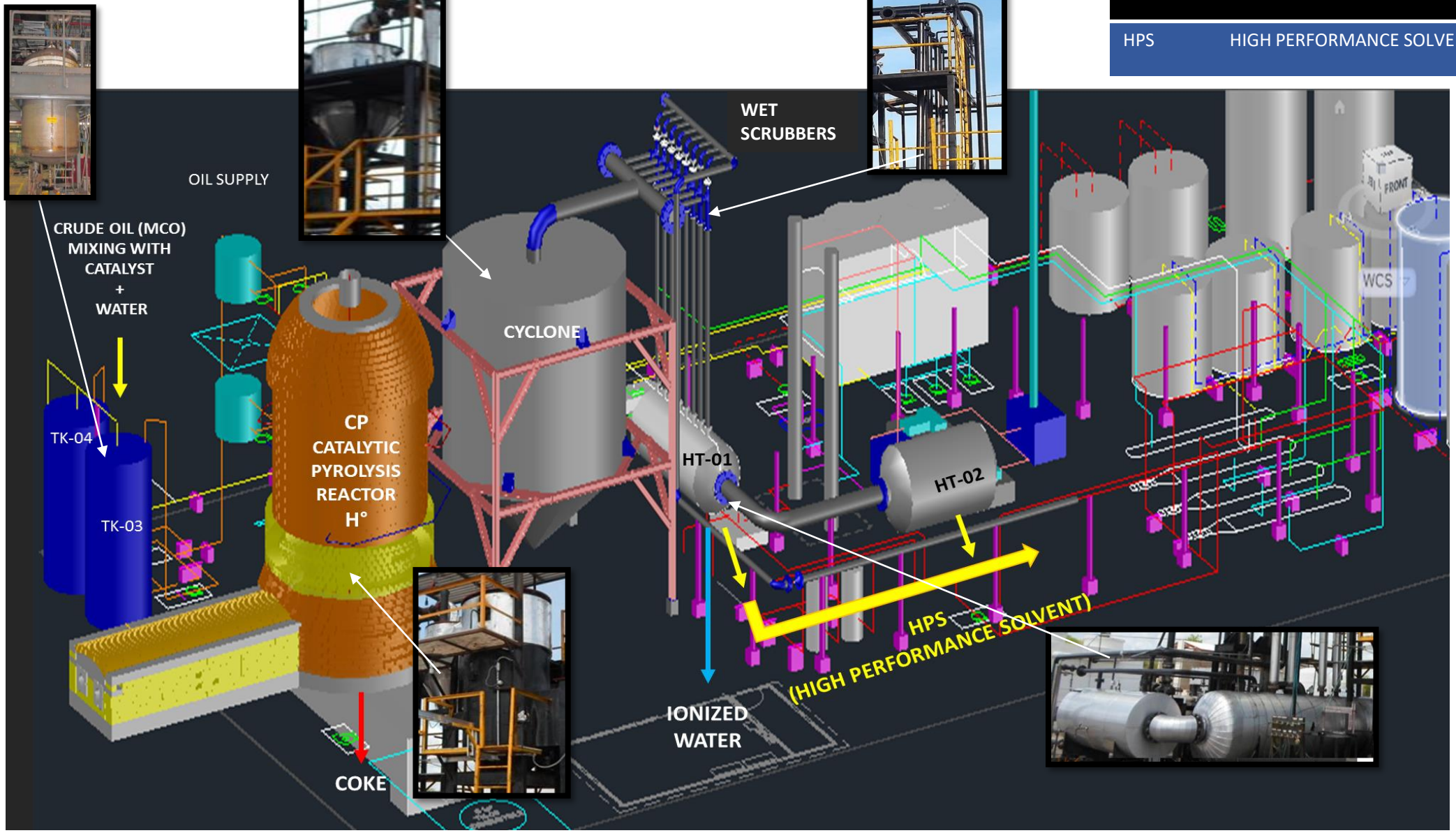
MCO	MAYA CRUDE OIL
HPS	HIGH PERFORMANCE SOLVENT



(CP) CATALYTIC PYROLYSIS PROCESS DESCRIPTION
(MAYAN CRUDE OIL DISTILLATIONS)
MINATITLAN REFINERY, JUNE 2018

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ORIGINAL MAYA CRUDE OIL (MCO)

INITIAL VOLUME (ML) = 280
INITIAL MASS (GRAMS) = 258

ORIGINAL MAYA CRUDE (MCO) FRACTION	LIQ TEMP (°C)	VAPOR TEMP (°C)	DISTILLED MASS (GRAMS)	DISTILLED VOLUME (ML)	ACCUMULATED VOLUME (ML)	% DISTILLED (GRAMS)	% DISTILLED (ML)	% DISTILLED ACCUM (GRAMS)	% DISTILLED ACCUM (ML)
FRACTION 1	211-330	54-200	34.16	45	45	13.24	16	13.24	16
FRACTION 2	331-345	201-250	28.65	35	80	11.1	12.5	24.34	28.5
FRACTION 3	396-423	251-300	47.45	55	135	18.4	19.64	42.74	48.14
FRACTION 4			44.71	52.6	187.6	17	19	59.74	67.14
FRACTION 5 (RESINS)	429-452	301-351	22.12	26.4	214	9	9.2		
	453-528	331-332	20.19	15		7.8	5.36		
	TOTAL		**197.28**	**229**		**76.54**	**81.7**		
COKE			38.3			14.74			
GAS			22.5			8.72			
TOTAL			258.08			100.00			

80:20 MIX (MCO: HPS)

INITIAL VOLUME (ML) = 328.82
INITIAL MASS (GRAMS) = 295.94

80:20 MIX (MCO: HPS) FRACTION	LIQ TEMP (°C)	VAPOR TEMP (°C)	DISTILLED MASS (GRAMS)	DISTILLED VOLUME (ML)	ACCUMULATED VOLUME (ML)	% DISTILLED (GRAMS)	% DISTILLED (ML)	% DISTILLED ACCUM (GRAMS)	% DISTILLED ACCUM (ML)
FRACTION 1	119-320	60-200	56.54	79.5	79.5	19.11	24.18	19.11	24.18
FRACTION 2	321-340	201-250	27.68	35	114.5	9.35	10.64	28.46	34.82
FRACTION 3	341-417	251-300	42.92	51	165.5	14.50	15.51	42.96	50.33
FRACTION 4	418-452	301-340	60.68	71	236.5	20.50	21.59	63.47	71.92
FRACTION 5	453-475	341-351	43.22	50	286.5	14.60	15.21	78.07	87.13
FRACTION 6 (RESINS)			6.75			2.28	0.00		87.13
	TOTAL		**237.79**	**286.5**		**80.35**	**87.13**		
COKE			33.98			11.48			
GAS			24.23			8.19			
TOTAL			296			100.02			

(CP) CATALYTIC PYROLYSIS PROCESS DESCRIPTION (MAYAN CRUDE OIL DISTILLATIONS)

MINATITLAN REFINERY, JUNE 2018

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MAYA CRUDE OIL DISTILLATIONS (MCO):

- DISTILLATES= 68.64%W
- RESINS + COKE = 23%W (DELAYED COKER)
- 8.36%W GASES

RESULTS 80:20 (MCO/HPS):

- DISTILLATES YIELD INCREASE = 78 %W
- RESINS REDUCTION FROM 8% TO 2.28%W
- FRACTION 5 APPEARS = 14.6%W
- COKE REDUCTION FROM 15%W TO 11.48%W
- RESINS + COKE= 58%W REDUCTION VS. REGULAR MAYA CRUDE OIL DISTILLATION

ANALYSIS CHART (PROBLEM / SOLUTION)

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(A)	HPS HIGH PERFORMANCE SOLVENT (20%) INITIAL STREAM
(B)	SUM OF DISTILLATES
(C)	DELAYED COKER STREAM
(D)	HPS COST = 60 USD/BBL
(E)	80 USD X BBL (80 X 30,195)= + 2,415,600
(F)	4.4 USD X BBL OF COKE BY RETAIL SALES CONCEPT 4.4 X 24,891= -110,000 COKER COST 10 USD X BBL 10 X 24,891= +250,000 TOTAL: +140,000

MAYA CRUDE OIL COST (JUNE 2018)
60 USD/BBL

HEAVY CRUDE OILS REFINING CURRENT VISION								
OIL	INITIAL STREAM (BBL)	ATMOSPHERIC DISTILLATION (BBL)	VACUUM DISTILLATION (BBL)	TOTAL DISTILLATION STREAM (BBL)	DELAYED COKER (BBL)	GASES (BBL)	TOTAL OUTLET (BBL)	PRIMARY DISTILLATES QUALITY (BBL)
MAYA CRUDE OIL (MCO)	150,000	43,500	57,000	100,500	42,780	6,720	150,000	REGULAR

REEC's HPS SOLUTION PROPOSAL								
OIL	INITIAL STREAM (BBL)	ATMOSPHERIC DISTILLATION (BBL)	VACUUM DISTILLATION (BBL)	TOTAL DISTILLATION STREAM (BBL) (INCREASE 30,195 BBL)	DELAYED COKER (BBL) (DECREASE 24,891 BBL)	GASES (BBL)	TOTAL OUTLET (BBL)	PRIMARY DISTILLATES QUALITY (BBL)
MAYA CRUDE OIL (MCO) + (HPS) HIGH PERFORMANCE SOLVENT (20%)	(A) (MCO) 118,000 (HPS) 32,000 **TOTAL= 150,000**	34,220+ 18,010 = **52,230**	44,840+ 33,625= **78,465**	79,060+ 51,635= (B) **130,695**	(C) **17,889**	**1,416**	**150,000**	IMPROVED (SEE CORMATOGRAPHS)

ECONOMICS (REEC PROCESS WITH 20% HPS)	INITIAL STREAM COST (USD)	PRIMARY DISTILLATION ADDITIONAL INCOME (USD)	DELAYED COKER INCOME (USD)	TOTAL INCOME (USD) PER DAY
REEC PROCESS WITH 20% HPS	(D) -1,920,000	(E) + 2,415,600	(F) +140,000	+ 635,600
TOTAL INCOME PER YEAR				**+ 231,994,000**

IMPORTANT NOTE:

Δ DISTILLATES:

CURRENT REFINING (MCO): 118,000 BBL X 0.67= 79,000 (X)

REFINING MCO + HPS (20%): (B) –(X)= (Y) → 130,695 – 79,000 = 51,695 BBL (Y) LIQUID GROSS GAIN

LIQUIDS NET GAIN = (Y) – (A) HPS → (51,695 – 32,000) ≈ ***20,000 BBL OF LIQUIDS NET GAIN***

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