recope®

30 de junio de 2012
GG-0888-2012

Ingeniero
Jorge Villalobos Clare
Presidente

Estimado señor:

ASUNTO: RECIBO DE INFORME DE WORLEY PARSONS.

Con la finalidad de que sea recibido conforme por usted y posteriormente por la Junta Directiva, a continuación refiero la información técnica y legal cursada en relación con la recepción del informe del PREFEED, del proyecto de ampliación y modernización de la refinería, elaborado por la firma Worley Parsons, en la cual me fundamento para solicitar el recibo conforme de ese informe:

1. Nota PMR-001-2011, del 1 de noviembre de 2011, suscrito por el Ing. William Ulate Padgett, en esa fecha jefe del Proyecto de Modernizacion Refinería y Director de Planificación a.i. En esta nota se menciona que "*el PREFEED será hecho por WorleyParsons de acuerdo a los requerimientos de la Junta Directiva de RECOPE*" y "*optimizará el Caso 10 del FSR (Estudio de Factibilidad elaborado por HQCEC), con el fin de validar ese estudio de factibilidad y será un hito de decisión del proyecto…*".

2. Nota WPM-SOR-1.51-L-0022, del 3 de abril de 2012, suscrita por el señor George H. Doremus, Director de Proyecto de WorleyParsons en donde adjunta la validación para el caso 10 del Estudio de Factibilidad.

   La carta del señor Doremus es la nota de remisión del informe de validación del caso 10 y el adjunto de esa nota es el informe de optimización del caso 10 del Estudio de Factibilidad. Este informe corresponde a un avance del PREFEED que se complementará con el análisis de riesgos y el análisis financiero. Este informe fue conocido por la Junta Directiva en la Sesión Ordinaria #4630-183 del 10 de abril de 2012, comunicado mediante nota JD-185-2012 del 20 de abril de 2012, también adjunta.

   Quedó pendiente de análisis por parte de los Directores para contar con la oportunidad de revisar la documentación entregada por el Señor William Ulate en esa Sesión. En la nota del señor Doremus se dice que pronto entregarán el análisis financiero.

3. Mediante correo electrónico del 19 de abril, el Ing. William Ulate remitió el documento sobre factibilidad financiera y análisis de riesgos realizado por

Tel: 2284-2710, Fax:2255-4993 Apdo. 4351-1000 San José jorge.rojas@recope.go.cr

WorleyParsons (Financial Feasibility and Risk Analysis), con lo cual se completan los documentos relativos al PREFEED. Estos documentos se adjuntan a esta nota.

4. Nota PMR-010-2012, del 9 de mayo de 2012, de SORESCO en la cual los ingenieros Roy Vargas Carranza, Diana Leandro Cordero, Otto Chaverri Arce y William Ulate Padgett, reportan la recepción del estudio técnico realizado por WorleyParsons. En esta nota, los citados ingenieros de RECOPE, asignados al proyecto y destacados físicamente en SORESCO, establecen que realizaron la valoración del informe sobre la base de lo requerido por ellos en el GG-391-2011 y concluyen que se da por recibido a satisfacción el estudio de validación del caso 10. Reseñan uno por uno los puntos que ellos recomendaron se debían incluir en el PREFEED, concluyendo que se cumplen adecuadamente y que dan por recibido a satisfacción el estudio de validación del caso 10.

5. Nota PMR-012-2012, del 11 de mayo de 2012, de SORESCO en la cual el grupo de ingenieros mencionados en el numeral anterior, avalan el cumplimiento de la recomendación de "revisar, corregir y optimizar" los resultados del Estudio de Factibilidad como una etapa inicial dentro de la Ingeniería Básica en acato a la decisión de la JD de RECOPE en su sesión del 01 de junio de 2011. Concluyen diciendo: "*...la decisión de la Junta Directiva de RECOPE de incluir el PREFEED en el FEED hizo que el cumplimiento del PREFEED se realizara en el desarrollo del FEED, sin elaborar una sección específica PREFEED en el documento de contrato del FEED-PMC con WorleyParsons. Lo anterior porque en las diferentes secciones del contrato se incluyeron todas las recomendaciones y observaciones del equipo técnico de RECOPE, ajustadas en forma y compatibles con la globalidad del contrato.*"

6. Nota PMR-014-2012, del 21 de mayo de 2012, suscrita por el Ing. William Ulate Padgett, Sub Gerente de SORESCO, en la cual se remiten a esta Gerencia General los reportes PMR-012-2012 y PMR-013-2012. E informa que: *"en el reporte PMR-012-2012 se detalla el cumplimiento de las recomendaciones y observaciones del grupo técnico de RECOPE que revisó el FSR de HQCEC. Se destaca que todas las recomendaciones y observaciones están en el contrato del FEED-PMC con WorleyParsons. La Junta Directiva de RECOPE acordó incluir las observaciones del grupo técnico de RECOPE en el FEED y lo esencial del PREFEED se indica en una sección especial donde se valida y optimiza el caso 10 del FSR y se marca como un hito, ahora, las demás observaciones de los técnicos por*

su naturaleza, son parte del FEED y su cumplimiento se está dando durante la ejecución de la ingeniería básica"

7. Nota GG-0477-2012, del 20 de abril de 2012, en la cual la Gerencia General solicitó a SORESCO trasladar a WorleyParsons siete observaciones realizadas por el Departamento de Estudios Económicos cuyas respuestas deben ser acreditadas por esa empresa como parte del informe sobre revisión y optimización del caso 10.

8. Nota IPMT-SOR-1.51-L-0001, del 2 de mayo de 2012, suscrita por el señor Louis V. Tarango de WorleyParsons, en la cual clarifica el reporte de validación del caso 10 en atención de las observaciones hechas por el Departamento de Estudios Económicos, reseñadas en el acápite anterior.

9. Notas GD-0251-2012 y GD-0278-2012, ambas del 14 de mayo de 2012, suscritas, la primera por el Ing. Rodrigo Castro Cordero, Gerente de Proyecto Modernización Refinería y la segunda por ese ingeniero y el Lic. Luis Carlos Solera Salazar, jefe del Departamento de Estudios Económicos y Financieros. Esas notas establecen que se dan por debidamente acreditadas y justificadas las observaciones hechas por el Departamento de Estudios Económicos y Financieros.

10. Nota JD-0185-2012, del 20 de abril de 2012, suscrita por la Licda. Lorena Fernández Solís, mediante la cual comunica el acuerdo de la Junta Directiva tomado en la Sesión Ordinaria #4630-183,Artículo #6, celebrada el 10 de abril de 2012, referente al informe de la Empresa WorParsons, sobre la verificación de la tasa interna de retorno del proyecto (Caso 10).

11. Nota del 6 de junio de 2012 de Honeywell UOP dirigida a RECOPE en la cual el señor Eric J. Hammel establece que *"basados en nuestra revisión, Honeywell-UOP considera que el proyecto que ahora se presenta es muy factible. Estamos de acuerdo con WorleyParsons en todos los aspectos del trabajo sobre el proceso que ellos desarrollaron. Los productos finales del proyecto pueden generarse para cumplir las especificaciones contenidas en las recomendaciones presentadas por WorleyParsons"* (se adjunta traducción libre en español.)

12. Nota PMR-017 del 14 de junio, en la cual el grupo técnico de RECOPE asignado en SORESCO da por recibido el documento referido en el acápite anterior y concluye que: *"UOP confirma que los resultados obtenidos por*

WorleyParsons son factibles y que los problemas mencionados por ellos durante la revisión del estudio de factibilidad fueron corregidos".

De conformidad con los documentos antes mencionados, la Gerencia General y la Gerencia del Proyecto le solicitamos, respetuosamente, dar por recibido de conformidad el informe de Worley Parsons respecto al desarrollo del PREFEED en el cual se verifica de la Tasa Interna de Retorno (TIR) del Proyecto de la Nueva Refinería con SORESCO (Caso 10 del Estudio de Factibilidad elaborado por la empresa HQCEC) y se confirma la configuración de la refinería. Posteriormente, trasladarlo a la Junta Directiva para el correspondiente trámite de recibo.

Atentamente,

GERENCIA GENERAL

RECOPE S.A. GERENCIA GENERAL SAN JOSE, COSTA RICA

Ing. Jorge Rojas Montero
Gerente General

GERENCIA PROYECTO

Ing. Rodrigo Castro Cordero
Gerente

DVC

Ce: Licda. Lorena Fernández Solís, Secretaría de Actas recope

01 de noviembre 2011
PMR-001-2011

Señores
Grupo Junta Directiva SORESCO-RECOPE
Refinadora Costarricense de Petróleo

Estimado Señores:

ASUNTO: APROBACIÓN CONTRATO FEED-PMC CON WORLEYPARSONS

El pasado jueves 27 de octubre 2011 se terminaron las negociaciones entre SORESCO y WORLEYPARSONS, cubriéndose todos los puntos de la minuta del 07 de octubre 2011 entre RECOPE Y SORESCO.

1. EL preFEED será hecho por WORLEYPARSONS de acuerdo a los requerimientos de la Junta Directiva de RECOPE.
2. El preFEED optimizará el Caso 10 de FSR, con el fin de validar ese estudio de factibilidad y será un hito de decisión del proyecto, por lo que se iniciará con ese trabajo como primera prioridad, sin que esto signifique que el resto de las tareas del FEED y PMC no se hagan.
3. Se definió que además de los crudos de diseño con que se optimiza el Caso 10, se correrá el LP con los crudos RONCADOR y LEONA en modo simulación.
4. El RECOPE-FEED, revamp, se hará en 7 meses, pasándose a suma fija al final del 3° mes.
5. Se quitó del PMC la participación del CEI en el contrato con WORLEYPARSONS y además se dejó la evaluación de las tecnologías abierta en su totalidad sin preferencia alguna por las tecnologías chinas en el SORESCO-FEED.
6. La Sección 5.05 del JVA, fue revisada por SORESCO y técnicamente se cubre la Sección 5.05 del JVA. SORESCO hará del conocimiento de WORLEYPARSONS la Sección 5.05 del JVA, con el fin de que hagan los ajustes necesarios de gestión en el FEED-PMC, al momento de ejecución. EL IMPT no tuvo cambios porque todas las partes estuvieron de acuerdo que está dentro de las mejores prácticas de ese tipo de desarrollo de proyectos, consiguiéndose, ahorros en tiempo y dinero, evitando además atrasos en las decisiones y conflictos.
7. No se aceptó por parte de SORESCO dos contratos, uno para el FEED y otro para el PMC, pero se dividió el documento en tres partes muy bien definidas: RECOPE-FEED, SORESCO-FEED y PMC.
8. WORLEYPARSONS aceptó que RECOPE recopilara toda la información para el revamp y que ingenieros de RECOPE participen junto con ingenieros de ellos en la ingeniería básica, donde estén ubicados geográficamente.

En otro orden de cosas y fuera de lo que quedó escrito en los documentos de Minuta de Acuerdo y Contrato, se coordinó con WORLEYPARSONS para que se nos enviara la primera o segunda semana de noviembre de este año, sus formatos de llenado de la información, la cual puede ser en inglés o español. Además, creen posible aprovechar la actual Unidad de GASCON y MEROX con el fin de disminuir costos de inversión, por lo que se estará enviando la información respectiva.

Con lo acordado y firmado en la reunión de negociación entre SORESCO y WORLEYPARSONS, le recomiendo a los Miembros de RECOPE en la Junta Directiva de SORESCO, aprobar se adjudique el FEED-PMC a WORLEYPARSONS y autorice al Gerente General de SORESCO a firmar el respectivo contrato.

Atentamente,

PROYECTO MODERNIZACIÓN REFINERÍA

William Ulate Padgett

ANEXOS: Minuta RECOPE-SORESCO 07 de octubre 2011
Minuta de Acuerdos SORESCO-WORLEYPARSONS 27 de octubre 2011
Borrador Contrato FEED-PMC con WORLEYPARSONS

C: Jorge Villalobos-Presidente RECOPE
Jorge Rojas-Gerente General RECOPE
Mario Gomez-Miembro Junta Directiva SORESCO
José Manuel Trejos-Miembro Juna Directiva SORESCO
Luis Carlos Solera-Miembro Junta Directiva SORESCO
Rafael Morice-Miembro Junta Directiva RECOPE
Lorena Fernandez-Secretaria Junta Directiva de RECOPE
Archivo del Proyecto

wup

WorleyParsons

resources & energy

181 West Huntington Drive
Monrovia, California 91016
USA
Telephone: +1 626 803 9000
Facsimile: +1 626 803 9020
www.worleyparsons.com

April 3, 2012

File #: WPM-SOR-1.51-L-0022

Mr. Shi Zhenmin
SORESCO
Forum I, Santa Ana
Torre G, piso 6to
San Jose, Costa Rica

Subject: SORESCO Moin Refinery Expansion & Modernization Project
Case 10 Validation Model

Dear Mr. Shi:

Enclosed please find the report of the Case 10 Validation Model to assist in the financial analysis for the Moin Refinery Expansion and Modernization Project. The financial analysis report to follow shortly.

If you have any questions, please feel free to contact either myself or Mr. Peter Nick.

Very truly yours,

George H. Doremus
Project Director

GHD:gk

cc: W. Ulate
Zhang Yuming
Su Jingxin
Roy Vargas
Andrew Kerr
Adel Messiha
Peter Nick

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & Modernization Project

L.P. Enhanced Validation for FSR Case Ten – Phase II

Summary

This report lists findings of WorleyParsons process validation work as of 03/26/2012 for the Soresco Moin refinery brownfield and greenfield studies.

In Phase II of this work, we utilize conversion unit yields from licensor quotes to modify the estimated configuration. There are no real significant changes from the Phase I efforts and nothing at all to change our contention that the choice of a delayed coker with hydrocracker a is the best selection for a "diesel fuel" oriented production scheme.

There were some issues with the potential design specs and initially reported yields for some of the conversion units, especially for Chinese licensors. These issues have been resolved and agreed to by all parties after a weeks' worth of collaboration meetings in Monrovia.

There is still one remaining issue - hydrogen consumption in the HCU (Hydrocracker) and DHT (Distillate Hydrotreater).

Table 1 shows the Phase I estimates for and the Phase II validated refinery unit capacities. The feasible under/overcapacity ratios are 60 /110 % for all units but the DHT which has an under/overcapacity ratio of 60 /120 % per Soresco management request.

WPM concurs with this decision. The ability of the DHT to absorb unit feed swings based on normal feed rate and quality changes is a critical factor in the success of the Soresco project. It is so critical for heavy ends processing that one technology licensor, Chevron, wants to combine the DHT and HCU units because it recognizes the synergy between the two for this plant.

Unit	CASE		Phase I 10A	Phase II 10A
ADU 1	**Feed Crude**	**Name**	**Pennington**	**Pennington**
		API	33.5	33.5
		Rate (BPSD)	25000	25000
		Nominal Rate (kta)	1200	1200
ADU 2	Feed Crude	Name	Vasconia	Leona
		API	27.3	21.5
		Rate (BPSD)	40000	40000
		Nominal Rate (kta)	2000	2000
VDU2	Feed Capacity	BPSD	27900	30200
DHT	Feed Capacity	BPSD	21700	28800
HCU	Feed Capacity	BPSD	22200	24800
DELAYED COKER	Feed Capacity	BPSD	12400	10500
KHT	Feed Capacity	BPSD	3600	2700
NHT	Feed Capacity	BPSD	12000	14600
C5/C6 ISOM	Feed Capacity	BPSD	6600	5100
CCR	Feed Capacity	BPSD	14200	15400
COKE MAKE	Estimated Capacity.	ST/D	511	526
SULFUR MAKE	Estimated Capacity	LT/D	16.3	18.5 x 2units

Table 1 – Phase I & II capacity case comparisons

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & Modernization Project

1. OVERALL CONFIGURATION MODELING ISSUES

New, modified, or extremely important assumptions in our configuration validation models since Phase II are newly presented or repeated as follows:

A. **ADU 1 yields.** We have modified the ADU#1 yields to match our brownfield Hysys v 7.3 model results.

B. **ADU 1 AGO draw.** We have validated the viability of using the ADU#1 AGO stripper to recover AGO from the atmospheric column. We chose to keep this function in ADU#! for the following reasons.

   a. The equipment and piping connections from the column to the AGO product pump exist and are seemingly adequate for the use we propose to put them to. It costs very little to have this option as opposed to a brand new unit.
   b. Taking AGO from the crude unit takes a capacity and duty load off the downstream vacuum unit, in this case, VDU-2
   c. Our preferred disposition of the AGO material is as HCU feed. We can send it hot from the product pumps, or we can selectively use the stream to maintain preheat train temperatures before sending it across unit boundaries at a reduced temperature. The amount of AGO is less than 1000 BPD and whether or not it comes at 650F or 400 F should make little difference to the HCU operational capacity.
   d. A fraction (0-70%) of this AGO, while nominally like a VGO material, could be sent to the DHT and end up yielding more percentage of diesel material than what hydrocracking of that stock would yield. The total amount of the ADU#1 AGO is less than 5% of the other DHT feed stock rates and given the cut point decrease of 10-15C expected in the DHT, would allow this material to blend in to the ULSD pool without messing end point and gravity characteristics of the fuel. This will be an operations optimization opportunity by Soresco but our refinery blending experience give us reason to expect some of this potential revenue enhancement to be available after startup

C. **ADU 2 AGO draw.** We are neutral as to whether or not WPC uses an AGO draw in the atmospheric column. **It is a matter for FEED optimization.** If an atmospheric AGO stream is not taken, it is possible a small amount of diesel can be recovered from the vacuum tower overhead and/or LVGO pump-around stream. We call it out and estimate it for the possibility it could be available as a DHT feed. Again, using this draw strategy is a matter for FEED optimization to determine if the benefits are worth the additional unit capital cost.

D. **VDU-2** flash zone is estimated at approximately 700 F at 25-35 mm pressure. We assume a 986F HVGO cut point as we feel the metals and asphaltenes content of this swing to 1050+ cut point material is too high for proper hydrocracker catalyst performance, which is where this material is mapped to for normal processing. If the HCU licensor concurs, this swing material will add to the hydrocracker feed at the expense of the coker feed. It should be noted that swing gasoil metals and asphaltene content for one crude may be OK and that of another crude may not. The hydrocracker licensor needs to be aware of all potential crude gasoils that will be fed to the unit.

Taking the 986-1050F VGO swing cut will require a 710-720 F flash zone at 10-15 mm Hg pressure. It will also add to the ultimate amount of hydrogen needed for both the Hydrocracker to process the heavier amount of heavy gas oil feed.

E. **KHT feed capacity.** Case10A requires the KHT to handle 3600 BPD of potential jet fuel. Preliminary analysis of the hydrotreater shows that this is within the capacity of the unit. We have not finished and accepted revamp proposal to raise the capacity, though we believe we can get to 5000 + BPD capacity. We need more time to engineer this solution.

Meanwhile, all ADU#2 heart cut kero will go to the DHT for eventual inclusion into diesel product, currently a more profitable operating mode. ADU#2 swing cut N/K material will go to the NHT and eventually to the CCR.

F. **All Heavy SR naphtha, swing naphtha, and Heavy Hydrocrackate (HHC) go to the new CCR.** In all but maximum jet make, we can't allow too much of the NK swing material to blend into jet because of 10% distillation limits. This material is low octane and represents a substantial downgrade loss if blended to gasoline or sold independently. The HHC RON can be as high as 80-82 but we are now thinking it probably should be a CCR feed, even if it is this high and is not as good a feed as straight run for RON increase. Soresco needs all the octane-bbl. it can get. Licensor clarification will probably confirm this concern. Sometimes the licensors can blend catalyst or condition the catalyst to provide a bit of naphtha isomerization. Even if the HHC gets a lower RON·base-delta boost, it would definitely help the overall octane balance without loading up on a high severity, high-aromatics content reformate. The cut point of the HHC depends upon what the CCR vendor will allow into their reactor. We would like to cut it at around 200 C but may have to keep it lower with the tails going to HCK. We have experience in reforming such material to get more hydrogen make as a valuable by-product of that unit. as much as for the octane boost. The biggest threat to utilizing the stock is an increase in the required regeneration rate - the R part of the CCR. Coke laydown on the CCR catalyst is the primary problem here.

G. **All straight run Heavy Naphtha & Coker Naphtha will go to combined new NHT,** in accordance with item F above, which may be integrated with the CCR operations. This assumes the olefins and di-olefins make in the latter feed is low enough to meet gasoline specs. If not, a selective hydrogenation unit may be needed for saturation of the double bond items. We feel you will be OK as this naphtha in native mode is no more than 5 % of the total naphtha pool. We assume that the DHT naphtha will first have to be treated in the DHT, then go to the NHT for ultimate splitting into light and medium fractions.

H. **Hydrogen Balance**. We have redone our initial simple hydrogen balance in terms of supply needs to each conversion reactor based on licensor needs. FEED project WORK will determine the detailed balance as we do not get this sort of info from the LP other than what we might guess as an input. We have assumed the CCR H2 is a typical 83-85mol% purity. It could be as low as 75%. The licensor will have to verity this information... We have left a high-conservative estimate of pure hydrogen makeup needs regardless of whether it is delivered from a CCR or a PSA (typ. 99+% purity). Again, the final configuration here will be the responsibility of the FEED project work. We cover more discussion of this topic in Section 2.0 of this report

I. **Sulfur Balance.** The initial sulfur plant balance in Phase I assumed that 80% of the feed crude sulfur will come out in the hydrotreater and hydrocracker vent gases since it is not really allowed to come out in the liquid products. We have changed this estimate to 85% just to up the SRU plant design basis to cover all reasonable potential scenarios. Typically, 80% is a more common recovery factor, but we wanted to be conservative.

J. **All Light SR naphtha goes to the new Isom unit.** The cut point for this material is 85C for both LN1 and LN2. This keeps most of the benzene and precursors away from the CCR. We are not certain but that a pre-feed BTX column in the CCR unit may be needed. The Isom catalyst vendor will indicate if this is necessary to keep aromatics away from its catalyst. Most tolerate 5-8% benzene in the isom reactor feed. Light Hydrocrackate and hydrotreated DCU Naphtha are also traditional gasoline blend stocks and could benefit as ISOM feedstocks. There is some marginal value to doing so and as stated above, as many low-aromatics octane-barrels as can be made are necessary for keeping the gasoline blender operations as flexible as possible. We also identify HCU debutanizer bottoms as a source of significant c5+ material from the HCU separator system – material that doesn't come off the main HCU fractionator. There could be several sets of Debutanizer columns in the plant-one for each hydrotreater as well. Each will have a recoverable, if small, amount of light naphtha of very low sulfur and aromatics content. Collection of such material is a FEED project optimization problem but it should be considered as a source of ISOM feed.

K. **Isom Unit Definition.** It is possible that the CCR&Isom licensor(s) will want some control on the NHT unit, probably needing very low sulfur on the CCR feed. Some newer cat reforming catalysts can hold up to 10-20 ppm sulfur but most CCR/reformers still want <1ppm. If the NHT is not linked to the CCR, then there will likely be an added pre-CCR hydrotreater as a part of the cat reformer unit package. Typical ISOM units have a sulfur guard bed followed by a DeCyclohexanizer unit to keep cyclic C6's an lighter going to the isom unit instead of the CCR with the heavy stream from this column. The DCH column would typically function as a naphtha splitter and not require one in the NHT. Please note that the ISOM unit may also have an aromatics saturation unit as well to handle benzene if the final reformate has excessive benzene or total aromatics make. The Isom licensor will decide what parts of the system are required for the Moin Refinery. If Coker naphtha components are present in the Isom feed, a catalytic diene removal (selective hydrogenation of diolefins) may be needed as well.

L. **All Straight Run Diesel, VDU & Coker LGO go to the new DHT to make ULSD stocks.** About 20 F is cut off the end point of the composite feed material (so you can handle a bit more Coker LGO) and you will crack a small but significant amount, enough to generate some naphtha material. The reactor hydrogen partial pressure will likely be over 1200 psig and the catalyst needs to be able to saturate olefins as well as sulfur and nitrogen. It also will have to do a bit of light chain aromatics saturation to make cetane and smoke point specs. Thus it is a much more severe hydrotreater than either the NHT or the KHT. We modified the Phase I model to more closely agree with CEI DHT yield estimates.

M. **All SR LVGO and HVGO go to the new Hydrocracker along with Coker HGO.** . We originally picked the DCU model cases to maximize liquid products. Item D above discusses the cut point issues for the straight run cuts. Depending upon crude feed source and the operations of the coker itself (temp and soak time), the yield of heavy Coker GO may be as high as 30% of whole feedstock with potential properties of 1.1~1.6wt% CCR, 600~640°C FBP and 400~800wppm asphalt. If this is the case, it may be necessary to use more recycle and restrict the cut point of the HCGO draw. There would thus be more coke make and gas make with less fuel make. It is a consideration to take up with the licensor before getting too far into fixing the FEED stage design. We modified the Phase I model to more closely agree with CEI HCU and DCU yield estimates from their licensor contacts.

N. Coker model yields. We initially assumed a 1.05 Recycle ratio to maximize liquid yields and estimate the max feed rate to the HCU. We believed the coke price we were instructed to use is too high to be sustained and that liquids to the HCU will give better return. Licensor information, however, is the key modeling priority for our work here. Therefore, we modified the Phase I model to more closely agree with CEI DCU yield estimates from their licensor contacts. They are reasonable since all mid and heavy distillates will be processed in either the DHT or HCU, ultimately making mostly diesel product anyway. It takes a great change in the light to heavy DCU gasoil product ratio to greatly affect the amount of high value product for sale in the end.

O. UPR & URG blends. We changed little in our use of oxygenates, estimating both MTBE and ethanol blend characteristics. Soresco management backed off on the 35% aromatics content in the gasoline after Phase I work showed that this level could not effectively be made with MTBE and only approached by using Ethanol. Both octane grades and oxygenate blends now must meet only the old 40% aromatics standard.

We attempted to maximize the amount of premium grade sales product that would be made from the refinery conversions and assumed that Soresco would buy the appropriate stocks on the market to meet regular gasoline demand. We did not include this added purchase program in the overall refinery economics. Soresco would be wise to look at this buy/make blending situation as another We did however, identify an opportunity to reduce octane giveaway (and trim aromatics a bit) by blending a small amount of low octane naphtha into both UPR and URG to close the octane giveaway from 0.3-0.5 RON down to 0.05-0.2 RON

With the choice of the DCU-HCU configuration, Soresco creates a bit of a problem for maximizing gasoline octane while keeping aromatics within the proposed 35% limits. Do you set the reformer to a single "one size fits all" severity and blend it with Isom and with non-enhanced low octane cuts such as HHC. If so, you will likely not be able to meet both octane minimum and aromatics maximum limits for your premium gasoline. Or you will limit your premium make to whatever Isom you can balance the blend with and hope your residual stocks can blend with the high severity reformate in at least a 2:1 ratio. An alternative option is to blend the low value stocks into the straight run CCR feed and run a lower overall RON product, say 87-90, but get more octane-bbl. overall into the gasoline pool.

Soresco can make all the URG product it would want to both octane and aromatics specs even with MTBE. In order to make premium, however, some amount of higher-severity (100-102) reformate is needed to blend with 89-90 octane ISOM in a roughly a 1:2 ratio to keep aromatics in spec – that is, below 35%. This means, also, in order to sell UPR, the refinery must not use all of its ISOM making URG. This is the optimization problem one faces. Ethanol usage (10%) helps the aromatics levels (and octane) but in all cases, it is going to be difficult to make reformate blend aromatics limits with a single severity operation.

Blend ratios for maximizing 95 RON production (70-80% of total gasoline pool) show that the aromatics content can just make the current 40% limit, but are far off from the proposed 35% limit. The ethanol blend scheme gets the aromatics level down to 36% which might indicate possible compliance within the error of the modeling data, but again, a solution at this ration here would just barely hit within the margins. Even with dual severity modes, Soresco will have a more difficult time making as much UPR with 4% MTBE as the oxygenate.

P. **No regular production of LRG, AVG, HSD, heating oil or Fuel oils** as normal significant sales. These are one-off or irregular types of batch processing projects and not considered for normal processing configuration analysis. This assumption has not changed.

Q. **Overall Gasoline Conversion Strategy**. The refinery also needs every octane-bbl. it can make that is low in aromatics. For the proposed Moin refinery configuration a C5/C6 Isomerization unit is correctly used for this function. Initial estimates by HQCEC assumed an 84-85 RON production with straight-run naphtha feed. Worleyparsons believes that a quality licensor unit with recycle will allow production of 89-90 RON blend stock with typically 5% or less aromatics. Maximizing the amount of this stream allows use of more high-severity CCR product. Octane-bbl. production can be enhanced by upgrading coker naphtha and light hydrocrackate from low to high 80's values. . The implications for the Isom Unit are discussed later in this report.

R. **Overall MidDistillate Conversion Strategy.** Current market conditions would drive the LP to maximize USD above Jet and Jet above gasoline, subject to product specs, of course. Optimal design strategy, however, would tend to ensure the ability of the refinery to meet domestic consumption and be able to sell more Jet if the market dictates. We have artificially (though perfectly maintaining product specs) about 3000 BPD of kero into diesel that would have otherwise gone to jet fuel. We have attempted to provide a design philosophy that would all other potential planning opportunites for Soresco to "upgrade" blend-stocks by mere operational decisions.

S. **ADU#1 Satgas vs. ADU#2 Sats/Unsat gas plant.** We initially recommended two gas plants, an existing revamped ADU1 and a new unsats gas plant needed for both net Greenfield unit light ends and coker olefins processing. In reality, the utilization of existing ADU1 equipment beyond the atmospheric tower is an issue needed for FEED activities in both brownfield and greenfield units. Our initial Brownfield FEED analysis in this area shows that we could handle only about half of the ADU#2 naphtha make in our debutanizer and naphtha splitters, both of which may need a reboiler and tower tray/packing revamp to do so. The same is true for the LPG/light ends material fed to the absorber/stripper. All of the ADU#2 LPG/LE material would overwhelm the Gascon #1 capacity. In addition, WPM believe that sending hydrogen rich vent streams to the Absorber may not be the best way to handle effective economic hydrogen recovery. For these reasons, we would suggest Soresco use Gascon#1 in a capacity offload scheme with Gascon#2 designed for the full load of the Greenfield vent and naphtha makes.

T. **Hydrogen Unit Design Assumptions.** : With more defined vendor liquid product yields and hydrogen makeup requirements, we are able to form an initial hydrogen balance for the Moin refinery model.

CEI presented a good idea for recovery of 99.9% Hydrogen from the CCR Separator off gas with a PSA unit. Combining this recovery with a combination of a steam-reforming plant and a 99.9% H2 from PSA unit and feeding all hydrogen needs from a PSA hydrogen header would seem to be an economical and operationally beneficial scheme which we endorse.

Since the Moin refinery has no outside natural gas network to feed from, it must generate all of its own hydrocarbon fuel or buy fuel oil to make up the difference in fuel duty availability. Thus the refinery RFG and LPG material makes necessarily form the feed stock to the hydrogen reformer. We have estimated amounts of hydrogen, water, and CO2 resulting from either fuel gas or LPG usage in the model.

U. Assumed Refinery Operating Costs for the LP. Soresco has indicated that the typical refinery operations cost they are responsible for is about $ 5 /bbl. RECOPE corporate costs are not covered by this number.

KBC analysis of year 2016 and beyond crude-product prices indicate that the refinery may be expected at about $17-19/bbl under the circumstances predicted by the KBC study. The refinery is expected to generate about 80% of its fuel needs for fired heaters and import 30MW every operating day. In addition, we assume that about 500 BPD of fuel oil per day is imported to make up the 20% shortfall. An alternative option was to use the coker naphtha as supplemental fuel gas in order to avoid any need to import oil. This option actually ends up costing $21/net MM BTU (basis; lost LPG sales revenue) which is nearly $4.5 higher than for simply using fuel oil. We chose the former fuel scheme.

The final values show for operating expense fixed and variable operations expenses are shown in Table 2 below.

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & Modernization Project

	Cost (2012)		Consumption		
Variable cost	**Value**	**Unit**	**Value**	**Unit**	**% COST**
Imported fuel oil***	500	BSPD	175.000	bbl/Y	14%
Fuel Gas***	0,00	US$/MMBTU	1.024.800	MMBTU/Y	0%
Electricity***	251.244.000	kWyear	26.631.864	US$/Y	24%
Catalysts & Chemicals**	3.067.500	US$/Y	3.067.500	US$/Y	3%
Make-up water from river**	0,00012	US$/m³	2.418.994	m3/Y	0%
Potable water**	0,5	US$/m³	54.600	m3/Y	0%
Sewage Charge**	197	US$/Y	197	US$/Y	0%
Total Variable Cost					40%
Fixed cost					
Employee expenses****	20	U$/man-hour	69.333	man-hour/month	15%
Maintenance **	3,50%	CAPEX	46.350.675	US$/YEAR	41%
Insurance & Local taxes**	0,15	US$/bbl	10062	US$/YEAR	3%
Total Fixed Cost					60%
Total Cost per year					100%

		ENERGY	Maintenance**	Employee expenses
Total Cost per barrel with maintenance =	$5,25	$1,98	$2,18	$0,78

RECOPE INFORMATION****			** maintenance global factor		
Employees:	INVESTMENT**	UNIT	FUEL	CONSUMPTION	
400	1.324.305.000	US $	FUEL OIL	500	BSPD
400	67.080	bbl/day	FUEL GAS	1024800	MMBTU

**FSR INFORMATION
***ESTIMATION WPM
****RECOPE INFO.

Table 2 – Fixed and Variable Operating Costs Predicted for the Moin Refinery

V. **Fuel Balances.** Enough information was gleaned in the last month to allow WPM to give reasonable estimates of energy duties, fuel make yields and power consumptions needed.

Once the reformer/H2 Unit needs were tightened, it was possible to determine the fuel makes available to run the refinery as well as the need for supplementary fuel oil purchases.

The fuel LHV supply was calculated in the model as:

FUEL GAS MAKES

Stream	Description.	Comments	LHV BTU/SCF		KTA	MW
GG1	GCU #1 Clean Fuel Gas to H2U	12.6 MOL % h2	lhv=	1,109.0	0.0	20.3
CH4	VENT GAS TO FUEL	5.6 WT% h2	lhv=	1060	26.5	20.3
GG2	Clean Fuel Gas to Fuel Gas header	10MOL % purity	lhv=	1,109.0	41.6	30.5
CHD	H2U PSA VENT GAS TO FUEL	9.3 WT% h2	lhv=	265.0	44.0	20.3
						3.2

		Comb. Rate				
RFG	**Refinery Fuel Gas-High BTU**	Rate	To Fuel Gas	kta=	68.1	Note: CO2 removed from H2U PSA vent gas not included
mw	lhv - btu/scf	194.56	MT/D			
24.4	1098	17866.76	LB/Hr			
		732.85	MOLS/HR			
		263384.53	scf/hr			
		289.2	**MMBTU/HR**	available		
RFG	**H2U PSA VENT GAS – Low Btu**	Rate	To Fuel Gas	kta=	44.0	Low BTU fuel gas
mw	lhv - btu/scf	125.80	MT/D			
3.3	264	11552.80	LB/Hr			
		3500.85	MOLS/HR			
		1258204.54	scf/hr			
		332.2	**MMBTU/HR**	available		

LPG **COKER NAPHTHA TO FUEL**

Available Coker LPG	23.80	kta	
LHV	19600	BTU/lb	
	67.98680914	Mt/d	
	149842.9274	lb/d	
	122.371724	**MM BTU/hr**	**potential duty**

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & Modernization Project

Total RFG (Hi&Low BTU) = 734 MM BTU/hr Potential duty

The total fired duty needs of the refinery These were taken from licensor data, some rigorous crude simulation models, and fill in with FSR data shows that the maximum fired duty is between 670 and 750 MM BTU/hr

It is possible that the Moin refinery can supply nearly all of its fired duty by fuel gas if it is willing to utilize the low BTU gas derived from the H2U PSA vent gas. This is predicated upon a 50.5 kta net PSA hydrogen stream taken from a steam reformer of high conversion and with relatively efficient CO2 removal – presumably from amine. If the reformer CO2 is substantially removed, the low BTU-gas will have an LHV of about 265 BTU/SCF. If the CO2 is not removed, the LHV will be about 175 BTU/SCF but the total volumetric make will increase by 50%. The net available energy will not significantly decrease but the gas volume increase for the same duty delivery will result in larger delivery headers, more complicated valving and controls, and more expensive custom designed burners with less design flexibility.

This scenario also requires the use of coker-derived LPG as fuel. which can provide approximately 120 MM BTU/hr or about 15-20% of the plant needs. While there are some good reasons to do this, the option actually ends up costing $21/net MM BTU (basis; lost LPG sales revenue) which is nearly $4.5 higher than for simply using fuel oil. We chose the former fuel scheme. If the coker LPG could be used in place of fuel gas for the hydrogen reformer, instead, the economics might go against fuel oil usage

In another scenario, , consolidated blended fuel gas (Hi and Low mixed) would have a low heating value of about 820 BTU/SCF, which is a workable level, especially if supplemented with some vaporized LPG to get the rate up to natural gas levels at 900+BTU/SCF.

These sorts of final configuration decisions are properly a part of FEED optimization for the Greenfield units.

Fuel Oil usage and Power Needs

The FSR shows total electrical power needs of 30 MW which we believe is a reasonable value for a limited steam turbine utilization and only needing a 50 kta steam boiler. At a 40% generation efficiency at the nearby Moin Power plant, this translates into a total fuel oil use of 45 BPH or 1080 BPD.

1 bpd of fuel oil/ MM BTU fired duty will be needed to make up refinery heating needs that can't be met by one or another fuel gas. Fuel Oil equivalent is roughly 1 bbl per 6 MM BTU of fired duty.

W. Product Makes After most of the licensor information has been incorporated into the validation model, the final Case10A feed purchases and product yields are:

Feedstock Purchases	Units	DAY	YEAR
Pennington	BSPD	25.000	8.750.000
Vasconia	BSPD	40.000	14.000.000
Ethanol	BSPD	2080	728.000
Total Purchases	BSPD	67.080	23.478.000
Product Sales	**Units**	**DAY**	**YEAR**
LPG	BSPD	749	262,150
Unleaded Premium	BSPD	14.480	5.068.000
Unleaded Regular	BSPD	5.600	1.960.000
Kero/Jet	BSPD	9.070	3.174.500
Diesel	BSPD	35,490	12.425.500
Coke	MTONS*	526	184.100
Sulfur	MTONS*	53	18.515
Total liquid	BSPD	65389	22.886.150

Table 3 – Feed Purchase and Product Makes for Case 10A

WorleyParsons
resources & energy

SORESCO

2.0 HYDROGEN CONSUMPTION FOR HIGH SEVERITY HYDROPROCESSING

WPM's original evaluation of the hydrogen consumption needs of the Greenfield HCU and DHT units were derived from the perceived need to provide the following makeup rates

Unit	Description	Design rate (SCF H2/BBL Fresh Feed)
DHT	Distillate Hydrotreater – Processes SR Diesel range and Coker Midbbl or light Gas oil material into Euro V type ULSD. Cetane >52, S<20 ppm, Aromatics <20 vol% This is a very severe service with considerable aromatics saturation.	700 SCF/BBL
HCU	Hvy Gasoil Hydrocracker – Processes 650-1000 F end point SR VGO and Coker HGO. 98+% conversion to diesel, kero, and naphtha blend stocks. Must meet Euro V+ ULSD needs Cetane >60, S<20 ppm, Aromatics <20 vol% This is a very severe service with considerable aromatics Saturation and paraffin/naphthene chain cracking	2500 SCF/BBL

Upon further evaluation of typical licensor data for various types of severe LGO hydrotreating and VGO Hydrocracking, WPM proposes to use the values above as expected consumption (chemical and other basis) and to change the design basis to 1000 and 2800 SCF/Bbl of Fresh Feed respectively.

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & Modernization Project

Case10AValidationCasesrEV9.xlsx was used to calculate the effect of this increase on the design capacity of the hydrogen/PSA unit. CCR vent gas hydrogen recovery is still retained as per CEI's suggestion. Even so, a total of 56.5 kta of 99.9% pure hydrogen is needed from new generation in a steam-HC reformer/PSA unit. WPM would suggest that two (2) 33 Nm^3/h units be installed, each with a nominal capacity of 30 kta of pure hydrogen. CEI/WPC has claimed that only one such unit will be required in addition to the CCR recovery scheme PSA.

The reason for our higher hydrogen consumptions is explained below.

INITIAL CONSUMPTION VALUATION

Typical consumption values for various projects using UOP catalyst indicate that the 700 and 2500 values represent reasonable values to use for our type of units, but that the final value should be based on a kinetic and thermo analysis of what reactions will actually take place. For example, almost total sulfur removal is easy to calculate. Similar levels of nitrogen and oxygen removal are also easy to find, although the kinetic removal of nitrogen is accomplished with more difficulty than sulfur removal. If the catalyst type and activity does not convert embedded nitrogen with any significance, the H2 consumption could be a bit lower but the resulting retention of nitro compounds in the products would not be very desirable. This retention can also be a by-product of hydrogen starvation.

The most critical component of the hydrogen consumption for the DHT will be aromatics saturation. For hydrocracking it will be aromatic saturation and also considerable paraffinic and naphthenic chain cracking. These reactions consume several times as much hydrogen per reaction site than simple HDS and HDS reactions.

Three Unocal pilot plant tests (NesteOy, Petronas, and Scanreff proposals' info) tallies up the **chemical** hydrogen consumption for a series of similar (to Moin feeds) heavy gasoil hydrocrackers and light gasoil hydrotreaters that were required to meet ULSD-like conditions for the most part. In some cases, the final aromatics content was considerably above 20 vol % and in others, it was not. All were required to remove S to 50 ppm, or essentially all the sulfur starting from 1-2 wt% in the feed. Although this data was derived from rigorous pilot plant data 20+ years ago, the chemistry is still valid. Catalyst activity affects temperature, H2 partial pressure, and space velocity needs, but the chemical consumption is still essentially the same.

In addition, the Unocal IROM design manual extract shows that the true hydrogen consumption, as opposed to pure chemical consumption, can be any-where from 10-40% above the former usage rate. This is our concern that we are low at least on design capacity of hydrogen.

WorleyParsons
resources & energy

SORESCO

We have recently validated this information informally with UOP and Haldor-Topsoe staff that WPM engineers have personally worked with in the past. Three WPM engineers have considerable HCU refinery operations and R&D licensing sales of hydrocrackers and hydrotreaters.

One final reference point is on a recent project in Saudi Arabia. The hydrogen consumption for a full conversion heavy gasoil HCU was set at 2800 SCF/BBL. We believe that this ought to govern at least the design of the hydrogen generation capacity. Using only the total 48 kta (max 18 from CCR gas) of hydrogen proposed by CEI will definitely be detrimental to the processing of any heavier, more sour crudes in the Moin refinery.

Reference files mentioned above(and others) for the basis of WPM DHT & HCU hydrogen consumption calues will be found on the Soresco Sharepoint site along with the proper validation model Rev9, a BFD and this report.

3.0 USE OF HEAVIER FEED CRUDES TO ADU#2

In Phase 1 an analysis was performed on use of Leona 22 and Roncador 18 gravity crudes instead of Vasconia. As set of yields based on earlier versions of the model, predicted capacities of the Refinery conversion and processing units. The percentage increase/decrease of capacities would still be expected to hold reasonably well for the capacities of Phase II presented in Table 1. We have put the Phase II capacities in Table 2 along with the relative capacity percentages for the two heavier crude cases.

Both the Leona and Roncador crudes are considerably heavier than the Vasconia crude. Their yields get shifted to the heavier products accordingly. The Leona crude has a high yield of diesel and light gas oil material, so the diesel yield at an overall refinery rate of 65000 BPSD Is highest. In contrast, Roncador crude has a high heavy gas oil fraction and resid fraction with a high CCR and asphaltene production. The resulting coker feed rate is highest of the three crude cases with a significant net hydrocracker feed as well.

The results in Table 2 can be interpreted in a couple of ways. If the new refinery design strictly matches Case 10A design capacities, then the other two crude case runs will need to have feed rate cuts to the level that VDU, DHT, DCU and HCU rates are within about 10% (the planned design rate contingency) above the Case 10A capacities shown.

Alternately, with some preplanning, use of the heavier crudes could allow Soresco to make some known but limited products. For example, use of the Roncador feed could allow a diversion of some VDU/DCU feed to the new Asphalt Column, VDU1. Use of the Leona crude may present an opportunity to divert some high sulfur diesel blend stock to storage, reducing the normally large DHT feed by enough capacity to stay within tentative Case 10A capacities.

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & Modernization Project

Unit	CASE		10A(New)	10B	10C
			VOL BASIS	% BASIS	% BASIS
ADU 1	**Feed Crude**	**Name**	**Pennington**	**Pennington**	**Pennington**
		API	27.3	27.3	27.3
		Rate (BPSD)	25000	100	100
ADU 2	Feed Crude	Name	Vasconia	Leona	Roncador
		API	25.3	21.5	17.94
		Rate (BPSD)	40000	100	100
VDU2	Feed Capacity	BPSD	28000	108.24	128.67
DHT	Feed Capacity	BPSD	28000	132.72	84.33
HCU	Feed Capacity	BPSD	21350	111.71	106.31
DELAYED COKER	Feed Capacity	BPSD	13000	84.68	125.81
KHT	Feed Capacity	BPSD	3600	38.57	51.43
NHT	Feed Capacity	BPSD	17500	121.67	89.17
C5/C6 ISOM	Feed Capacity	BPSD	5100	92.42	96.97
CCR	Feed Capacity	BPSD	14400	108.45	85.92
GASOLINE BLENDER	Prod Capacity	BPSD	22000 MAX	105.91	88.89
JET BLENDER	Prod Capacity	BPSD	15000 MAX	92.17	92.17
ULSD BLENDER	Prod Capacity	BPSD	36000 MAX	96.27	101.12
COKE MAKE	Estimated Capacity.	ST/D	526	97.06	241.68
SULFUR MAKE	Estimated Capacity.	LT/D	18.5	186.50	69.33

Table 2 – Three heavy crude case (% of Case 10 A Yield basis)

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & Modernization Project

4.0 ATTACHED MATERIAL, FUEL, HYDROGEN AND OCTANE BALANCE SPREADSHEETS

The attached spreadsheet, *Case10A_ValidationREV9.xls* holds the Phase II material balances contains trial refinery product stream hydrogen and fuel balances based upon the Phase I model modified with licensor information.

Within the spreadsheet, there is a revised volume balance worksheet where we mostly match good data in terms of volume yields. For each unit and stream, we match the volume balance to a weight rate and calculate a corresponding API gravity of each cut. This allows us to check on reasonability of the values. For example, light naphtha are expected to have an API value of 69-77, heavy naphthas 53-64, kero, 42-46, diesel 32-39, etc. We then adjusted volume and weight rates so that the unit balanced on weight exactly and the volume balance offset was minor. In fact, most hydrotreater models increase the volume yield of product by adding hydrogen and thus lightening the product gravity some. In hydrocrackers, this volume gain is even more pronounced.

In each spreadsheet, the refinery units where we are satisfied that the feed streams and yield products are reasonably well balanced have their title blocks outlined in yellow. Items of interest on this spreadsheet include:

ADU-1 Existing atmospheric preflash and crude tower for light sweet crudes (Cases 10A,B,and C use Pennington). Treated as one unit operation with CPF#1.

ADU-2 New atmospheric preflash and crude tower for heavier, more sour crudes (Case 10 uses Vasconia, 10 B uses Leona21, and 10C uses Roncador18). Treated as one unit operation with CPF#2.

VDU-2 New Vacuum Unit

DCU - New Delayed Coker Unit

ISOM – New C5/C6 Isomerization Unit

KHT – Existing Kerosene Hydrotreater assuming it is mechanically sound for re-use, which it appears to be from our limited initial examination. A more thorough inspection needs to be done to validate this assumption

NHT – New consolidated Naphtha Hydrotreater, which also serves as the naphtha desulfurizer for the feed to the Isom and CCR Units.

DHT – New consolidated Distillate Hydrotreater, which reduces the sulfur content of the feed to the diesel blenders to 15 ppm, max

HCU – New Hydrocracker Unit with a 98+% conversion of feed to diesel or lighter products.

The spreadsheet also has worksheets illustrating the limits of UPR vs URG for 4% MTBE and 10% Ethanol gasoline blends, as well as for fuel gas estimates in support of the hydrogen plant needs and the total refinery fired heater duty.

Spreadsheets will be found on the official project Soresco Sharepoint site.

WorleyParsons

resources & energy

SORESCO Project Main Refinery Expansion & Modernization

SORESCO

CASE [illegible] EVALUATION CASE
FLOW BALANCE WORKSHEET
[illegible] CRUDE TO [illegible]
[illegible] CRUDE TO [illegible]

UNIT CAPACITIES

BROWNFIELD UNIT			GREENFIELD UNIT		
Unit	Feed BPSD	Feed klb	Unit	Feed BPSD	Feed klb
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

REFINERY BALANCE SUMMARY

NET Liq. PRODUCT BALANCE
TOTAL GASOLINE
TOTAL KERO/JET
TOTAL DIESEL
TOTAL LPG to sales
TOTAL LPG to fuel
TOTAL LPG to [illegible]
TOTAL LIQUIDS

NET LIQ FEED

NON LIQ PRODUCT BALANCE

NET FUEL OUT NO AVAILABLE

POWER CONSUMPTION

HYDROGEN BALANCE

REFINERY FUEL BALANCE

WorleyParsons
resources & energy

SORESCO

SORESCO Project Moin Refinery Expansion & Modernization

SORESCO-RECOPE AS OF: 14-Mar-12
MOIN REFINERY APP PAN
EXPANSION & MODERNIZATION PROJECT CASE 10 A VALIDATION CASE
ETHANOL BLEND SHEET

DUAL OCTANE POOL WITH ethanol

URG Naphtha Pool

Stream	bpd	RON	BPD*RON	ARO	bpd*ARO
RF90	4300	90	387,000.0	50.0	215,000.0
RF97	0	97	0.0	68.5	0.0
ISOM	600	90	54,000.0	1.3	804.0
SRBP	150	65	9,750.0	9.0	1,350.0
Sum hc	5050		450,750.0		217,154.0
ETOH (10.(	550.0	111	61,050.0	0.0	0.0
SUM TOT	5600.0		511,800.0		217,154.0
AVG		91.393		38.778	

UPR Naphtha Pool

Stream	bpd	RON	BPD*RON	ARO	BPD*ARO
RF90	0	90	0.0	50.0	0.0
RF97	8050	97	780,850.0	68.5	551,425.0
ISOM	4600	89	409,400.0	1.3	6,164.0
SRBP	300	65	19,500.0	9.0	2,700.0
Sum hc	12950		1209750	0.0	560289
ETOH (10.(	1530.0	111	169,830.0	0.0	0.0
SUM TOT	14480.0		1,379,580.0		560,289.0
AVG		95.275		38.694	

	Gaso Blender	
R89	CCR Reformate (89 RON A	4100
SRBP	ST RUN BYPASS OR PUR(	450
R97	CCR Reformate (98 RON A	8050
IN1	ISOM Isomerate to Gasoline	5100
ETHANOL	ETOH @ 10%	2080.0
		19780

Total Ethanol	2080.0 BPD
Total UPR	14480.0
Total URG	5600.0
	20080.0

WorleyParsons
resources & energy

SORESCO

SORESCO Project Moin Refinery Expansion & Modernization

FUEL GAS		per FSR Table 9.4-2							n+n	N	N+n+M/2			
COMP	VOLFRAC	VOLFRAC	MW	xpr	n	m	2N	m/2	prod make	prod make	prod make	LHV	xpr	
	reported	recalc							h20	co2	H2			
H2	0.1246	0.148404	2.016	0.299182	0	2	0	1			0.148404	274	40.6627	
CH4	0.421	0.501429	16.02	8.032897	1	4	2	2	1.00286	0.501429	2.005717	909	455.7992	
C2H4	0.0202	0.024059	28.04	0.674616	2	4	4	2	0.09624	0.048118	0.144354	1499	36.06455	
C2H6	0.181	0.215579	30.06	6.4803	2	6	4	3	0.86232	0.431158	1.509052	1619	349.0222	
C3H8	0.0403	0.047999	44.06	2.114838	3	8	6	4	0.28799	0.143997	0.47999	2315	111.1178	
C3H6	0.0235	0.02799	42.04	1.176679	3	6	6	3	0.16794	0.083969	0.251906	2182	61.07313	
C4H10	0.006	0.007146	58.1	0.415198	4	10	8	5	0.05717	0.028585	0.092901	3005	21.47451	
C4H8	0.01	0.01191	58.1	0.691996	4	8	8	4	0.09528	0.047642	0.142925	2875	34.2425	
CO2	0.0023	0.002739	44.02	0.120588	1	0				0.0023			0	
H2O	0.003	0.003573	18.02	0.064388	0	2			0.00715				0	
N2	0.0077	0.009171	28.01	0.256881	0	0	0	0					0	
	0.8396	1	20.32756	20.32756					2.576941	1.287198	4.77525		1109.457	BTU/SCF
bad form ! Have to normalize		Not unreasonable FG ratios however												
One more reason to distrust FSR														
LPG	1	1	51.08		3.5	9	7	4.5	7.00000	3.5	11.5		19600	btu/LB-Liq GPSA DATABOOK
50% c3-50% c4														

								LEFT SIDE	RIGHT SIDE
20.32756 kta	plus	46.43648 kta	yields	56.66244 kta	plus	9.626904 kta		66.76405	66.28934
FG		h2o		CO2		H2			
51.08 kta	plus	126.14 kta	yields	154.07 kta	plus	23.184 kta		177.22	177.254
FG		h2o		CO2		H2			

from FG
3.261057 kta H2O per kta FG
2.787468 kta CO2 per kta FG
0.473589 kta H2 per kta FG

from LPG
3.470125 kta H2O per kta FG
3.016249 kta CO2 per kta FG
0.453876 kta H2 per kta FG

FUEL VALUE OF LPG

Available Coker LPG	23.8 kta	
LHV	19600 BTU/lb	
	68 Mt/d	
	149872 lb/d	
	122.3955 MM BTU/h	potential duty

LHV CALCS

H2U OUTLET		xpr		
MPCTG H2	0.946	1.907136	58.85285	wt% H2
MPCTG CO	0.015	0.6603		
mPCTG ch4	0.015	0.2406		
Mpctg h2o	0.024	0.43248		
	1	3.240516		

MW CALCS

H2U OUTLET		xpr	lhv	
MPCTG H2	0.946	1.907136	2.016	1.907136
MPCTG CO	0.015	0.6603	44.02	0.6603
mPCTG ch4	0.015	0.2406	16.02	0.2403
Mpctg h2o	0.024	0.43248	18.02	0.43248
	1	3.240516		3.240216

CCR PSA O	before psa	after psa	lhv	
MPCTG H2	0.85	0.06	274	16.44
MPCTG ch4	0.09	0.09	909	81.81
mPCTG c2h	0.02	0.02	1619	32.38
Mpctg c3h	0.04	0.04	2315	92.6
	1	0.21		1063

CCR PSA O	before psa	after psa	lhv	
MPCTG H2	0.85	0.06	2.016	0.12096
MPCTG ch4	0.09	0.09	44.02	3.9618
mPCTG c2h	0.02	0.02	28	0.56
Mpctg c3h	0.04	0.04	44	1.76
	1	0.21		30.48933

H2U PSA V	before psa	after psa	lhv	
MPCTG H2	0.946	0.06622	274	18.14428
MPCTG CO	0.015	0.015	0	0
mPCTG ch4	0.015	0.015	909	13.635
Mpctg h2o	0.024	0.024	0	0
	1	0.12022		264.3427

H2U PSA V	before psa	after psa	lhv	
MPCTG H2	0.946	0.06622	2.016	0.1335
MPCTG CO	0.015	0.015	44.02	0.6603
mPCTG ch4	0.015	0.015	16.02	0.2403
Mpctg h2o	0.024	0.024	18.02	0.43248
	1	0.12022		12.19913

Option 1

FUEL GAS EKTA		MW		MOLE FR	LHV	
MAIN REF I	58.4	20.3	2.876847	0.186109	1109	206.3945
CCR PSA VI	26.3	30.5	0.862295	0.055783	1060	59.13049
H2U PSA V	37.5	3.2	11.71875	0.758108	265	200.8986
			15.45789	1		466.4236

Option 1

FUEL GAS EKTA		MW			MOLE FR	LHV	
MAIN REF I	58.4	20.3	1185.52	0.596437	0.596437	1109	661.4487
CCR PSA VI	26.3	30.5	802.15	0.403563	0.403563	1060	427.7767
H2U PSA V	0	0	0		0	0	0
	84.7		1987.67	1	1		1089.225

mw= 0.6*20.3+0.4*30.5   24.38

WorleyParsons
resources & energy

SORESCO

SORESCO Project Moin Refinery Expansion & Modernization

SORESCO-RECOPE
MOIN REFINERY
EXPANSION & MODERNIZATION PROJECT

AS OF: 11-Apr-12
APP PAN

CASE 10 A VALIDATION CASE
ECONOMICS

BUY	UNITS	UNIT COST $USD	MTBE CASE QUANTITY	REVENUE K $/SD		ETOH CASE QUANTITIE	REVENUE K $/SD	
PENNINGT(	BPSD	-113.95	25000	-2848.75		25000	-2848.75	
VASCONIA	BPSD	-102.76	40000	-4110.40		40000	-4110.40	
MTBE	BPSD	-138.54	708	-98.09				
ETOH	BPSD	-120.16				2088	-250.89	
SRBP (Note	BPSD	-110	450	-49.50		450	-49.50	
			TOTAL BUY	-7106.74	$K/D	485	-7259.54	
				-109.33	$/BBL Crude		-111.69	/BBL Crude

Productio	Amount BPD	Projected Demand 2015	2020
Total Gasol	22.8	19.4	22.1
Jet	13.5	11.5	13.9
USD	26.8	25.4	32.4
LPG	1.23	5.0	6.5

SELL	UNITS	UNIT COST $USD	MTBE CASE QUANTITY	REVENUE K $/SD		ETOH CASE QUANTITIE	REVENUE K $/SD	
UPR	BPSD	121.65	13710	1667.82		14480	1761.49	
URG	BPSD	117.39	4580	537.65		5600	657.38	
JET	BPSD	124.99	9070	1133.66		9070	1133.66	
USD	BPSD	127.22	35490	4515.04		35490	4515.04	
COK	Long tons	115.58	526	60.80		526	60.80	
SULFUR	Long tons	46.01	52.9	2.43		52.9	2.43	
LPG	BPSD	84.41	0	749.20		0	749.20	
FUEL GAS (	MM BTU/d	NA	NA	0.00		NA	0.00	
			TOTAL SELL	8666.59	$K/D		8880.00	
			Total Liquid Prod	62850	BBLS		64640	
				133.3322	$/BBL Crude		136.6154	$/BBL Crude

Notes
1. SRBP is straight run CCR feed bypass or purchased outside stock used to trim octane giveaway

SORESCO Project Moin Refinery Expansion & Modernization

SORESCO

Year	0 2013	1 2014	2 2015	3 2016	4 2017	5 2018	6 2019	7 2020	8 2021	9 2022
Initial Investment	[redacted]	[redacted]	[redacted]							
Incomes Product Price in C$										
LPG										
Unleaded Regular				23,322,308	24,425,820	25,529,391	26,632,933	27,736,475	28,607,378	29,478,281
Unleaded Premium				242,024,018	253,007,246	264,063,181	275,336,993	286,247,562	294,858,065	303,468,968
Kero/Jet				647,391,058	675,790,576	704,377,938	733,528,922	761,740,536	784,004,836	806,264,137
Diesel				416,903,406	434,402,268	452,026,147	470,025,078	487,398,923	501,976,709	516,554,495
Coke, KTONS				1,659,932,000	1,729,913,666	1,799,895,331	1,873,383,656	1,941,027,548	1,997,785,175	2,054,542,801
Sulfur, KTONS				21,690,604	22,744,927	23,557,446	24,472,792	25,215,928	25,947,187	26,636,174
Premium				1,147,264	1,141,557	1,135,849	1,130,141	1,124,434	1,118,726	1,113,019
				25,262,027	25,893,578	26,510,918	27,201,440	27,684,551	28,391,665	29,296,207
Total				3,007,872,716	3,167,319,667	3,297,126,151	3,431,714,955	3,558,375,956	3,662,879,741	3,767,358,681
Expenses Crude Price in CR ( )										
Pennington				1,031,512,500	1,086,225,000	1,130,937,500	1,175,912,500	1,221,325,000	1,258,162,500	1,295,000,000
Vasconia				1,505,564,569	1,571,180,227	1,638,810,468	1,705,822,333	1,773,799,505	1,828,588,652	1,883,393,896
Ekland				93,793,605	98,157,899	102,550,316	106,794,405	110,901,732	114,143,189	117,384,646
Total				2,630,870,674	2,755,563,126	2,872,298,284	2,988,529,238	3,106,026,236	3,200,894,341	3,295,778,542

Year	10 2023	11 2024	12 2025	13 2026	14 2027	15 2028	16 2029	17 2030	18 2031
Unleaded Regular	30,349,184	31,220,087	32,090,990	33,164,706	34,238,423	35,312,139	36,385,855	37,459,571	39,830,815
Unleaded Premium	312,079,071	320,689,574	329,300,077	340,061,082	350,676,771	361,292,459	371,908,148	382,523,837	403,066,053
Kero/Jet	828,533,438	850,797,738	873,062,039	900,886,925	928,336,062	955,785,200	983,231,338	1,010,683,476	1,063,801,862
Diesel	531,132,281	545,710,067	560,287,655	576,419,257	596,300,626	614,181,995	632,063,364	649,944,734	683,921,745
Coke, KTONS	2,111,300,426	2,168,058,054	2,224,815,681	2,296,773,358	2,366,393,262	2,436,013,166	2,505,633,070	2,575,252,974	2,704,457,517
Sulfur, KTONS	27,228,501	27,698,070	27,982,756	28,240,550	28,812,911	29,491,220	30,026,875	30,759,800	31,432,276
Premium	1,107,311	1,101,604	1,095,896	1,090,189	1,081,481	1,078,774	1,073,066	1,067,358	1,061,651
	30,028,612	30,779,327	31,548,811	32,337,531	33,145,969	33,974,618	34,823,984	35,694,583	36,586,916
Total	3,871,756,826	3,976,054,521	4,080,164,102	4,210,973,597	4,338,958,505	4,467,129,571	4,595,149,701	4,723,386,333	4,964,156,867
Pennington	1,331,925,000	1,368,850,000	1,405,775,000	1,451,012,500	1,496,950,000	1,542,975,000	1,589,000,000	1,635,025,000	1,725,325,000
Vasconia	1,938,215,640	1,993,051,295	2,047,910,246	2,116,110,705	2,184,645,999	2,253,199,960	2,321,773,056	2,390,365,764	2,528,607,690
Ekland	120,626,104	123,867,561	127,109,018	131,160,041	135,156,358	139,152,676	143,148,993	147,145,310	154,878,811
Total	3,390,766,743	3,485,771,856	3,580,794,304	3,698,283,246	3,816,752,357	3,935,327,636	4,053,922,049	4,172,536,075	4,408,811,501

Year	19 2032	20 2033	21 2034	22 2035	23 2036	24 2037	25 2038	26 2039	27 2040
Unleaded Regular	42,168,098	44,530,830	46,897,563	49,167,993	51,173,579	53,260,558	55,432,866	57,693,774	60,016,896
Unleaded Premium	423,539,799	441,017,028	461,497,012	484,978,996	504,421,539	522,565,401	542,437,262	563,064,797	584,176,947
Kero/Jet	1,114,746,014	1,169,702,736	1,222,670,920	1,275,649,420	1,322,930,043	1,371,963,074	1,422,813,465	1,475,548,570	1,530,234,748
Diesel	717,791,465	751,677,825	785,579,695	819,495,897	849,789,850	881,103,625	913,778,680	947,557,922	983,585,865
Coke, KTONS	2,837,764,223	2,977,837,768	3,112,777,608	3,345,497,033	3,364,534,577	3,487,938,151	3,615,867,890	3,748,469,806	3,885,979,995
Sulfur, KTONS	32,174,904	32,856,037	33,528,334	34,314,699	35,145,542	35,996,502	36,868,066	37,760,732	38,675,013
Premium	1,055,943	1,050,236	1,044,528	1,038,821	1,054,686	1,061,710	1,077,896	1,091,245	1,103,760
	37,501,622	38,439,162	39,400,141	40,385,145	41,394,773	42,429,613	43,490,381	44,577,043	45,692,064
Total	5,208,711,469	5,460,111,412	5,706,352,801	5,950,528,005	6,169,441,370	6,396,421,667	6,631,766,507	6,875,781,489	7,128,795,608
Pennington	1,815,837,500	1,905,750,000	1,996,050,000	2,086,437,500	2,165,179,598	2,246,893,430	2,331,691,170	2,419,689,483	2,511,008,087
Vasconia	2,667,415,616	2,806,155,272	2,944,825,766	3,083,426,278	3,203,351,613	3,327,947,501	3,457,346,368	3,591,859,696	3,731,563,296
Ekland	162,586,945	170,296,909	178,008,542	185,721,677	192,682,368	199,903,911	207,396,172	215,169,205	223,233,565
Total	4,645,840,061	4,882,202,181	5,118,884,308	5,355,585,455	5,561,216,579	5,774,744,842	5,996,473,660	6,226,717,484	6,465,804,949

Gross Margin [redacted]
Gross Margin per barrel [redacted]
Operating costs [redacted]
INITIAL-CAPEX
Working capital [redacted]
Rescue Value (+) [redacted]
Net Margin [redacted]
20,521,095
Net Flow US$ [redacted]
4,813,402,464
[redacted]
LAC Fees [redacted]

0020

0031

recope®

Jorge Rojas Montero <jorge.rojas@recope.go.cr>

Reporte Análisis de Riesgo de WP final.

3 mensajes

William Ulate <william.ulate@recope.go.cr> 19 de abril de 2012 13:21

Para: JORGE VILLALOBOS CLARE <jorgevillaloboscare@jdrecope.com>, Jorge rojas <Jorge.Rojas@recope.go.cr>, Luis Carlos Solera Salazar <Luis.Solera@recope.go.cr>, Mario Gomez <mgomez@gomezygalindo.com>, Rafael Morice <Rafael.Morice@aaa-net.com>, Rodrigo Castro Cordero <rodrigo.castro@recope.go.cr>

CC: Lorena Fernandez Solis <Lorena.Fernandez@recope.go.cr>, Roy Vargas Carranza <Roy.Vargas@recope.go.cr>, Diana Leandro Cordero <Diana.Leandro@recope.go.cr>, Otto Chaverri Arce <Otto.Chaverri@recope.go.cr>, Andres Barboza Jimenez <JoseAndres.Barboza@recope.go.cr>, Henry Arias Jiménez <Henry.Arias@recope.go.cr>, William Obando Obando <William.Obando@recope.go.cr>

Les adjunto el reporte final definitivo elaborado por los especialistas financieros de WP.

Lo relevante es que confirman el TIR de 19,2% y la probabilidad de éxito del proyecto es de 74% (todo proyecto sobre 60% es bueno), utilizando la sensibilización de las variable: margen bruto (precio), inversión y costos de operación.

Con ese análisis de riesgo se termina de confirmar que el proyecto es muy bueno y debemos continuar sin lugar a dudas.

William Ulate Padgett

AYUDEMOS A LA NATURALEZA, NO USE PAPEL NI TINTAS

William Ulate <william.ulate@recope.go.cr> 19 de abril de 2012 13:23

Para: JORGE VILLALOBOS CLARE <jorgevillaloboscare@jdrecope.com>, Jorge rojas <Jorge.Rojas@recope.go.cr>, Luis Carlos Solera Salazar <Luis.Solera@recope.go.cr>, Mario Gomez <mgomez@gomezygalindo.com>, Rafael Morice <Rafael.Morice@aaa-net.com>, Rodrigo Castro Cordero <rodrigo.castro@recope.go.cr>

CC: Lorena Fernandez Solis <Lorena.Fernandez@recope.go.cr>, Roy Vargas Carranza <Roy.Vargas@recope.go.cr>, Diana Leandro Cordero <Diana.Leandro@recope.go.cr>, Otto Chaverri Arce <Otto.Chaverri@recope.go.cr>, Andres Barboza Jimenez <JoseAndres.Barboza@recope.go.cr>, Henry Arias Jiménez <Henry.Arias@recope.go.cr>, William Obando Obando <William.Obando@recope.go.cr>

sorry, va el archivo adjunto

William Ulate Padgett

AYUDEMOS A LA NATURALEZA, NO USE PAPEL NI TINTAS

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Financial Feasibility and Risk Analysis

Summary

The following is a financial risk simulation model used to assess what the Internal Rate of Return (IRR) is, and the predictability of reaching the assessed IRR using a Monte Carlo simulation with normal distribution across a random sample of ranges based on historical data provided in the KBC study, and the current economic environment.

The software used to run the simulation is @RISK. This software performs the 10,000 iterations in a Microsoft Excel spreadsheet to show the possible outcome of the calculated IRR.

This report also uses the findings of WorleyParsons process validation work as of 3/26/2012 for the Soresco Moin refinery to create the future scenario of the refinery and providing the basis of the future cash flow calculation.

The tables below detail the results of the financial model. The financial model can be found in the excel files that accompany this analysis. The Financial Model was rigorously put together in conjunction with the Worley Parson Engineering and Finance team, and the Soresco leadership team.

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Financial Results

After careful study of all variables and data, and a thorough validation of the financial model in the mechanics and flow of the data the results are as follows:

A. NPV = $ 1,013,171,744

B. IRR = 19.2%

C. The Monte Carlo Risk simulation puts the success rate of hitting the IRR at a convincing

74%

TABLE 1 – Key assumptions in working capital and operating costs.

Initial Investment (2012) *	1,324,305,000	Units
Premium (2012)	1	US$/bbl
Inflation rate	2.5%	%
Working capital (2016)	10,280,463	bbl
Operating cost (2016)	5.3	US$/bbl
CRUDES FEED	65,000	BSPD

*adjusted using the 6/10 rule by ($33,500,000)

WorleyParsons resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Table 2 – The first 3 years of the monetary investment breakout. Nominal dollars is used in the cash flow analysis.

ITEM	Construction years: -2	-1	0	TOTAL
Investment schedule	30%	40%	30%	
Interest rate loan	0.00%	0.00%	0.00%	
Bank Loan	70%	70%	70%	
	US$			
Investment	397,291,500	529,722,000	397,291,500	1,324,305,000
Loan investment	278,104,050	370,805,400	278,104,050	927,013,500
Accumulated interest	0	0	0	0
Total investment	397,291,500	529,722,000	397,291,500	1,324,305,000
Nominal Investment	407,223,788	556,539,176	427,839,492	1,391,602,455

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Table 3.1 – The 3 Key Variables considered in the Monte Carlo simulation are gross margin, investment, and operating costs. The maximum and minimum margins are based on historical ranges.

Risk Variables	Base	Max.	Probable	Min.	Standard Deviation	Type of Variable	Type of Distribution
Gross Margin	0%	43%	0%	-32%	0.189	External	Normal
Investment	0%	10%	0%	-15%	0.064	External	Normal
Operation cost	0%	25%	0%	-5%	0.077	External	Normal

Table 3.2 – The dollar figures of the above ranges for the 3 key variables are shown below.

Variables	Max.	Probable	Min.
Gross Margin ($/bbl)	25.0	17.5	12.0
Investment (MM$)	1,457	1,324	1,126
Operating cost ($/bbl)	6.6	5.3	5.0

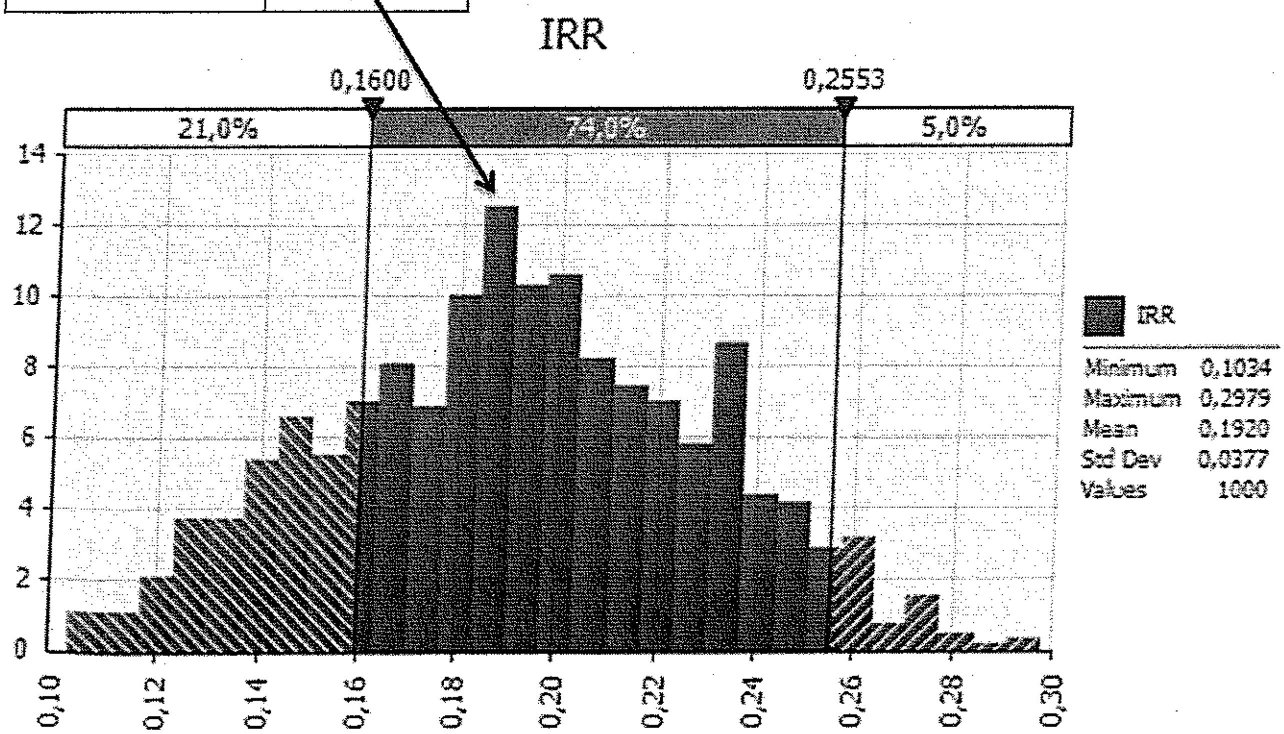
WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Table 4 – The calculation of the IRR is 19.2%, and the Monte Carlo simulation success rate for achieving this IRR is displayed on the graph as 74%.

IRR	19.2%



WorleyParsons
resources & energy

SORESCO

0037

SORESCO Project Moin Refinery Expansion & Modernization

Initial Investment (2012)	1,324,305,000	Units
Premium (2012)	1	US$/bbl
Inflation rate	2.5%	%
Working capital (2016)	10,280,461	bbl
Operating cost (2016)	5.3	US$/bbl
CRUDES FEED	65,000	BSPD

**adjust by (6/10) rule ($33,500,000)

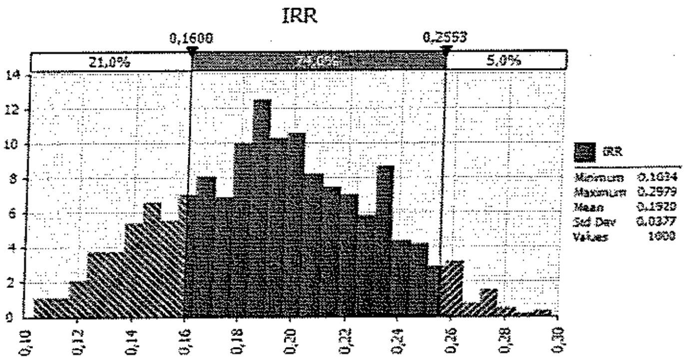
	Construction years	-2	-1	0	
	Investment schedul	30%	40%	30%	
	Interest rate loan	0.00%	0.00%	0.00%	
	Bank Loan	70%	70%	70%	
ITEM	US$				TOTAL
Investment		397,291,500	529,722,000	397,291,500	1,324,305,000
Loan investment		278,104,050	370,805,400	278,104,050	927,013,500
Accumulate interest		0	0	0	0
Total investment		397,291,500	529,722,000	397,291,500	1,324,305,000
Nominal Investment		407,223,788	556,539,176	427,839,492	1,391,602,455

Risk Analisys

Risk Variables	Base	Max.	Probable	Min	Estándar Desviation	Kind of variables	Kind of distribution
Gross Margin	0%	43%	0%	-32%	0.189	External	Normal
Investment	0%	10%	0%	-15%	0.064	External	Normal
Operation cost	0%	25%	0%	-5%	0.077	External	Normal

IRR	19.2%

Variables	Max.	Probable	Mín
Gross Margin ($/bb)	25.0	17.5	12.0
Investment (MM$)	1,457	1,324	1,126
Operation cost ($/bbl)	6.6	5.3	5.0



WorleyParsons
resources & energy

SORESCO Project Moin Refinery Expansion & Modernization

SORESCO

Product	Units	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
LPG (nominal)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
LPG (constant)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
95 Super Gasoline, New (nominal)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
95 Super Gasoline, New (constant)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
91 Regular Gasoline, New (nominal)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
91 Regular Gasoline, New (constant)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jet kerosene (nominal)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jet kerosene (constant)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Diesel, New (nominal)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Diesel, New (constant)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Oil 1%S (nominal)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Oil 1%S (constant)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Oil 3.5%S (nominal)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Oil 3.5%S (constant)	$/bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sulphur (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sulphur (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Coke (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Coke (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ethanol (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ethanol (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vacuum (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vacuum (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PROYECCIONES DE INFLACIÓN INTERNACIONALES PARA PRECIOS KBC

Año	[illegible]	[illegible]
Índice	[illegible]	[illegible]

PROYECCIONES DE INFLACIÓN INTERNACIONALES PARA COSTOS OPERATIVOS Y PASSIUM

Año	[illegible]	[illegible]
Índice	[illegible]	[illegible]

PROYECCIONES DE INFLACIÓN INTERNACIONALES PARA INVERSIÓN

Año	[illegible]	[illegible]
Índice	[illegible]	[illegible]

Product	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Average 2016-2035
LPG (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
LPG (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
95 Super Gasoline, New (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
95 Super Gasoline, New (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
91 Regular Gasoline, New (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
91 Regular Gasoline, New (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jet kerosene (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jet kerosene (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Diesel, New (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Diesel, New (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Oil 1%S (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Oil 1%S (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Oil 3.5%S (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel Oil 3.5%S (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sulphur (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sulphur (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Coke (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Coke (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ethanol (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ethanol (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vacuum (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vacuum (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] (nominal)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] (constant)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

0038

WorleyParsons
resources & energy

SORESCO

SORESCO Project Moin Refinery Expansion & Modernization

Variable cost	Cost (2010) Value	Unit	Consumption Value	Unit	% COST
Imported fuel oil	300	$/bbl	175,000	bbl/Y	34%
Fuel Gas	4.00	US$/MMBTU	1,024,000	MMBTU/Y	0%
Electricity	251,244,000	kWh/year	26,633,864	US$/Y	21%
Catalysts & Chemicals	3,067,500	US$/Y	3,067,500	US$/Y	3%
Make-up water from river	0.00012	US$/m³	2,488,994	m3/Y	0%
Potable water	0.5	US$/m³	54,650	m3/Y	0%
Sewage Charge	147	US$/Y	147	US$/Y	0%
Fixed cost					
Employees expenses	20	US$/man hour	49,333	man hour/month	15%
Maintenance **	4.50%	CAPEX	46,350,675	US$/YEAR	41%
Insurance & Local taxes	0.15	US$/bbl	30,663	US$/YEAR	3%

Variable cost	2016	2017	2018	2019	2020	2021	2022	2023	2024
Imported fuel oil	17,135,126	17,909,832	18,684,539	19,486,196	20,250,252	20,868,315	21,484,377	22,099,940	22,713,501
Fuel Gas									
Electricity	29,296,095	30,151,510	30,684,787	31,656,947	32,445,340	33,209,549	34,091,037	34,943,313	35,816,896
Catalysts & Chemicals	3,265,944	3,470,595	3,537,260	3,646,234	3,727,451	3,830,847	3,926,459	4,024,896	4,125,446
Make-up water from river	320	325	337	345	354	363	372	381	390
Potable water	30,134	30,487	31,600	32,451	33,262	34,094	34,946	35,820	36,715
Sewage Charge	317	323	328	331	340	346	352	276	265
Fixed cost									
Employees expenses	18,547,496	18,826,633	19,247,898	19,779,731	20,274,224	20,781,079	21,300,606	21,833,122	22,378,950
Maintenance **	31,142,471	32,411,334	53,712,573	55,096,347	56,473,747	57,885,612	59,332,783	60,416,302	62,336,505
Insurance & Local taxes	3,807,296	3,961,165	4,061,092	4,166,345	4,240,419	4,346,121	4,506,074	4,620,776	4,736,265

Variable cost	2025	2026	2027	2028	2029	2030	2031	2032
Imported fuel oil	23,331,065	24,096,977	[illegible]	25,609,502	26,365,765	27,122,027	28,779,615	30,297,714
Fuel Gas								
Electricity	36,712,314	37,630,127	38,570,880	39,535,152	40,523,530	41,536,619	42,575,034	43,639,410
Catalysts & Chemicals	4,233,583	4,334,297	4,442,653	4,553,720	4,667,564	4,784,253	4,903,859	5,026,456
Make-up water from river	400	410	420	431	442	453	464	476
Potable water	37,633	38,574	39,539	40,527	41,540	42,579	43,643	44,734
Sewage Charge	272	275	285	293	300	307	315	323
Fixed cost								
Employees expenses	22,938,423	23,511,884	24,099,661	24,702,173	25,319,727	25,952,721	26,601,539	27,264,077
Maintenance **	63,894,917	65,492,290	67,129,598	68,807,838	70,528,030	72,291,234	74,098,519	75,950,978
Insurance & Local taxes	4,854,702	4,976,070	5,100,472	5,227,983	5,358,683	5,492,650	5,629,966	5,770,716

Variable cost	2033	2034	2035	2036	2037	2038	2039	2040
Imported fuel oil	32,007,739	33,606,067	35,198,046	36,567,756	37,990,771	39,407,160	41,004,080	47,440,799
Fuel Gas								
Electricity	44,730,395	45,848,655	46,994,873	48,169,741	49,373,987	50,608,337	51,873,545	53,170,384
Catalysts & Chemicals	5,151,117	5,280,920	5,412,943	5,545,267	5,684,974	5,827,148	5,974,877	6,124,249
Make-up water from river	488	500	512	525	538	552	565	580
Potable water	45,853	46,999	48,174	49,378	50,613	51,878	53,175	54,504
Sewage Charge	331	339	348	356	365	374	383	393
Fixed cost								
Employees expenses	27,946,210	28,644,946	29,361,111	30,097,199	30,849,629	31,620,870	32,413,912	33,224,676
Maintenance **	77,849,733	79,795,976	81,790,896	83,835,669	85,931,560	88,079,819	90,281,646	92,538,692
Insurance & Local taxes	5,911,983	6,062,854	6,214,429	6,369,790	6,529,035	6,692,261	6,859,567	7,031,057

Total Cost per barrel with maintenance *

Assumptions		
Operating rate		
Employees		
400	1,254,305,000	US$
400	67,000	bbl/day

** maintenance global factor		
FUEL	CONSUMPTION	
FUEL OIL	300	BLS/Y
FUEL GAS	1,024,000	MMBTU

WorleyParsons
resources & energy

SORESCO

SORESCO Project Moin Refinery Expansion & Modernization

Feedstock Purchases	Units	DAY	YEAR
Pennington	BSPD	25,000	8,750,000
Vasconia	BSPD	40,000	14,000,000
Etanol	BSPD	2080	728,000
Total Purchases	BSPD	67,080	23,478,000
Product Sales	**Units**	**DAY**	**YEAR**
LPG	BSPD	749	262,150
Unleaded Premium	BSPD	14,480	5,068,000
Unleaded Regular	BSPD	5,600	1,960,000
Kero/Jet	BSPD	9,070	3,174,500
Diesel	BSPD	35,490	12,421,500
Coke	MTONS*	526	184,100
Sulfur	MTONS*	53	18,515
Total liquid	BSPD	65,389	22,886,150

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Financial Feasibility and Risk Analysis

Summary

The following is a financial risk simulation model used to assess what the Internal Rate of Return (IRR) is, and the predictability of reaching the assessed IRR using a Monte Carlo simulation with normal distribution across a random sample of ranges based on historical data provided in the KBC study, and the current economic environment.

The software used to run the simulation is @RISK. This software performs the 10,000 iterations in a Microsoft Excel spreadsheet to show the possible outcome of the calculated IRR.

This report also uses the findings of WorleyParsons process validation work as of 3/26/2012 for the Soresco Moin refinery to create the future scenario of the refinery and providing the basis of the future cash flow calculation.

The tables below detail the results of the financial model. The financial model can be found in the excel files that accompany this analysis. The Financial Model was rigorously put together in conjunction with the Worley Parson Engineering and Finance team, and the Soresco leadership team.

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Financial Results

After careful study of all variables and data, and a thorough validation of the financial model in the mechanics and flow of the data the results are as follows:

A. NPV = $ 1,013,171,744

B. IRR = 19.2%

C. The Monte Carlo Risk simulation puts the success rate of hitting the IRR at a convincing 74%

TABLE 1 – Key assumptions in working capital and operating costs.

Initial Investment (2012) *	1,324,305,000	Units
Premium (2012)	1	US$/bbl
Inflation rate	2.5%	%
Working capital (2016)	10,280,463	bbl
Operating cost (2016)	5.3	US$/bbl
CRUDES FEED	65,000	BSPD

*adjusted using the 6/10 rule by ($33,500,000)

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Table 2 – The first 3 years of the monetary investment breakout. Nominal dollars is used in the cash flow analysis.

Construction years	-2	-1	0	
Investment schedule	30%	40%	30%	
Interest rate loan	0.00%	0.00%	0.00%	
Bank Loan	70%	70%	70%	
ITEM	US$			TOTAL
Investment	397,291,500	529,722,000	397,291,500	1,324,305,000
Loan investment	278,104,050	370,805,400	278,104,050	927,013,500
Accumulated interest	0	0	0	0
Total investment	397,291,500	529,722,000	397,291,500	1,324,305,000
Nominal Investment	407,223,788	556,539,176	427,839,492	1,391,602,455

WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Table 3.1 – The 3 Key Variables considered in the Monte Carlo simulation are gross margin, investment, and operating costs. The maximum and minimum margins are based on historical ranges.

Risk Variables	Base	Max.	Probable	Min.	Standard Deviation	Type of Variable	Type of Distribution
Gross Margin	0%	43%	0%	-32%	0.189	External	Normal
Investment	0%	10%	0%	-15%	0.064	External	Normal
Operation cost	0%	25%	0%	-5%	0.077	External	Normal

Table 3.2 – The dollar figures of the above ranges for the 3 key variables are shown below.

Variables	Max.	Probable	Min.
Gross Margin ($/bbl)	25.0	17.5	12.0
Investment (MM$)	1,457	1,324	1,126
Operating cost ($/bbl)	6.6	5.3	5.0

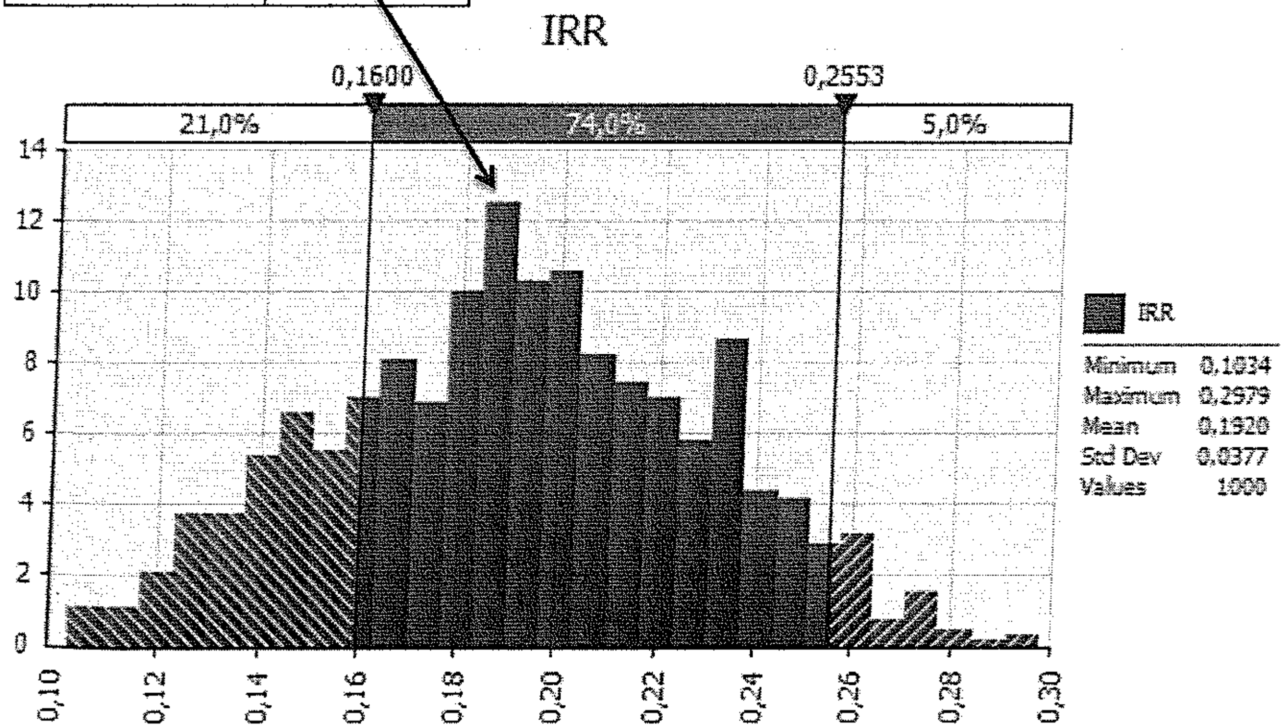
WorleyParsons
resources & energy

SORESCO

COSTA RICA MOIN Refinery Expansion & ModernizationProject

Table 4 – The calculation of the IRR is 19.2%, and the Monte Carlo simulation success rate for achieving this IRR is displayed on the graph as 74%.

IRR	**19.2%**



SORESCO

MAYO 09, 2012

PMR-010-2012

RECEPCIÓN DEL ESTUDIO DEL CASO 10 POR PARTE DEL EQUIPO TÉCNICO DE RECOPE EN SORESCO.

Se realizó una valoración del estudio técnico realizado por WorleyParsons con base en los requerimientos solicitados en la nota GG-0391-2011 realizada por el grupo técnico de RECOPE designado por la Gerencia General en ese momento para la revisión del FSR de HQCEC y el contrato firmado por SORESCO-WorleyParsons.

Los principales puntos considerados se enumeran a continuación:

a. Se revise, corrija, optimice y se evalúe financieramente el esquema de refinación, considerando análisis rigurosos de sensibilidad y riesgo.
b. Los resultados técnicos y financieros derivados, confirmen que se puede continuar con el proyecto.
c. El contratista deberá utilizar un software LP para optimizar los resultados, siguiendo las mejores prácticas de ingeniería (RPMS, PIMS o similar)
d. Los resultados del LP deberán ser consistentes con la calidad de los productos especificada del FSR.
e. El contratista deberá simular dos crudos adicionales (Roncador de Brasil y Leona de Venezuela) para analizar la sensibilidad técnica del esquema de refinación y la capacidad de los equipos especificada en el FSR.

A partir de la revisión del informe y el cumplimiento de los puntos enumerados, se tiene lo siguiente:

a. WorleyParsons cumple satisfactoriamente con este punto: se realizó la simulación del caso 10 en un software LP y se logró confirmar que el esquema de refinación seleccionado es adecuado para los requerimientos de rendimiento y calidad de los productos especificados en el FSR. Como parte del proceso de optimización se recomendó incrementar la capacidad de producción a 65 000 BPSD, se revisó la capacidad de las unidades y los rendimientos de los productos.

A partir de los resultados de producción arrojados por el modelo LP y la revisión de los montos de inversión propuestos inicialmente en el FSR, se realizó el análisis financiero y de sensibilidad del proyecto. Finalmente se incluye un análisis de

SORESCO

riesgo para las variables más sensibles (margen de refinación, inversión y costos operativos).

b. WorleyParsons cumple satisfactoriamente. El estudio confirma los resultados del FSR, obteniéndose una tasa interna de retorno del proyecto por encima del 16%, con una probabilidad de éxito del 74%.

c. WorleyParsons cumple satisfactoriamente. Se utilizó el software PIMS y una vez obtenidos los resultados del mismo, se sometieron a criterio de sus expertos para corroborar que los mismos sean operativamente razonables.

d. WorleyParsons cumple adecuadamente con este punto. Se logró obtener dentro de especificación todos los productos de acuerdo al FSR con excepción de la especificación del 35% de los aromáticos en la gasolina, obteniéndose un valor del orden de 37%. WP indicó (así como también lo había manifestado HQCEC) que no es posible sin la inclusión de otras unidades de alta conversión al esquema seleccionado, obtener los rendimientos requeridos y otras especificaciones de la misma. Así mismo, es importante mencionar que en la actualidad no se tiene en CR ni en la norma centroamericana (RTCA) una especificación para aromáticos en la gasolina y que el valor promedio que RECOPE vende es del orden del 40%. Finalmente WP recomienda trabajar con los licenciatarios en el FEED para ajustar los aromáticos.

e. WorleyParsons cumple satisfactoriamente con este punto. A partir de las simulaciones realizadas con los 2 crudos adicionales (Roncador y Leona), se analizó la flexibilidad del esquema de refinación seleccionado; así como la capacidad de las unidades más críticas, lo que permite tomar decisiones sobre el tamaño y la carga a la que se operaría la refinería con estos crudos o similares.

A partir del análisis realizado, se da por recibido a satisfacción el estudio de validación del caso 10.

Ing. Roy Vargas Carranza

Ing. Diana Leandro Cordero

Ing. Otto Chaverri Arce

V. B Ing. William Ulate Padgett

SORESCO

MAYO 11, 2012

PMR-012-2012

CUMPLIMIENTO DE LAS RECOMENDACIONES DEL EQUIPO TECNICO DE RECOPE ASIGNADO POR LA GERENCIA GENERAL PARA LA REVISIÓN DEL FSR DE HQCEC

Mediante nota GG-0391-2011 el grupo Técnico de RECOPE encargado por la Gerencia General para la revisión del FSR de HQCEC emitió una serie de recomendaciones, las cuales transcribimos a continuación:

a. El preFEED debe ser realizado por una compañía independiente de las partes y que no sea la encargada de elaborar el FEED.

b. En el preFEED se revise, corrija, optimice y se evalúe financieramente el esquema de refinación, considerando análisis rigurosos de sensibilidad y riesgo.

c. Los resultados técnicos y financieros derivados del preFEED confirmen que se puede continuar con el proyecto.

d. RECOPE tenga un control directo sobre la calidad del preFEED y SORESCO acoja e implemente las recomendaciones de RECOPE con el fin de que los resultados sean satisfactorios para ambas partes.

e. RECOPE seleccione a la compañía que elabore el preFEED y SORESCO realice el proceso de contratación y cubra los costos involucrados.

f. RECOPE otorgue una "no objeción" a la compañía que se seleccione para elaborar el FEED.

Se hizo una revisión del cumplimiento de esas recomendaciones por parte de SORESCO y RECOPE, obteniéndose los siguientes resultados:

a) La Junta Directiva de RECOPE, en su sesión del 01 de junio de 2011 decidió que las recomendaciones y observaciones del equipo técnico de RECOPE se realicen dentro del FEED y no se contrate una etapa previa al FEED (preFEED). Bajo este escenario, las recomendaciones de los técnicos de RECOPE fueron incluidas como parte del alcance del contrato y se especificó a WORLEYPARSONS, que es una compañía independiente a las partes (SORESCO y RECOPE), que la validación de los resultados del FSR serían el primer trabajo a realizar, estableciéndose como hito de

SORESCO

decisión para la continuación del proyecto y como el primer entregable del FEED.

b) Esta recomendación se cumple en el contrato del FEED-PMC, pues dentro de los trabajos que le corresponde realizar a WORLEYPARSONS, se debe revisar, corregir y optimizar los resultados del FSR. Específicamente, WORLEYPARSONS realizó la simulación del caso 10 en un software de programación lineal (LP), con lo que se logró confirmar que el esquema de refinación seleccionado es adecuado para los requerimientos de rendimiento y calidad de los productos especificados en el FSR. Como parte del proceso de optimización, se recomendó incrementar la capacidad de producción a 65 000 BPSD, se revisó la capacidad de las unidades y los rendimientos de los productos.

A partir de los resultados de producción dados por el modelo de LP y la revisión de los montos de inversión propuestos inicialmente en el FSR, se realizó el análisis financiero (en dólares nominales, sin cargas financieras, antes de impuestos, a 25 años) y de sensibilidad del proyecto. Finalmente, se incluyó un análisis de riesgo para las variables más sensibles (margen de refinación, inversión y costos operativos).

c) Con la optimización y validación del Caso 10 del FSR por parte de WORLEYPARSONS, se confirmó que el TIR del FSR es 16% o mayor, con una probabilidad de éxito del 74%. Los principales resultados técnicos de la validación del Caso 10 son similares al FSR dentro del rango razonable de un estudio de este tipo. Es importante destacar que el paquete de diseño del FEED dará una ingeniería con suficiente detalle como para conocer las tecnologías a utilizar, balances de masa y energía por unidad y equipos principales, consumos de energía eléctricos y de combustibles y otros detalles con los cuales se calculará la inversión del proyecto con una incertidumbre de +/- 10%.

d) Dentro de las distintas secciones del contrato FEED-PMC con WORLEYPARSONS fueron incluidas las recomendaciones y observaciones del equipo técnico de RECOPE (solicitadas como parte del preFEED) por ser un requerimiento para la continuación del proyecto. Lo anterior fue en cumplimiento a la petición de la Junta Directiva de RECOPE según acuerdo del 01 de junio de 2011. Por ser el FEED-PMC una contratación de SORESCO y enmarcada dentro de sus procedimientos y administración, RECOPE no puede tener un control directo de la ejecución de ese contrato. Sin embargo, personal de RECOPE fue asignado a SORESCO como parte del equipo de administración y control del proyecto.

e) Al igual que el punto anterior, el FEED es una contratación bajo la administración de SORESCO, por lo que RECOPE no escoge directamente a la compañía que realizará el FEED. SORESCO realizó los trámites de contratación y cubre el costo de acuerdo a sus procedimientos.

f) La Junta Directiva de RECOPE el 23 de noviembre del 2011 dio la no objeción al contrato del FEED-PMC de SORESCO.

Como comentario final, la decisión de la Junta Directiva de RECOPE de incluir el preFEED en el FEED hizo que el cumplimiento del preFEED se realizara en el desarrollo del FEED, sin elaborar una sección específica preFEED en el documento de contrato del FEED-PMC con WORLEYPARSONS.

Lo anterior porque en las diferentes secciones del contrato se incluyeron todas las recomendaciones y observaciones del Equipo Técnico de RECOPE, ajustadas en forma y compatibles con la globalidad del contrato.

Ing. Roy Vargas Carranza

Ing. Diana Leandro Cordero

Ing. Otto Chaverri Arce

V. B Ing. William Ulate Padgett

SORESCO

MAYO 21, 2012

PMR-014-2012

Sr.
Jorge Rojas

Estimado Sr. Rojas:

ASUNTO: REPORTES PMR-012-2012 Y PMR-013-2012

Le adjunto los REPORTES PMR-012-2012 y PMR-013-2012 referentes al cumplimiento del preFEED y la revisión de la enmienda del adendum del FEED del REVAMP para pasar a suma fija.

Ambos reportes fueron elaborados por el equipo técnico de RECOPE en SORESCO y cuentan con el visto bueno de este servidor.

En el reporte PMR-012-2012 se detalla el cumplimiento de las recomendaciones y observaciones del grupo técnico de RECOPE que revisó el FSR de HQCEC. Se destaca que todas las recomendaciones y observaciones están en el contrato del FEED-PMC con WORLEYPARSONS. La Junta Directiva de RECOPE acordó incluir las observaciones del grupo técnico de RECOPE en el FEED y lo escencial del preeFEED se indica en una sección especial donde se valida y optimiza el caso 10 del FSR y se marca como un hito, ahora, las demás observaciones de los técnicos por su naturaleza, son parte del FEED y su cumplimiento se está dando durante la ejecución de la ingeniería básica.

En el reporte PMR-012-2012 únicamente se confirma que el equipo técnico de RECOPE en SORESCO revisó el contrato original con WORLEYPARSONS, el adendum y la enmienda para pasar el FEED del REVAMP a suma fija, afirmándose que no se encontraron objeciones técnicas. Cabe destacar que el contrato original obtuvo una no objeción por parte de la Junta Directiva de RECOPE y que el pasar de rembolsable a suma fija es parte del cumplimiento del contrato original.

Saludos,

PROYECTO MODERNIZACIÓN REFINERÍA

William Ulate Padgett

COPIA:
Jorge Villalobos
Rodrigo Castro
wup

recope®

20 de abril de 2012
GG-0477-2012

Ingeniero
William Ulate Padgett
Sub Gerente General de SORESCO

Estimado señor:

ASUNTO: OBSERVACIONES AL INFORME DE WORLEY PARSONS

Con respecto al informe de Worley Parsons, sobre la revisión y optimización del caso 10, he recibido las siguientes observaciones del Departamento de Estudios Económicos y Financieros los cuales que deben ser acreditados por esa empresa:

a) Fundamento por medio del cual la proyección pasa de 20 a 25 años.
b) Por qué se reduce el costo de la mano de obra con respecto al estudio de HQCEC.
c) Aclarar que el aumento de 60.000 a 65.000 BB no requiere un aumento en la inversión considerada por HQCEC.
d) Aclarar que se aumenta el periodo en 25 años, pero que el estudio de KBC solo tiene precios proyectados para 20 años.
e) Aclarar el cambio en la ejecución de la inversión:40/30/30 a 30/40/30.
f) Explicar el valor de rescate del proyecto, calculado como una perpetuidad.
g) Todos esos aspectos tienen el efecto de aumentar el TIR, pero no se justifican en el informe de Worley Parsons. Deben ser acreditados para darle validez técnica al proyecto.
h) Es importante aclarar que no se dice que la información está imprecisa, solo que es necesario acreditarla en el informe. Si Worley Parsons cambia la información de HQCEC (la cual se explica en un documento de 17 capítulos) debe haber una razón para ello y es necesario exponerla.

Por lo anterior le solicito obtener la acreditación de dichas observaciones a la mayor brevedad posible.

Atentamente,

GERENCIA GENERAL

Firmado digitalmente por JORGE ALBERTO ROJAS MONTERO (FIRMA)
Nombre de reconocimiento (DN): serialNumber=CPF-01-0369-0459, sn=ROJAS MONTERO, givenName=JORGE ALBERTO, c=CR, o=PERSONA FISICA, ou=CIUDADANO, cn=JORGE ALBERTO ROJAS MONTERO (FIRMA)
Fecha: 2012.04.20 18:03:35 -06'00'

Ing. Jorge Rojas Montero
Gerente

Ce: Ing. Rodrigo Castro Cordero
Lic. Luis Carlos Solera Salazar

Tel: 2284-2710, Fax:2255-4993 Apdo. 4351-1000 San José jorge.rojas@recope.go.cr

WorleyParsons

resources & energy

IPMT-SOR-1.51-L-0001

May 2, 2012

William Ulate Padgett
RECOPE
Forum 1, Santa Ana
Torre G, piso 6to
San Jose, Costa Rica

Subject: SORESCO Moin Refinery Case 10 Validation Report Clarifications

Dear Mr. Ulate

Pursuant to our discussion this afternoon, following is our response to the clarifications requested regarding the SORESCO Moin Refinery Case 10 Validation Report:

The responses are presented in the same order as set out in your request.

1. The financial analysis was performed based on 25 years in order to be consistent with the Client's lease requirements of 25 years which is then also consistent with the requirements of the CNPC-RECOPE lease agreement for 15 years (shorter than 75% of the economic life). Also, performing an analysis based on 20 years is not reflective of the typical life of refineries which is significantly greater than 20 or even 25 years. Physical equipment life is set as a design requirement by the Client. Client policy sets the economic life based on the influences of funding and taxing authorities.

2. SORESCO-RECOPE performed an analysis of the maximum employee requirements and advised WorleyParsons to utilize 400 employees. WorleyParsons reviewed and found that using 400 was a reasonably conservative approach. WorleyParsons' comparative calculations indicated a need for an additional 116 persons in operations plus additional maintenance and other support personnel resulting in a total addition of approximately 200 employees or a total employee count of 400.

3. WorleyParsons did consider the additional investment of $33,500,000 using the rule of 6/10's as indicated in the report documents.

4. The pricing for crude and products for the additional five years was made by extrapolating the previous year's trends and forecasting for five more years. This would

be the typical way in which forecasts for products would be performed that many years in the future.

5. The distribution of disbursements was changed to be more in line with what would typically be expected for any project of this type. The highest disbursement requirements will nearly always fall in the middle of the schedule not the first year. The principal expenditures in the first year are for engineering and long lead equipment, while the second year is the remainder of all procurements and start of construction.

6. RECOPE rescue value calculation method was provided by RECOPE to WorleyParsons for review. WorleyParsons reviewed the method and found that it was consistent with other calculation methods and thus reasonable. Therefore, the RECOPE rescue value calculation method was utilized.

We trust that the responses provided satisfy your requirements. Should you have any questions please do not hesitate to contact the undersigned or Mr. Andrew Kerr.

Sincerely

Louis V Tarango

Deputy Project Director

XC: Andrew A. Kerr

recope®

14 de mayo de 2012
GD-0251-2012

Ingeniero
Jorge Rojas Montero
Gerente General

Estimado Señor

ASUNTO: ACREDITACIÓN DE INFORMACIÓN POR PARTE DE WORLEY PARSONS

Con fecha del 20 de abril de 2012 usted le remitió al Ing. William Ulate Padgett la nota GG-0477-2012 en el que le remite observaciones del Departamento de Estudios Económicos y Financieros al informe de Worley Parsons sobre la revisión y optimización del caso 10 que solicitan acreditación de cierta información contenida por dicho informe. El Departamento de Estudios Económicos aclara en su solicitud que *"no se dice que la información está imprecisa, solo que es necesario acreditarla en el informe"*.

El 2 de mayo de 2012 el Ing. William Ulate remite a RECOPE la respuesta pormenorizada que Worley Parsons preparó para cumplir con la acreditación solicitada. En esta respuesta Worley Parsons se refiere a cada uno de los puntos que se incluyeron en la solicitud de acreditación y explica y justifica los valores entregados en el informe de referencia.

En la nota de Worley Parsons está suscrito por el señor Louis V Tarango, Deputy Project Director de dicha empresa.

Atentamente,

PROYECTO MODERNIZACION REFINERIA

Ing. Rodrigo Castro Cordero
Gerente de Proyecto

GERENCIA DE DESARROLLO RECOPE

krs

C: Exp. Proyecto Modernización, Refinería

Tel.:2284-27-00, ext: 4523/4525 Apdo. 155 Limón, Costa Rica rodrigo.castro@recope.go.cr
www.recope.go.cr

recope®

23 de mayo de 2012
GD-0278-2012

Ingeniero
Jorge Rojas Montero
Gerente General
RECOPE

Estimado Señor

ASUNTO: ACREDITACIÓN DE INFORMACIÓN POR PARTE DE WORLEY PARSONS

Mediante nota GG-0477-201 de fecha 20 de abril de 2012, se solicita al Ing. William Ulate Padgett, sub-gerente de SORESCO, que se aclaren las consultas planteadas por el Departamento de Estudios Económicos y Financieros, referentes al informe de Worley Parsons sobre la revisión y optimización del caso 10.

La empresa Worley Parsons, mediante nota IP MT- SOR-1.51 -L-000 1, fechada el 2 de mayo de los corrientes, acreditó la información requerida y justificó los valores entregados en el informe de referencia. Dicha nota fue suscrita por el señor Louis V. Tarango, Deputy Project Director de dicha empresa.

Sin otro particular,

Atentamente,

Ing. Rodrigo Castro Cordero
Gerente del Proyecto Nueva Refinería

Lic. Luis Carlos Solera
Estudios Económicos y Financieros

REFINADORA COSTARRICENSE DE PETRÓLEO, S.A. DEPTO. ESTUDIOS ECONÓMICOS Y FINANCIEROS

FWQ/

C.

C:\Users\Flory-wq\Documents\2012\Consecutivo 2012\GD-0278-2012 INFORMACION WORLEY PARSONS.docx1

Tel.: 2284-4843 Apdo. 4351-1000 San José, Costa Rica rodrigo.castro@recope.go.cr
www.recope.go.cr

re©ope®

REFINADORA COSTARRICENSE DE PETRÓLEO, S. A.

20 de abril de 2012
JD-185-2012

Ing. Jorge Villalobos Clare,
Presidente

PROYECTO NUEVA REFINERÍA CON SORESCO: INFORME DE LA EMPRESA WORLEY PARSONS, SOBRE LA VERIFICACIÓN DE LA TASA INTERNA DE RETORNO DEL PROYECTO (CASO #10)

Para su conocimiento y fines consiguientes, me permito comunicar el acuerdo tomado por la Junta Directiva de la Empresa en el Artículo #6, de la Sesión Ordinaria #4630-183, celebrada el martes 10 de abril de 2012:

> Dar por recibida la exposición del señor William Ulate Padgett, Subgerente General de SORESCO, empresa responsable del Proyecto de Modernización de la Refinería, sobre el informe presentado por la empresa Worley Parsons, respecto a la verificación de la Tasa Interna de Retorno del Proyecto de la Nueva Refinería con SORESCO, y continuar con el análisis de este asunto en la próxima sesión ordinaria, con el fin de que los directores tengan la oportunidad de analizar la documentación entregada por el señor Ulate Padgett en la presente sesión

Atentamente,

JUNTA DIRECTIVA

Firma digital

Ana Lorena Fernández Solís
Secretaria de Actas

imcs/sistemalotusnotes/comunicados

Fc: MSc. Fernando Mills Moodie, Auditor General, a .i.
Ing. Jorge Rojas Montero, Gerente General
Licda. Zoraida Fallas Cordero, Directora Jurídica, a. i.

UOP A Honeywell Company

0058

UOP LLC
25 E. Algonquin Rd.
Des Plaines, IL 60017-5017
Tel: 847.391.2000
Fax: 847.391.2253
www.uop.com

June 6, 2012

Refinadora Costarricense de Petróleo S.A.
Apartado 4351
San José, Costa Rica

Subject: Observations to the Revised Refinery Configuration (Case 10 – Phase II)
RECOPE S.A. - Moín Refinery Expansion Project, Limón, Costa Rica

Dear Sirs:

We were recently allowed an opportunity to review the findings of WorleyParsons regarding the Moín Refinery Expansion & Modernization Project technical configuration contained in their "L.P. Enhanced Validation for FSR (Feasibility Study Review) Case Ten – Phase II" report. WorleyParsons performed a deep evaluation of all characteristics the project. Their report contains a description of the modifications that were made to the estimated refinery configuration to improve its robustness and to address issues that had been identified previously, including those issues identified by Honeywell UOP in our report "UOP Feasibility Study Review for RECOPE S.A. Refinery Expansion Project" issued in May 2011. In our review of the WorleyParsons report, Honeywell again enlisted specialists from our Refinery Configuration and Process Profitability engineering group.

In order to properly address and review all the issues found during previous work on the project, it is clear that WorleyParsons performed a rigorous modeling of both the existing process units of the Moín refinery and those new process units considered in the project. Our review of the report did not reveal any flaws in the modeling that was performed and we believe there are now no serious issues with the configuration; the configuration should be considered highly reliable. As was concluded previously, the Delayed Coking – Hydrocracking process based configuration case is the optimal selection, however with the additional study from WorleyParsons, we are now also confident that there is a thoroughly consistent technical basis for unit selection and design that will lead to units that are correctly sized and designed. Estimates of refinery margin and capital expense made based on the revised configuration are now expected to also be much more reliable.

There were five outstanding issues that Honeywell UOP had identified in our updated report dated May 27, 2011. Each of these issues was fully addressed by WorleyParsons and have been resolved. Our observations on the final resolution of each issue are as follows:

1. Coker yields. As with other process units, the coker yields were updated from licensor information. This was a key modeling priority for WorleyParsons. From that

modeling, they found no problems with product qualities and quantities.

2. Hydrogen consumption in hydroprocessing units: WorleyParsons performed an extensible review of the issue, now using reasonable values for hydrogen consumption that are very much in line with Honeywell UOP's earlier recommendations based on our experience.

3. Reformer product property prediction: WorleyParsons' reformer product properties are aligned to Honeywell UOP's expectations. They examined all possible feeds to isomerization and reforming units, and generated results for product properties similar to Honeywell UOP's. This is corroborated in WorleyParson's comment regarding a dual operational mode for the reforming unit as a solution to allow successful production of both Premium and Regular Unleaded gasolines meeting product specifications.

4. Gasoline blending: The issue with addition of MMT is not longer a problem in the project. WorleyParson's proposition of relaxing of the existing aromatic content specification from 35 vol-% to 40 vol-% in order to more easily produce gasoline is consistent with the conclusions reached by Honeywell UOP. In addition, WorleyParsons mentioned use of isomerate of higher RONC (88-90 or even higher) that would also help to further mitigate this issue.

5. Naphtha splitting: As it was originally recommended by Honeywell UOP, WorleyParsons established the same cut points for the split naphtha: 85 °C End Point for the light naphtha going to the isomerization unit and approximately 200 °C End Point for the heavy naphtha going to reforming unit, thus avoiding benzene precursors and lowering the aromatic content on the reformate.

Based on our review, Honeywell UOP believes that the project now presented is very feasible. We generally are in agreement with WorleyParsons in all aspects of the process work that they developed. The finished products from the project can be produced to meet specifications following the recommendations presented by WorleyParsons.

If you have any questions or concerns about our review presented here, please contact me. We would be pleased to discuss with RECOPE in greater detail in a follow-up meeting that may be arranged at your earliest convenience.

Best Regards,

Honeywell UOP

Eric J. Hammel
UOP LLC - Process Technology & Equipment

UOP LLC

ASUNTO: Observaciones a la revisión de la Configuración de la Refinería (Caso 10 – Fase II) de RECOPE – Proyecto de la Nueva Refinería, Limón, Costa Rica

Estimados Señores:

Recientemente se nos dio la oportunidad de revisar los hallazgos de la empresa WorleyParsons en relación a configuración técnica incorporada en el proyecto de Nueva Refinería contenido en su informe "Validación y Mejora del Caso 10 del Estudio de Factibilidad – Fase II". WorleyParsons llevó a cabo una evaluación profunda de todas las características del proyecto. Su informe contiene una descripción de las modificaciones que fueron hechas a la configuración estimada de la refinería para mejorar su robustez y para prestar atención a asuntos que habían sido previamente identificados, incluyendo aquellos identificados por Honeywell UOP en nuestro informe "Revisión del Estudio de Factibilidad del Proyecto de Nueva Refinería de RECOPE" emitido en mayo del 2011. En nuestra revisión del informe de WorleyParsons, Honewell incorporó de nuevo profesionales del grupo de Ingenieros Especialistas en Configuración de Procesos de Refinación y Rentabilidad de Procesos.

Para abordar en forma adecuada y revisar todos los puntos descubiertos durante el trabajo previo en el proyecto, lo primero que se observa es que está claro que WorleyParsons llevó a cabo un modelamiento riguroso de ambas, las unidades de proceso existentes en la refinería de Moín y aquellas nuevas unidades de proceso que están siendo consideradas en el proyecto. Nuestra revisión del informe no detectó ninguna falla en el modelamiento que se elaboró y creemos que no existen asuntos problemáticos con la configuración; la configuración debe tenerse por altamente confiable. Tal como se había concluido anteriormente, el caso relacionado con la configuración basada en el proceso "Delayed Coking – Hydrocacking" es la selección óptima, sin embargo con los estudios adicionales de WorleyParsons, ahora estamos seguros que existe una base técnica consistente para la selección y diseño de unidades que redundará en unidades correctamente dimensionadas y diseñadas. También se espera que las estimaciones de los márgenes de la refinería y los costos de capital basados en la configuración revisada, ahora sean mucho más confiables.

Existían cinco asuntos pendientes que Honeywell UOP había identificado en nuestro informe actualizado de fecha mayo 27 de 2011. Cada uno de estos asuntos fue abordado en forma completa por WorleyParsons y han sido resueltos. Nuestras observaciones en la resolución final de cada uno de los asuntos son las siguientes

1. Rendimiento de coker. Así como con las otras unidades de proceso, los rendimientos de coker fueron actualizados a partir de la información de los licenciatarios. Esta era una prioridad clave de modelamiento para WorleyParsons. A partir de ese modelamiento, no se encontraron problemas con las cantidades ni las calidades de los productos.
2. Consumo de Hidrógeno en las Unidades de Hidroprocesamiento: WorleyParsons desarrolló una revisión extensa de este asunto, utilizando ahora valores razonables para el consumo de Hidrógeno que están mucho más en línea con los valores recomendados anteriormente por Honeywell UOP basados en nuestra experiencia.
3. Predicción de propiedades de los Productos de Reformado: las propiedades de los productos de reformado se alinean con las expectativas de Honeywell UOP. Ellos examinaron todas las alimentaciones posibles para las unidades de isomerización y de reformado y generaron resultados de las propiedades de los productos similares a los de Honeywell UOP. Esto se corrobora en el comentario de WorleyParson relacionado al modo de operación dual de las unidades de reformado como una solución para permitir la producción en forma exitosa de ambos, gasolina sin plomo Premium y Regular que cumpla con las especificaciones de producto.
4. Mezclado de Gasolina: Los asuntos relacionados a la adición de MMT dejaron de ser un problema en el proyecto. La proposición de WorleyParsons de reducir el contenido del aromático existente en las especificaciones de gasolina de 35 vol-% a 40 vol-% para producir más fácilmente gasolina es consistente con las conclusiones alcanzadas por Honeywell UOP. Adicionalmente WorleyParsons menciona el uso de isomerados de mayor RONC (88-90 o aun más alto) que también contribuiría a mitigar todavía más este asunto.
5. Separación de Nafta: tal como fue recomendado originalmente por Honeywell UOP, WorleyParsons estableció los mismos puntos de corte para la separación del nafta: 85 ºC de Punto Final para la nafta "light" que alimenta la unidad de isomerización y aproximadamente 200 ºC de Punto Final para la nafta pesada que alimenta la unidad de reformado, para así evitar los precursores de benceno y disminuir el contenido de aromáticos del producto reformado.

Basados en nuestra revisión, Honeywell UOP considera que el proyecto que ahora se presenta es muy factible. Estamos de acuerdo con WorleyParsons en todos los aspectos del trabajo sobre el proceso que ellos desarrollaron. Los productos finales del proyecto pueden generarse para cumplir las especificaciones contenidas en las recomendaciones presentadas por WorleyParsons.

Si existen preguntas o inquietudes acerca de la revisión que presentamos, por favor contáctenos. Sería de nuestro agrado comentar con RECOPE un mayor nivel de detalle en una reunión de seguimiento que pueda ser convenida tan pronto sea posible.

SORESCO

PMR-017

14 Junio de 2012

ASUNTO: Observaciones a la Configuración de Refinería Revisada (Caso 10 – Fase II) RECOPE S.A. – Proyecto de Expansión de Refinería Moín, Limón, Costa Rica

El grupo técnico de RECOPE asignado en SORESCO revisó el documento emitido por UOP donde avala el estudio de validación del caso 10 realizado por WorleyParsons (L.P. Enhanced Validation for FSR Case Ten – Phase II" report) y concluye:

UOP confirma que los resultados obtenidos por WorleyParsons son factibles y que los problemas mencionados por ellos durante la revisión del estudio de factibilidad fueron corregidos.

Ing. Roy Vargas Carranza

Ing. Diana Leandro Cordero

Ing. Otto Chaverri Arce

V. B Ing. William Ulate Padgett