Summary of Expansions and Updates in GREET™ 2015

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October 2015

This memo summarizes the expansions and updates in Argonne National Laboratory's GREET 2015 release and provides links to key documents related to the expansions and updates.

I. Major Expansions and Updates

1. Water consumption for hydrogen from various sources, petroleum fuels, biofuels, and hydro-electric power:
   Developed water consumption for hydrogen pathways from biogas, coal, and biomass gasification and updated water consumption for petroleum and biofuels pathways, hydro-electricity generation, and hydrogen production via steam methane reform and electrolysis. Detailed information on the life-cycle water consumption is documented in the following reports:
   a. https://greet.es.anl.gov/publication-water-lca
   b. https://greet.es.anl.gov/publication-water-hydro

2. Shale oil:
   Developed energy and GHG emissions intensities of U.S. shale oil production with operation data from Bakken and Eagle Ford. Detailed information on these developments will be documented in two reports that are forthcoming.

3. Oil sands:
   Updated energy and GHG emissions of Canadian oil sands production for surface mining and in situ technologies. These updates are documented in the following journal articles:
   a. http://pubs.acs.org/doi/abs/10.1021/acs.est.5b01255
   b. http://pubs.acs.org/doi/abs/10.1021/es300718h

4. High-octane fuels:
   Developed high-octane-fuel (HOF, with research octane number of 100) pathways in GREET with E10, E25, and E40 ethanol blends. Detailed information on the HOF pathways is documented in the following technical report:
   https://greet.es.anl.gov/publication-high-octane-various-shares

5. Bioethanol:
   Introduced land management practices, including cover crop and manure applications to corn-soy systems for soil carbon simulations, and added scenario-specific soil carbon changes with land management changes. Detailed information on these updates is documented in the following technical report:
   https://greet.es.anl.gov/publication-cclub-land-management

6. Waste to energy:
   Expanded and updated waste-to-energy pathways to include renewable natural gas and hydrothermal liquefaction fuels from wastewater treatment plant biosolids and renewable natural gas from municipal solid waste. Detailed information on these updates is being documented for publication in November 2015.

7. Aluminum:
   Updated the life-cycle inventory for aluminum by including primary production; secondary production; and the semi-fabrication processes of hot rolling, cold rolling, extrusion, and shape casting. Detailed information on these updates is documented in the following technical report:
   https://greet.es.anl.gov/publication-2015-al-update

8. Other metals for vehicle production and catalyst production (the latter is for fuel production processes):
   Added and updated several metals, especially those relevant to catalyst production, including molybdenum, platinum, zinc, nickel, and silicon. Detailed information on these additions and updates is documented in the following technical report:
   https://greet.es.anl.gov/publication-mo-pt-zn-ni-si

II. Other Updates

1. Natural gas:
   Updated methane leakage emissions for natural gas pathways. Detailed information on this update is documented in the following technical memorandum:
   https://greet.es.anl.gov/publication-fugitive-ch4-2015

2. Electricity generation mix for the United States:
   Updated U.S. electricity generation mix based on EIA AEO 2015.

3. Boiler emission factors:
   Updated stationary combustion emission factors for coal and biomass boilers for industrial applications. Detailed information on these updates is documented in the following technical report and memorandum:
   https://greet.es.anl.gov/publication-em-coal-bio-boiler

4. Bioproducts:
   Updated life-cycle analysis of the bioproducts module in GREET and expanded this module to include L-lactic acid and ethyl lactate. Detailed information on this update and expansion is documented in the following technical report and memorandum:
   a. https://greet.es.anl.gov/publication-bioproducts-lca
   b. https://greet.es.anl.gov/publication-fuel-chemicals-biomass

5. Catalysts for thermochemical biofuels production:
   Developed the energy and material flows for the production of gamma aluminum-based catalysts, including spent catalyst treatment and recovery. Detailed information on these developments is documented in the following technical report:
   https://greet.es.anl.gov/publication-catalyst-module

6. Soybean-based fuels:
   Updated N_2O emissions in soybean fields to separately account for N_2O emissions from nitrogen fixation by legumes. Detailed information on this update is documented in the following technical memorandum:
   https://greet.es.anl.gov/publication-update-n2o-soybean

7. Vehicle fuel economy and emissions:
   Updated fuel economies and emissions of light-duty vehicles (LDVs) and heavy-duty vehicles (HDVs). Detailed information on these updates is being documented for publication in November 2015.

8. Li-ion batteries:
   Added and updated anode materials data for Li-ion battery anodes, including graphite and metallic lithium. Detailed information on these additions and updates is documented in the following technical report:
   https://greet.es.anl.gov/publication-anode-cathode-liion

9. Lightweight pickup trucks:
   Provided a detailed update to the material composition of baseline and lightweight pickup trucks. Detailed information on these updates is documented in the following technical memorandum:
   https://greet.es.anl.gov/publication-pickup-truck-update

10. Vehicle powertrain material composition:
    Examined the powertrain material composition of several different types of passenger vehicle technologies, including plug-in hybrid vehicles and fuel cell vehicles, as well as those of vehicles with spark ignition and compression ignition engines. Detailed information on this analysis is documented in the following technical memorandum:
    https://greet.es.anl.gov/publication-2015-powertrain-materials

11. Glass and glass fiber for vehicle applications:
    Updated the life-cycle inventory for glass and glass fiber. Detailed information on these updates is documented in the following technical memorandum:
    https://greet.es.anl.gov/publication-glass-fiber-update

12. Copper for vehicle applications:
    Updated the life-cycle inventory for copper, focusing specifically on copper production in Chile. Detailed information on this update is documented in the following technical memorandum:
    https://greet.es.anl.gov/publication-chilean-copper