CALIFORNIA HYDROGEN BUSINESS COUNCIL

Hydrogen Means Business in California!

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List of Reports covering Hydrogen Blending Limits for Injection in NG System

1. *Pipeline Mechanics for (Renewable) Hydrogen in Germany and the EU* – Report to be published

2. *Hydrogen-enriched natural gas as a domestic fuel: an analysis based on flash-back and blow-off limits for domestic natural gas appliances within the UK*, Jones, Al-Masry, Dunnill, 2018 https://pubs.rsc.org/en/content/articlelanding/2018/se/c7se00598a#!divAbstract

3. *Review of hydrogen tolerance of key Power-to-Gas (P2G) components and systems in Canada*: final report Yoo, Yeong; Glass, Nancy; Baker, Ryan, 2018 https://nrc-publications.canada.ca/eng/view/fulltext/?id=94a036f4-0e60-4433-add5-9479350f74de

4. *The effects of injecting hydrogen (renewable gases)* - EASEE-gas GMOM, Marcogaz, March 2018 https://easee-gas.eu/uploads/kcFinder/files/20180328-PanelDiscussion-MARCOGAZ%20H2Injection.pdf

5. *Analysis of compression and transport of the methane hydrogen mixture in existing natural gas pipelines*, Witkowski et al, September 2018 (Presents the results of a comprehensive analysis of the process of compression and pipeline transport of the natural gas/hydrogen mixture with safety issues, Poland) https://reader.elsevier.com/reader/sd/pii/S0308016118301698?token=07D17B1F76F84C2D3741E299E59687EB47A6E4505A08D21E9082DF208710B554F7BCD572F90C60AC8BA1A285A7614280

6. *Power to gas and H2/NG blend in SMART energy networks concept*, Kouchachachvili, Entchev, 2017 https://www.sciencedirect.com/science/article/pii/S0960148118302325

7. *Utilizing 'Power-to-Gas' Technology for Storing Energy and to Optimize the Synergy between Environmental Obligations and Economical Requirements,* 2017 (U of Waterloo, Ph.D. thesis) https://uwspace.uwaterloo.ca/bitstream/handle/10012/11979/AL%20RAFEA_KAMAL.pdf?sequence=1

8. *Clean energy and the hydrogen economy,* Brandon, Kurban, January 2017 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5468720/pdf/rsta20160400.pdf

9. *Development of Business Cases for Fuel Cells and Hydrogen Applications for Regions and Cities, Hydrogen injection into the natural gas grid,* FCH, Roland Berger, Brussels, Fall 2017 https://www.fch.europa.eu/sites/default/files/FCH%20Docs/171121_FCH2JU_Application-Package_WG5_P2H_Hydrogen%20into%20gas%20grid%20%28ID%202910558%29%20%28ID%202911642%29.pdf

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10. *Hydrogen injection into the natural gas grid,* FCH 2 JU, Brussels, Fall 2017 https://www.fch.europa.eu/sites/default/files/FCH%20Docs/171121_FCH2JU_Application-Package_WG5_P2H_Hydrogen%20into%20gas%20grid%20%28ID%202910558%29%20%28ID%202911642%29.pdf

11. *The Potential to Build Current Natural Gas Infrastructure to Accommodate the Future Conversion to Near-Zero Transportation Technology*, UC Davis Institute of Transportation Studies, March 2017 https://steps.ucdavis.edu/wp-content/uploads/2017/05/2017-UCD-ITS-RR-17-04-1.pdf

12. *Future Gas Series Part 1: Next Steps for the Gas Grid*, Policy Connect/Carbon Connect, September 2017 (UK's transition to a low carbon economy), https://www.policyconnect.org.uk/sites/site_pc/files/report/1001/fieldreportdownload/futuregaspt1nextstepsforthegasgridwebcompressed.pdf

13. *Dynamic modeling of natural gas quality within transport pipelines in presence of hydrogen injections,* Giulio Guandalini, Paolo Colbertaldo, Stefano Campanari, 2016 (Unsteady operation of a portion of gas grid dealing with realistic industrial and residential consumptions concentrated in offtake points, Milano) https://www.sciencedirect.com/science/article/pii/S0306261916303178

14. *Hazards, safety and knowledge gaps on hydrogen transmission via natural gas grid: A critical review*, Labidine, Fotis et al., 2016 (Greece, Malaysia) https://www.sciencedirect.com/science/article/pii/S0360319916321620?via%3Dihub#fig1

15. *The Potential of Power-to-Gas*, Enea Consulting, January 2016 http://www.enea-consulting.com/wp-content/uploads/2016/01/ENEA-Consulting-The-potential-of-power-to-gas.pdf

16. *Challenges and Opportunities of Hydrogen Delivery via Pipeline, Tube-Trailer, LIQUID Tanker and Methanation-Natural Gas Grid,* Reddi, Mintz et al., April 2016 https://onlinelibrary.wiley.com/doi/pdf/10.1002/9783527674268.ch35 (A chapter of a book titled *Hydrogen Science & Engineering: Materials, Processes, Systems and Technology*, 1st Edition. Edited by Detlef Stolten & Bernd Emonts, Wiley-VCH Verlag GmbH & Co. KGaA. Published by Wiley-VCH Verlag GmbH & Co. KGaA)

17. *Hydrogen effects on X80 pipeline steel in high-pressure natural gas/hydrogen mixtures,* Meng, Gu et al, October 2016 (China) https://www.sciencedirect.com/science/article/pii/S036031991630427X

18. *Steel Pipe and Welds - Hydrogen Environmental Embrittlement,* D. Ersoy, Chicago: Gas Technology Institute, 2015

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19. *Injection of biogas, SNG and hydrogen_Potential and limits* - Deutsche Verein des Gas- und Wasserfaches (DVGW), January 2015 https://www.researchgate.net/profile/Manuel_Goetz/publication/271514119_Injection_of_biogas_SNG_and_hydrogen_into_the_gas_grid/links/54ca41e60cf2c70ce521a4e3/Injection-of-biogas-SNG-and-hydrogen-into-the-gas-grid.pdf

20. *Influence of added hydrogen on underground gas storage: a review of key issues,* Clausthal-Zellerfeld, Germany, February 2015 (Change in capacity and efficiency of UGS associated with the blending of hydrogen in the stored natural gas, the geological integrity of the reservoir and cap rocks, the technical integrity of gas storage wells, etc.) https://link.springer.com/content/pdf/10.1007%2Fs12665-015-4176-2.pdf

21. *Power to gas: Technological overview, systems analysis and economic assessment for a case study in Germany,* April 2015, Schiebahn, Grube, Robinius, Tietze, Kumar, & Stolten Gas infrastructure in Germany, 5% H2 httfps://www.sciencedirect.com/science/article/pii/S0360319915001913

22. *Integration of Wind Energy, Hydrogen and Natural Gas Pipeline Systems to Meet Community and Transportation Energy Needs: A Parametric Study,* Garmsiri, Rosen, Smith, April 2014 (Parametric analysis to determine the feasibility and size of systems producing hydrogen that would be injected into the natural gas grid. Specifically, wind farms located in southwestern Ontario, Canada) https://sciforum.net/paper/view/5abc659aad78f3494478b09a6627a42b

23. *Admissible Hydrogen Concentrations in Natural Gas Systems*, Klaus Altfeld and Dave Pinchbeck, 2013 http://www.gerg.eu/public/uploads/files/publications/GERGpapers/SD_gfe_03_13_Report_Altfeld-Pinchbeck.pdf

24. *Blending Hydrogen into Natural Gas Pipeline Networks: A Review of Key Issues,* Melaina, Antonia, Penev, NREL, 2013 https://www.nrel.gov/docs/fy13osti/51995.pdf

25. *Entwicklung von Modularen Konzepten zur Erzeugung, Speicherungund Einspeisung von Wasserstoff und Methan in Erdgasnetz,* Henel, Koeppel et al, Deutscher Verein des Gas- und Wasserfaches 2013, https://www.dvgw.de/medien/dvgw/leistungen/forschung/berichte/g1_07_10.pdf In German. English title: *Development of Modular Concepts for Generation, Storage and Feeding Hydrogen and Methane Into the Natural Gas Grid*

26. *Power to Gas: The Final Breakthrough for the Hydrogen Economy?*, Raphael Goldstein, Germany, January 2013 https://www.degruyter.com/view/j/green.2013.3.issue-1/green-2013-0001/green-2013-0001.xml

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27. *A review of hydrogen delivery technologies for energy system models,* UCL Energy Institute, University College London. Section 3.5.6, 2012 http://www.wholesem.ac.uk/bartlett/energy/research/themes/energy-systems/hydrogen/WP7_Dodds_Delivery.pdf (Transporting hydrogen using natural gas infrastructure)

28. *Impact of hydrogen injection in natural gas infrastructures*, Guillermo Hernández-Rodríguez, Luc Pibouleau, Catherine Azzaro-Pantela, Serge Domenech, 2011 (Modelling and evaluating natural gas (NG) pipeline networks under hydrogen injection, France,) https://www.sciencedirect.com/science/article/pii/B9780444542984501203

29. *Preparing for the hydrogen economy by using the existing natural gas system as a catalyst* O. Florisson, SES6/CT/2004/502661. Groningen, Netherlands: N.V. Nederlandse Gasunie, 2010 https://cordis.europa.eu/project/rcn/73964/en