Qing YANG

School of Energy and Power Engineering, Huazhong University of Science and Technology Tel: +86-13638604669

Dongli Building, 1037 Luoyu Road, Wuhan, Hubei, China 430074 E-mail: qyang@hust.edu.cn

Specialized in Energy and Power Engineering, I have a broad background of engineering, chemistry, and social science. I focus on experimental study of the mechanism of biomass advanced thermal conversion technologies-**biomass torrefaction and pyrolysis**, combined with reflections and feedbacks from systems accounting. I am developing new generations of catalysts, reactors and computational models that are essential for understanding, controlling and optimizing the chemical transformation of biomass to fuels and chemicals. A number of these technologies are moving rapidly towards commercialization. Our group's novel poly-generation biomass pyrolysis demonstration plant has gained international attention and a "Blue Sky Award" by United Nations Industrial Development Organization.

I have also devoted to **energy policy** study based on **systems accounting** for environmental impacts from renewable energies and carbon capture and sequestration (CCS) technologies, I have been involved in the life cycle assessment of nonrenewable energy consumption, pollutant emissions, greenhouse gas emissions from renewable energy derived processes and CCS technologies in global, national, city, plant scales, by using and modifying of a range of systems methods- **energy analysis, exergy analysis, emery analysis, life cycle assessment and ecological footprint.**

With more than 40 papers been published in journals, including 4 highly-cited papers and 1 hot paper by ESI, and 1 paper ranking Top25 hottest papers by Elsevier, my total citation is 948 by google scholar for all the papers, with a **H index of 18.** And also serve as peer reviewer for prestigious international journals, such as Renewable and Sustainable Energy Reviews, Applied Energy, Journal of Cleaner Production, Energy Conservation and Management, Energy, Energy Policy, Energy Indicators.

Brief Research Highlights:

- Developing new generations of catalysts, reactors and computational models that are essential for understanding, controlling and optimizing the chemical transformation of biomass to fuels and chemicals, toward a negative carbon future.
- The first one with my supervisor to propose an indicator to identify non-renewability of energy systems;
- Initially revealed greenhouse gas emissions of typical renewable energies, wind electricity, solar thermal power, bio-ethanol and bio-gas in China based on improved life cycle assessment method;
- Combining systems thinking and experimental study tightly, I am one of the researcher in the world who use findings from systems accounting to guild the experimental studies on concrete thermal-chemical processes and renewable energy derived technologies;
- SWOC analysis and strategy analysis for CCS technologies in China.

Research Interests:

Thermal-chemical conversion of biomass;

Life cycle assessment;

Energy policy;

Energy, exergetic and eMergy analysis for energy systems.

Working Experience

July 2015-present

Visiting scholar, Harvard John A Paulson School of Engineering and Applied Sciences, Harvard University, Cambridge, MA 02138, USA

-Taking part in carbon emission project, which is aiming to ***reveal the changing carbon contents of coal*** in China since bench mark year of 2005.

-Involved in ***the thermal-chemical molding for co-gasification of biomass and coal***, and evaluated its environmental impacts;

-Lead the research of ***advanced solar PV system's conversion efficiency*** under the polluted atmospheric environment；

-Also working as ***a teaching assistant at course "Energy and Climate: vision for the future" at Harvard University***.

Dec. 2013-present

Associate Professor, Department of New Energy Science and Engineering, School of Energy and Power Engineering, Huazhong University of Science and Technology, Wuhan, P.R. China

Mainly Teach the Following Courses:

Technical English, 32 hours, for undergraduate students, both in Chinese and English;

Thermal-chemical conversion of biomass technologies and its mechanism, for undergraduate students, both in Chinese and English;

Introduction of Renewable Energy, 32 hours, for undergraduate students, in Chinese;

Energy Economics, 16 hours, for graduate students, in English.

July 2011-Nov.2013

Assistant Professor, Department of New Energy Science and Engineering, School of Energy and Power Engineering, Huazhong University of Science and Technology, Wuhan, P.R. China

Also as **vice director and first full-time faculty of the newly established department**, I took charge of every aspects regarding building a whole new system of a new department, including formulating training plans for both undergraduates and graduates, establishing experimental platforms and off-campus base for practice teaching for undergraduates，interviewing new employees, proposing development plans, etc. And recently the department has 4 full-time associate professors, 4 full-time assistant professors, more than 20 graduates and 120 undergraduates.

Education

Peking University (PKU, "Chinese Harvard"), Beijing, China **Summer 2005-July 2011**

Graduate doctored student of Science, College of Engineering, majoring in **energy engineering,** with systems thinking of energy flow, material flow and information flow on the boundaries of defined energy systems.

Thesis Title: Renewable Energy Assessment Based on Systems Ecological Thermodynamics

Supervisor: Professor G.Q. Chen

Honors: The May 4th Scholarship (The highest honor to student in PKU); Social Work Honors of PKU.

Related Course Work: Modern Thermodynamics; Advanced Power Engineering; Thermodynamics for Bio-fuels; Thermo-dynamical Analysis for Renewable Energy; Heat and Mass Transfer; Environmental Economics; Environmental Management and Policy; Systems Ecology.

During my PhD I have also led seminars, supervised undergraduates in the laboratory.

Huazhong University of Science and Technology (HUST), Wuhan, China **July 2001-June 2005**

Undergraduate student of Engineering, majoring in Energy and Power Engineering

Thesis Title: Experimental study on the performance of DME (Dimethyl Ether) engine and related emissions.

Honors: The National Scholarship (The highest honor to student, 1/400); three times of "First Class Honors" of HUST (10/400).

Related Course Work: Higher Math; College Physics; General Chemistry; Heat Transfer; Thermodynamics; Engineering Material; Fluid Dynamics; Renewable Energy; Principles of Steam Turbine; Power Engineering; Principle of Mechanics; Mechanics of Materials.

Grants

As principal:

Jan. 2016-now, National Natural Science Foundation of China on "Mechanism study on enhanced biomass low-temperature de-oxygen combined with catalyst pyrolysis process to make mononuclear aromatics" (No. 51576087)

Jan. 2014-Dec. 2016, National Natural Science Foundation of China on "Coupling mechanism study on biomass low-temperature de-oxygen and its pyrolysis process" (No. 51306067)

Jan. 2013.1-Dec. 2014, Natural Science Foundation of Hubei Province in China on "Mechanism study on Municipal waste low-temperature de-oxygen and its pyrolysis process"

Apr. 2013-Jul. 2014 Provincial Key Lab Research Program "Integrated assessment model of biomass resources in rural China based on ecological thermodynamics"

May. 2013-Dec. 2014 Enterprise Program "Experimental study on burning coal with tobacco residuals for power generation"

Sep. 2013-Sep. 2016 Enterprise Program "Experimental study on drying of lignite in China"

As research member:

2013-2015, National 973 Program for "Research on biomass pyrolysis mechanism";

2013-2017, Specific Science Program from Chinese Department of Agriculture "Study on condensation technology of forming liquid product efficiently from biomass pyrolysis processes";

2005-2010, National 973 Program for "Research on urban ecological evolution mechanism" (No.2005CB724204);

2009-2011, National Natural Science Foundation of China on "Resource-Economy-Environment integrated assessment, simulation and regulation for city systems" (No.70903005).

Social Activities

Editor membership of ***Open Journal of Energy Efficiency*** - Oct, 2012-present

Reviewer for ***Renewable and Sustainable Energy Reviews, Applied Energy, Journal of Cleaner Production, Biotechnology for Biofuels, Energy Policy, Process Safety and Environmental Protection****, etc.* - Oct, 2011-present

Member of ***System Dynamic Society, International Energy Economics Association*** 2017, 2018

Awards

Blue Sky Award by ***United Nations Industrial Development Organization***, "High-value added comprehensive utilization of biomass pyrolysis for co-generation and co-supply" as 2014 Global Top Investment Scenarios to Apply new Technologies for Renewable Energy Utilization, 2014. (Award to our research group, I am one of the team member; It is a **worldwide selection,** evaluated by BlueSky Award Evaluation Exerpt Committee, and **only ten** technologies can get this award every year)

Young Scholar of Distinction by Huazhong University of Science and Technology (HUST), 2014. (Only 10 faculty members in HUST got this title per year, there are 3120 full-time faculties in HUST; 10/3120, 0.3%)

Top Ten Female Teacher by Huazhong University of Science and Technology, 2015. (10/1500, 0.6%)

Huazhong Scholar by Huazhong University of Science and Technology, 2016. (about 3%)

Conferences and Presentations

Yang Q, Zhang XY, Li JS, Chen YQ, Yang HP, Chen HP. A systems analysis for energy consumption and greenhouse gas emissions for biomass gasification power plant in China. **International Conference of Energy, Ecology and Environment (ICEEE 2017**). Stockholm, Sweden 2017, 7.26-7.29. (Oral presentation)

Yang Q, Greenhouse gas emissions from large scale PV power plants in China, "Resourceful Things: **An Interdisciplinary Symposium on Resource Exploration and Extraction in**

China". Cambridge, USA 2016, 4.20-4.22. (Oral presentation)

Yang Q, Mei YY, Yang HP, Chen HP. Effect of atmosphere for physical and chemical characteristics of products from biomass torrefaction. **The 4th International Symposium on Gasification and its Applications (iSGA-4)**. Vienna, Austrian 2014, 9.2-9.5(Oral presentation)

Yang Q, Wu XF, Yang HP, Wang XH, Zhang SH, Chen HP, Chen GQ. Fossil energy cost and greenhouse gas emissions of a "pig-biogas-fish" system in China. In: OuYang PK, Song ZQ, Jeffries TW, editors. **International Conference on Biomass-Energy Technologies.** Nan Jing, China 2012. (Oral presentation)

Yang Q, Yang HP, Chen HP, Chen YQ, Liu B. Greenhouse gas emissions and energy balance of a Chinese biomass gasification system. In: John Grace, editor. **The 3rd International Symposium on Gasification and its Applications (iSGA-3)**. Vancouver BC, Canada 2012. (Oral presentation)

Yang, Q., Chen, G.Q., 2010. Greenhouse Gas Emission and Fossil Energy Cost of Renewable Energy. **International Conference on Ecological Informatics and Ecosystem Conservation** (ISEIS 2010). Beijing Normal University, Beijing, China. (Oral presentation)

Publications

1. **Yang, Q.***, Han, F., Yang, H.P., Chen, H.P. (2016). "Greenhouse gas emissions of a biomass-based pyrolysis plant in China." Renewable and Sustainable Energy Reviews 53: 1580-1590.

2. **Yang, Q.***, Chen, G.Q.*, Liao, S., Zhao, Y.H., Peng, H.W., Chen, H.P. (2013). "Environmental sustainability of wind power: an emergy analysis of a Chinese wind farm." Renewable and Sustainable Energy Reviews 25: 229-239.

3. **Yang, Q.**, Guo, S.*, Yuan, W.H., Chen, Y.Q., Wang, X.H., Wu, T.W., Ahmed Alsaedi, Hayat T. (2015). "Energy-dominated carbon metabolism: a case study of Hubei province, China." Ecological Informatics 26: 85-92.

4. **Yang, Q.** and G. Chen (2013). "Greenhouse gas emissions of corn–ethanol production in China." Ecological modelling 252: 176-184.

5. **Yang, Q**. and G. Chen (2012). "Nonrenewable energy cost of corn-ethanol in China." Energy Policy 41: 340-347. (Highly cited paper)

6. Wu, X. D., **Yang, Q**✦., Chen, G. Q. *, Hayat, T., & Alsaedi, A. (2016). "Progress and prospect of CCS in China: Using learning curve to assess the cost-viability of a 2× 600MW retrofitted oxyfuel power plant as a case study." Renewable and Sustainable Energy Reviews 60: 1274-1285. (✦co-first author)

7. Li, J. S., Chen, G. Q. *, Chen, B., **Yang, Q. ***, Wei, W. D. *, & Wang, P., et al. (2016). "The impact of trade on fuel-related mercury emissions in Beijing—evidence from three-scale input-output analysis." Renewable & Sustainable Energy Reviews 75: 742-752.

8. Wu, X.F., **Yang, Q***., Xia, X.H., Wu, T.H., Wu, X.D., Shao, L., Hayat, T., Alsaedi, A. & Chen,

G.Q.* (2015). "Sustainability of a typical biogas system in China: Emergy-based ecological footprint assessment." Ecological Informatics 26: 78-84.

9. Mei, Y.Y., Liu, R.J., **Yang, Q**. *****, Yang, H., Shao, J., Draper, C., ... & Chen, H. (2015)"Torrefaction of cedarwood in a pilot scale rotary kiln and the influence of industrial flue gas." Bioresource Technology 177: 355-360.

10. Wu, X.F., Chen, G.Q.*, Wu, X.D., **Yang, Q**. *****, Alsaedi, A., Hayat, T., & Ahmad, B. (2015). "Renewability and sustainability of biogas system: Cosmic exergy based assessment for a case in China." Renewable and Sustainable Energy Reviews 51: 1509-1524.

11. Chen, Y.Q., Liu, B., Yang, H.P., **Yang, Q. ***, & Chen, H. (2014). "Evolution of functional groups and pore structure during cotton and corn stalks torrefaction and its correlation with hydrophobicity." Fuel 137: 41-49.

12. Chen, Y.Q., Yang, H.P., **Yang, Q. ***, Hao, H., Zhu, B., & Chen, H. (2014). "Torrefaction of agriculture straws and its application on biomass pyrolysis poly-generation." Bioresource Technology 156: 70-77.

13. Wu, X.F., Wu, X.D., Li, J.S., Xia, X.H., Mi, T., **Yang, Q.***, Chen, G.Q., Chen, B., Hayat, T. and Alsaedi, A.*, (2014). "Ecological accounting for an integrated "pig–biogas–fish" system based on emergetic indicators." Ecological Indicators 47: 189-197.

14. Han, M.Y., **Yang, Q.***, Wu, X.D., Wu, T.H., Chen, G.Q. (2013). "SWOC analysis on CCS: a case for oxy-fuel combustion CO_2 capture system." Journal of Environmental accounting and management 1(4): 333-343.

15. Chen, G.Q.*, **Yang, Q.***, Zhao, Y.H., (2011). "Renewability of wind power in China: a case study of nonrenewable energy cost and greenhouse gas emission by a plant in Guangxi." Renewable and Sustainable Energy Reviews 15(5): 2322-2329.

16. Chen, G.Q.*, **Yang, Q.***, Zhao, Y.H., Wang, Z.F., (2011). "Nonrenewable energy cost and greenhouse gas emissions of a 1.5 MW solar power tower plant in China." Renewable and Sustainable Energy Reviews 15(4): 1961-1967.

17. **Yang, Q.**, Chen, B., Ji, X., He, Y.F., Chen, G.Q.*, (2009). "Exergetic evaluation of corn-ethanol production in China." Communications in Nonlinear Science and Numerical Simulation 14(5): 2450-2461. (Highly cited paper)

18. Li, J.S., Luo, R., **Yang, Q.***, & Yang, H. (2016). "Inventory of CO2 emissions driven by energy consumption in Hubei Province: a time-series energy input-output analysis." Frontiers of Earth Science: 1-14.

19. Mei, Y., Che, Q., **Yang, Q. ***, Draper, C., Yang, H., Zhang, S., & Chen, H. (2016). "Torrefaction of different parts from a corn stalk and its effect on the characterization of products." Industrial Crops and Products 92: 26-33.

20. **Yang, Q.***, Wu, X.F., Yang, H.P., Zhang, S.H., Chen, H.P., (2012). "Nonrenewable energy cost and greenhouse gas emissions of a "pig-biogas-fish" system in China." The Scientific World Journal 2012.

21. **Yang, Q**., Han, F., Wu, X., Wang, D., Wang, X., Yang, H., ... & Chen, H. (2014).

"Comprehensive Evaluation of Biomass Energy Technologies in China." Journal of Technology Innovations in Renewable Energy 3(3): 85.

22. **Yang, Q.,** Chen, G.Q., Zhao, Y.H., Chen, B., Li, Z., Wang, Z.F., (2011). "Energy cost and greenhouse gas emissions of a Chinese solar tower power plant." Procedia Environmental Sciences 5: 77-80.

23. **Yang, Q**., Chen, G.Q., Zhao, Y.H., Chen, B., Li, Z., Zhang, B., Chen, Z.M. (2011). "Energy cost and greenhouse gas emissions of a Chinese wind farm." Procedia Environmental Sciences 5: 25-28.

24. **Yang Qing**, Mei Yanyang, Hao Hongmeng, Yang Haiping*, Wang Xianhua, Chen Hanping. (2013). "Effect of torrefaction on characteristics of pyrolytic products of biomass." Transactions of the Chinese Society of Agricultural Engineering 29(20): 214-219.

25. **Yang Qing**, Chen Hanping, Yang Haiping, Zhang Liqi, Shu Shuiming, Huang Shuhong. "Huazhong University of Science and Technology: exploration and practice on the construction of new energy science and engineering." China Electric Power Education (7): 29-31.

26. Liu Rujie，Mei Yanyang，**Yang Qing***，Yang Haiping，Chen Yingquan，Wang Xianhua et al. (2016). "Influence of oxygen concentration on biomass torrefaction." Acta Energiae Solar Sinica, 37(8), 2154-2159.

27. Chen Denmin，Liu Feng，**Yang Qing***，Han Fei，Lin Guiying，Chen Hanping."Nonrenewable energy cost and greenhouse gas emissions of biomass direct combustion system." Acta Energiae Solar Sinica, 37(3): 553-558.

28. Han Fei，Liu Feng，**Yang Qing***，Chen Demin，Wang Xianhua，Yang Haiping，Chen Hanping(2015). "Emergy analysis of biomass pyrolytic poly-generation system." Acta Energiae Solar Sinica, 36(12): 3060-3065.

29. Feng Lei，Zhang Shihong，**Yang Qing***，et al (2015). "Study on microwave drying characteristics and kinetics of coking coal." Journal of China Coal Society 40(10): 2458-2464.

30. Liu Yingpeng，**Yang Qing***，Hu Min，et al (2015). "Investigation on the moisture reabsorption law of lignite after drying and the prediction of equilibrium moisture content." Journal of China Coal Society 40(11) : 2661－2667.

31. Zhang Yang, Mei Yanyang, **Yang Qing***, Yang Haiping, Liu Jie, Chen Hanping(2015). "Torrefaction and HZSM-5 catalyst combination improving pyrolytic products of cedarwood." Transactions of the Chinese Society of Agricultural Engineering, 2015, 31(23): 208-213.

32. Li, P., Chen, X., Wang, X. *, Shao, J. *, Lin, G.Y., Yang, H.P., **Yang, Q.**, &Chen, H.P.(2017). "Catalytic Upgrading of Fast Pyrolysis Products with Fe-, Zr-, and Co-Modified Zeolites Based on Pyrolyzer－GC/MS Analysis." Energy Fuels 31：3979－3986.

33. Chen, B., **Yang, Q**., Li, J. S. *, & Chen, G. Q. * (2017). "Decoupling analysis on energy consumption, embodied ghg emissions and economic growth — the case study of macao." Renewable & Sustainable Energy Reviews 67：662-672.

34. Wu, X. D., **Yang, Q**., Chen, G. Q. *, Hayat, T., & Alsaedi, A. (2016). "Progress and prospect of CCS in China: Using learning curve to assess the cost-viability of a 2× 600MW retrofitted

oxyfuel power plant as a case study." Renewable and Sustainable Energy Reviews 60: 1274-1285.
35. Yang, H.P., Liu, B., Chen, Y.Q., Chen, W., **Yang, Q**., Chen, H.P., (2016). "Application of biomass pyrolytic polygeneration technology using retort reactors." Bioresource Technology 200: 64-71. (Highly cited paper)
36. Chen, L., Wang, X., Yang, H., Lu, Q., Li, D., **Yang, Q**., & Chen, H. (2015). "Study on pyrolysis behaviors of non-woody lignins with TG-FTIR and Py-GC/MS." Journal of Analytical and Applied Pyrolysis 113: 499-507.
37. Xia, X.H., Huang, G.T., Chen, G.Q.*, Zhang, B., Chen, Z.M., **Yang, Q.**, (2011). "Energy security, efficiency and carbon emission of Chinese industry." Energy Policy 39(6): 3520-3528.
38. Jiang, W. Q., Li, J. S., Chen, G. Q., **Yang, Q**., Alsaedi, A., Ahmad, B., & Hayat, T. (2016). "Mercury emissions embodied in Beijing economy." Journal of Cleaner Production 129: 134-142.
39. Li, P., Yang, H., Wang, X., Gong, W., Shao, J., & **Yang, Q**., et al. (2016). "Effects of acid and metal salt additives on product characteristics of biomass microwave pyrolysis." Journal of Renewable & Sustainable Energy, 8：230-237.
40. Chen, B., Li, J. S., Chen, G. Q., Wei, W. D., **Yang, Q**., & Yao, M. T., et al. (2016). "China's energy-related mercury emissions: characteristics, impact of trade and mitigation policies." Journal of Cleaner Production 141：1259-1266.
41. Wu, Z., Li, Z., Zeng, L., Shao, L., Tang, H.S., **Yang, Q**., Chen, G.Q., (2011). "Environmental dispersivity in free-water-surface-effect dominated wetland: multi-scale analysis." Frontiers of Environmental Science & Engineering 5(4): 597-603.
42. Cai, Z.F., **Yang, Q**., Zhang, B., Chen, H., Chen, B.*, Chen, G.Q.*, (2009). "Water resources in unified accounting for natural resources." Communications in Nonlinear Science and Numerical Simulation 14(9): 3693-3704.
43. Hu, J.H., Li, Y., Yang, H.P., **Yang, Q.,** Shao, J.A., Wang, X.H., Chen, H.P (2014). "Release of nitrogenous products and the catalytic characteristics of metal ions during coal pyrolysis." Journal of Fuel Chemistry and Technology 42(8): 913-921.
44. Zhang, B., Chen, G.Q., **Yang, Q**., Chen, Z.M., Chen, B., Li, Z., (2011). "How to guide a sustainable industrial economy: emergy account for resources input of Chinese industry." Procedia Environmental Sciences 5: 51-59.
45. Hu, J.H.，Li, Y.，Yang, H.P.*，**Yang, Q.**，Shao, J.A., Wang, X.H., Chen, H.P., (2014)."Release of nitrogenous products and the catalytic characteristics of metal ions during coal pyrolysis." Journal of Fuel Chemistry and Technology 42(8)：913-921.
46. Chen, G.Q., Li, J.S., Chen, B., Wen, C., **Yang, Q.,** Alsaedi, A., Hayat,T., (2016). "An overview of mercury emissions by global fuel combustion: The impact of international trade." Renewable and Sustainable Energy Reviews (65): 345-355. (Hot paper)