





Life cycle cost and life cycle environmental analysis of the different waste-to-renewable natural gas pathways: An effort to identify an optimal pathway under different Multi-criteria decision-based scenarios

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Abstract

Currently, due to the insufficient resources of renewable natural gas, the development of renewable pathways to integrate into the natural gas-industry portfolio can reduce many concerns about the reserves depletion and the environmental crises. In the present article a structure-oriented framework for gas networks is developed to compare and prioritize different investment scenarios for renewable natural gas production projects. In this regard, different pathways to produce renewable natural gas through the waste-to-natural gas process were discussed and compared based on different waste feedstocks. To discuss and compare different pathways, a decision-making structure and framework under life cycle cost analysis (LCCA) and life cycle environmental analysis (LCEA) is employed to choose the appropriate pathway for the waste-to-natural gas process. The optimal pathway is identified through different multi-variable decision-making scenarios (under different geographical conditions, access to different feedstocks, and different interests of stakeholders). From the outcomes, under the neutral and Pro-economic scenarios, the renewable natural gas production pathway driven by landfill gas integrated with the pressure swing adsorption- biogas upgrading unit is the optimal and desirable option. While under an Eco-friendly scenario, the pathway driven by animal manure integrated with the pressure swing adsorption-upgrading unit is an optimal and desirable pathway.