**ANSWERS TO REVIEWER COMMENTS**

**Reviewer A:**

* Does the manuscript contain enough significant original material?: **Yes**
* Is the manuscript clearly and concisely written? **Yes**
* Are the conclusions adequately supported by the data? **No**
* Does the manuscript give appropriate credit to related recent  
  publications? **Yes**
* Are the references appropriate and free of important omissions? **Yes**
* Is the length of the manuscript appropriate? **Yes**
* Does the manuscript need condensation or extension? **No**
* Is the quality of the figures (including legends and axes labelling)  
  satisfactory? **Yes**
* Are the nomenclature and units in accordance with SI? **Yes**
* Are the English grammar and syntax satisfactory? **No**

**Authors:**

The authors would like to thank the reviewer for positive evaluation. The conclusion has improved and the language has checked in the revised manuscript.

**Reviewer A:**  
I have one big question for the authors, and a few minor issues:

Firstly, one of the other reviewers suggested the authors discuss whether an additional low temperature WGS might economically improve H2 yields. I can't seem to find any indication in the manuscript that the authors have done so, apart from in the conclusion at Line 282, which states that the necessity of using both high and low temp WGS reactors is an important output of this work. How can this necessity be an important output of the work if an additional low temperature WGS is not mentioned anywhere else in the manuscript?

**Authors:**

WGS reaction is exothermic and the hydrogen product is thermodynamically favored at low temperature, 200 °C (Utaka et al., 2000; Gines et al., 1995). However, at low temperatures, the reaction kinetics slow, even using catalysts (Xue et al., 1996) and excess steam needs to be recycled. Typically, a high temperature shift, operating 300-350 °C maximize the conversion (Battersby et al., 2008) and on an industrial scale, the higher temperature WGS is usually carried out (Chianese et al., 2015). Therefore, according to the explanations given above, in this study WGS reactor operating at 310 °C was considered in the model and low temperature WGS assessment has not found useful.

This discussion has included in the revised manuscript with additional supporting references.

**Additional references:**

T. Utaka, K. Sekizawa, K. Eguchi CO removal by oxygen-assisted water gas shift reaction over supported Cu catalysts Appl. Catal. A: Gen., 194 (2000), pp. 21-26.

M.J.L. Gines, N. Amadeo, M. Laborde, C.R. Apesteguia Activity and structure-sensitivity of the water–gas shift reaction over Cu–Zn–Al mixed oxide catalysts Appl. Catal. A:Gen., 131 (1995), p. 283.

E. Xue, M. O’Keeffe, J.R.H. Ross. Water–gas shift conversion using a feed with a low steam to carbon monoxide ratio and containing Sulphur Catal. Today, 30 (1996), p. 107

S. Battersby, M. C.Duke, S. Liu, V.R., João, C. D. da Costa. Metal doped silica membrane reactor: Operational effects of reaction and permeation for the water gas shift reaction, Journal of Membrane Science 316 (2008), p. 46-52.

S.Chianese, J. Loipersböck, M. Malits, R. Rauch, H. Hofbauer, A. Molino, D. Musmarra Hydrogen from the high temperature water gas shift reaction with an industrial Fe/Cr catalyst using biomass gasification tar rich synthesis gas, Fuel Processing Technology 132 (2015), p. 39-48

**Reviewer A:**

Abstract: Ln 24-26. Suggest rephrasing this last sentence of abstract - the results show the benefit of converting biomass waste to energy, but do not show anything about importance of minimizing environmental impact.

**Authors:** The results signify biomass utilization and conversion to green energy. Waste minimization and renewable energy production via gasification are the main motivation behind this study.

**Reviewer A:**

Lines 80 and 83. The tea production values dont seem to make much sense - in line 80, 150k tonnes of black tea are produced annually, but in line 83, 1350k tonnes are produced in 2016, an order of magnitude more?

**Authors:** The order of magnitudedifferencecomes from the amounts of tea in dry and wet basis. The authors agree with the reviewer and corrected the sentence as

“Approximately 70.000 hectares are covered with tea plantations and 150.000 tons of **dry** black tea is produced each year. The tea factories in and around Eastern Black Sea region produce about 30.000 tons of waste every year. Despite the fact that the production area remains almost the same, the amount of production increases. According to the production statistics for the year 2016; 1,350,000 tons of **wet** tea was produced”

**Reviewer A:**

Lines 87and 89: is the tea waste used as fertilizer, or is it not used for any purpose? These lines seem contradictory.

**Authors:** Tea wastecan be used as fertilizeraftercomposting process. These wastes are not used for any purpose and commonly stored in depository area. The contradictory sentence “The tea waste is generally used as fertilizer” has removed in the revised manuscript.

**Reviewer A:**  
Lines 87and 89: is Line 106-107. This sentence is very fragmented, please modify word order -currently sounds like gasification responsible for release of tea waste to nature?

**Authors:** The authors agree with the reviewer and the sentence has corrceted as “In this study, the potential of converting the tea factory wastes to renewable energy by gasification has examined.

**Reviewer A:**  
Lines 87and 89: is Please also try to improve the quality of the English, there are still a  
lot of hard to decipher sentences in the manuscript

**Authors:** The language has checked and improved in the revised manuscript as requested by the reviewer.

**Reviewer A:**  
In my opinion, this manuscript should be published after major revision and additional review  
If manuscript is suitable for publishing, referees recommendation \_Original scientific paper

**Authors:**  
The authors would like to thank the reviewer for his/her valuable contribution and positive evaluation of this study.