



401.661 Advanced Construction Technology

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Consider the gasoline shortages of the 1970s. In 1979 the United States experienced a severe gasoline shortage. Iran's exports of oil dropped in the wake of the revolution there, and petroleum prices on the world market increased sharply. Within weeks, a shortage of gasoline began. Some service stations found their tanks emptied before the next delivery could refill them. Drivers, remembering the first oil embargo in 1973, and worried that they wouldn't be able to get their tanks filled, began to top off their tanks. Soon, long lines of cars were seen in front of gas stations, and "Sorry — No Gas" signs sprouted along the highways of America, as station after station found its underground tanks pumped dry. The shortage was the top story on the evening news and in other media, and interviews with anxious drivers dominated the news. In some states, mandatory rationing was imposed, including limiting purchases to, for example, no more than \$10 worth of gas. California imposed 'odd-even' purchase rules: drivers were allowed to buy gas only every other day, based on whether their license plate number was odd or even. It seemed that the flow of gasoline and oil into the US had been slashed. Curiously, the impact of the Iranian revolution on the flow of oil to the US was small. True, US oil imports from Persian Gulf countries (including Iran) fell by 500,000 barrels per day between 1978 and 1979 (about 3% of US consumption), but imports from other nations increased by 640,000 barrels per day, so imports in 1979 actually increased by 140,000 barrels per day. Domestic production fell by 150,000 barrels per day, so total supply was essentially constant, while consumption fell by about 330,000 barrels per day, a drop of 2% from 1978. Plainly, for the year as a whole, there was no shortage. But if the flow of oil into the US was essentially constant, what caused the shortage? Where did the gas go?

Q1) Develop a stock and flow diagram for the gasoline supply chain suitable to explain the genesis of the gas crisis.

* 1. Do not consider the entire supply chain for gasoline (e.g., gasoline upstream of deliveries to retail service stations).

Q2) Add the information feedbacks that determine the rates of flow in your stock and flow diagram. These information links will close some feedback loops, some of which will help you explain the dynamics of the gas crisis. Identify the polarity of the important loops and give them an appropriate name.

* 1. Assume that the rate at which gasoline is delivered to service stations is exogenous.

2. The decision rules governing all rates of flow in your models can only utilize information actually available to the decision-makers. In this case, drivers do not know directly how much gasoline is in the underground tank at a service station. In identifying the information links that govern the rates of flow in your diagram, be sure to ask how individual drivers would learn about the shortage and come to believe that the supply of gas was inadequate. How then would they react?

Q 3) Where did the gas go? Using your diagram, explain the genesis of the gas crisis, focusing on where the gas went. Next, assess the effectiveness of the maximum purchase and odd-even purchase policies. Finally, what policy would you recommend to ease the shortage? Explain why you think your policy would be effective in terms of the stock/flow and feedback structure of the system.

**This assignment was prepared by John Sterman, 1987-1998, and edited and reformatted by Moonseo Park, 2003.*