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Comment Received From: Guofu Chen
Submitted On: 9/24/2020
Docket Number: 19-ERDD-01

RE 19-ERDD-01 and Advanced Combustion â€“ Request for Information

Additional submitted attachment is included below.

From: Guofu Chen
To: Brian Kolodji
Cc: Marc Straub; Energy - Docket Optical System
Subject: RE: 19-ERDD-01 and "Advanced Combustion – Request for Information"
Date: Thursday, September 24, 2020 11:37:36 AM

Thanks for your interest Brian. I'm quite busy today and I took a quick look at your calculation. 1 ton/day oxygen = ~ 30 Nm3/h. Each Nm3/h oxygen separation requires about 0.37 kW, so for 1 ton/day oxygen, the power requirement will be around 30 * 0.37 = 11.1 kW. For cryogenic ASU, 1 ton/day or even 250 ton/day is very small and I don't think it is economical at all. 100 ton/day will start to make sense for a cryogenic ASU. I hope this will help a little. Thanks. Guofu

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From: Brian Kolodji <bkolodji@sbcglobal.net>
Sent: Thursday, September 24, 2020 12:30 AM
To: Guofu Chen <gchen@ENERFLEX.COM>
Cc: Marc Straub <mstraub@generon-ca.com>; Energy - Docket Optical System <docket@energy.ca.gov>
Subject: [EXTERNAL] Fw: 19-ERDD-01 and "Advanced Combustion – Request for Information"

Dr. Chen,

You have published a very interesting article titled "Calculate the Power of Cryogenic Air Separation Units" published in the June 2020 issue of the Chemical Engineering Progress Magazine. This email is specifically in regards to oxygen production and power consumption using Cryogenic Air Separation Units (ASUs). I was hoping you might comment on the above calculation below and provide further details for the "Request for information" by the California Energy Commission, specifically on power requirements and capital costs for cryogenic separation units (see the requested info below this email). The request is very short notice, with the information due by 5PM California time tomorrow, but I figured if anybody could give a quick answer, it would be you.

In your article, you state that an ASU can be designed to produce solely 95% pure oxygen from air (at 20.96% oxygen) and the power consumption can be calculated by summing terms for separation, compression, and liquefaction. The feed air must be pressurized in an ideal design (meaning assuming no piping/ equipment pressure losses and temperature difference in the vaporizer is zero and the production of only gaseous oxygen) to an operating pressure of 0.3658 MegaPaschalls (MPa) minimum from an ambient pressure at 0.1013 MPa, yielding an actual separation power of 55.8 Kilowatts (KW) to produce 209.3 Normal Meter Cubed of Oxygen gas per hour (NM3/Hr), or 3606 Metric Tons per Day (MT/D). This is equivalent to 0.0153 KW to produce 1 MT/D, or 0.381 KW to produce 25 MT/D, or 1.53 KW to produce 100 MT/D. These power consumption values specifically exclude power term for liquefaction of the oxygen, as this I am proposing minimum concept costs.

As you may not know, I am also a member of AIChE and a chemical engineer. Also, I am California business owner of Kolodji Corp and Black Swan, LLC. I have patented and patent pending devices, methods, and processes, including membrane designs and processes for oxygen enrichment and oxy-combustion. I have designed oxy-combustion systems for several companies, including Shell Oil and Lyondell Corp, specifically to increase refinery sulfur plant capacity by 300% using high grade (95%+ pure) cryogenically produced oxygen. As for membranes, I have worked for the largest gas separation membrane supplier (UOP/Honeywell) and then for the largest membrane user in off-shore oil and gas production (MODEC.) My Black Swan, LLC oxygen producing technology from air has been prototyped with Generon, a Dow Chemical Legacy Company with membrane manufacturing in California, and piloted with membranes fabricated and supplied by Generon. The fifth Black Swan, LLC technology pilot plant is planned for later this year, with a funded demonstration plant, and with plans for 2021 demonstration/ industrial scale plants at a refinery cogen unit (5 MW), two biogas power plants (up to 2 MW), and three other industrial scale plant boiler operations (up to 50MMBTU/Hr.) The membranes are used for separating oxygen (and CO2) from air, without pressurizing the feed air, that saves up 50% in natural gas firing rates, reduces GHG emissions by as much, with only 15% of the savings used on parasitic, but green, energy use. An article on oxy-combustion article is attached.

Thought you at Enerflex Energy Systems (your phone number 832-230-9936?) might want to weigh in on this recently received email (again, see below) regarding the request for information (again, due tomorrow, Thursday, September 24, 2020 by 5PM California Time) from the California Energy Commission on oxygen production, power consumption, and capital costs, as well as other operating costs using cryogenic air separation processes (specifically mentioned) such as the cryogenic double column ASU for solely oxygen production as described in your article, and Oxy-combustion technology as well.

Please let me know.

Regards,

Brian Kolodji, PE

Kolodji Corp/Black Swan, LLC

Energy Carbon Management
Cell: (713) 907-8742

5612 Segovia Way, Bakersfield, CA 93306

2019/2020 Chair Carbon Mgt and Sustainability,

AIChE National Meetings

"...Peace be with you..."

----- Forwarded Message -----

From: California Energy Commission <listenergia@listserver.energy.ca.gov>
Sent: Friday, September 4, 2020 4:26 PM
To: NATURALGAS@LISTSERVER.ENERGY.CA.GOV
Subject: [EXTERNAL] NATURALGAS-LIST: Advanced Combustion Technologies - Request for Information

September 04, 2020

The California Energy Commission (CEC) is gathering information to inform a solicitation for a future solicitation on oxygen-enriched combustion and would appreciate your responses to the following:

1. **The following will help us target our specific research:**
    a. What are major barriers (technical, economical, and other) for wide adoption of oxygen-enriched combustion?
    b. What are examples of research that could eliminate barriers to wide adoption of oxygen-enriched combustion?
    c. What are examples of current or past projects involving oxygen-enriched combustion? What are important lessons learned from these projects?
    d. What California industries could benefit most from oxygen-enriched combustion?
    e. What are technical challenges that could result from higher oxygen content and higher combustion temperature (e.g., increased NOx emissions; accelerated degradation of materials in burners, furnaces, kilns)?
    f. Provide examples of existing projects using centralized oxygen generation, distribution

via pipeline networks or other approaches that could benefit from R&D.

2. **The following will help us establish performance metrics and technology status in California:**

    a. Besides cryogenic separation, pressure/temperature swing absorption, ion transport membranes, are there any other promising technologies that should be considered?
    b. For the technologies listed in item 2a:

        i. What is the estimated energy requirement to produce oxygen at the following capacities: 1 metric ton of oxygen per day, 25 metric tons per day, 100 metric tons per day
        ii. What is the estimated capital and operational costs for 1 metric ton per day of oxygen production capacity?

    c. Identify California research teams working on oxygen-enriched combustion.
    d. Identify California companies who develop and sell equipment for oxygen production and oxygen-enriched combustion.

Written comments must be submitted to the Docket Unit by **5:00 p.m. September 24, 2020**.

Written comments, attachments, and associated contact information (e.g., address, phone number, email address) become part of the viewable public record. This information may also become available via any internet search engine.

The CEC encourages use of its electronic commenting system. Please submit your comments to the Docket Unit at https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=19-ERDD-01. Select or enter a proceeding to be taken to the "Add Comment" page. Enter your contact information and a comment title describing the subject of your comment(s). Comments may be included in the "Comment Text" box or attached in a downloadable, searchable Microsoft® Word (.doc, .docx) or Adobe® Acrobat® (.pdf) file. Maximum file size is 10 MB.

Written comments may also be submitted by email. Include docket number 19-ERDD-01 and "**Advanced Combustion – Request for Information**" in the subject line and send todocket@energy.ca.gov.

For more information:
https://www.energy.ca.gov/publications/displayOneReport_cms.php?pubNum=CEC-500-2019-035
(If link above doesn't work, please copy entire link into your web browser's URL)

DO NOT REPLY DIRECTLY TO THIS EMAIL
Email us your questions or comments.