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Geologic Resources Supply - Demand Model (GeRS-DeMo)

Posted by Gail the Actuary on December 9, 2011 - 2:52pm
Topic: Supply/Production
Tags: modeling, oil production modeling, steve mohr [list all tags]

This is a guest post by Steve Mohr, who recently received his PhD in Chemical Engineering at the University of Newcastle in Australia. He now works as a research consultant at the Institute for Sustainable Futures.

Last year I placed a summary of my PhD thesis on The Oil Drum. The thesis described a new model that projects fossil fuel (coal, conventional oil, unconventional oil, conventional gas, and unconventional gas) for all countries to determine the world's fossil fuel supply and demand. At the time I did not make the model itself public, as it was written partially in C++ and partially in Maple. C++ is free; Maple, however, is expensive. In 2010 I was lucky enough to work with Dr Gavin Mudd and by extension the Institute for Sustainable Futures (ISF), and I was able to add a recycling component to the model enabling the model to be applied to the projections of metals.

In 2011, I commenced work at the ISF. Recently the ISF very kindly allowed me time to convert the model out of Maple and into Excel, in the process making the model easier to use, and freely available. As a result, the model was placed on the ISF website. It can be found at this link.

GeRS-DeMo - or *Geologic Resource Supply - Demand Model* estimates the demand, production (from mines or fields) and recycling of any geologic resource. The production from mines works by bringing idealised mines online throughout time and over time the supply and demand interactions allow more or less mines to come online and also mines to shut down earlier than expected (and restart later) or upgrade the mines (by doubling the mines production). The production from fields works by putting idealised fields online as shown in Figure 1. The sizes of the fields vary, with initial fields being relatively large, and a final fields being relatively small. Due to the variability in sizes, all fields in a given region are assumed to have two constant ratios (inputted) one between the maximum production to the Ultimately Recoverable Resources (URR), and the other for the URR remaining when production begins to decline relative to the URR.

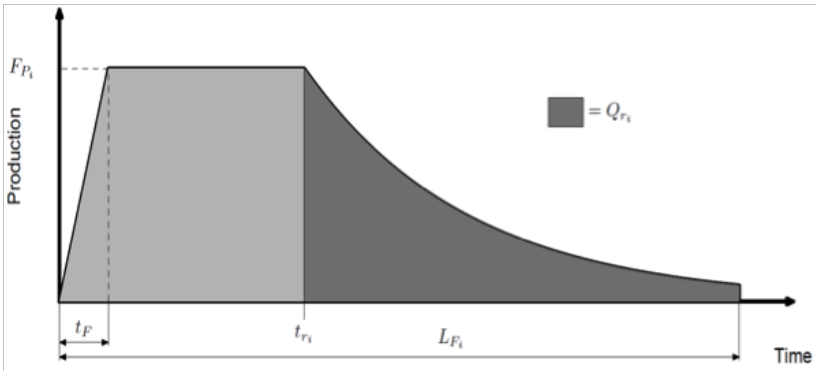

Figure 1. Expected production of idealized field

The model has been used to successfully on coal (black and brown), oil (conventional, shale, natural bitumen/tar sand and extra heavy oil), gas (conventional, tight, coalbed methane, shale) phosphorus, lithium, gold, nickel, copper resources. It also can and has been used on world, country and regional levels.

Specifically, it can be used to predict the historic and future production, amount of recycling and demand of a metal, fossil fuel, or mineral. The simplest example (included in the link) shown is lithium production in Australia. In this case the projection is made by inputting likely mine productions and lives for actual current and historic lithium mines in Australia. When the example is run the graph shown in Figure 2 is generated.

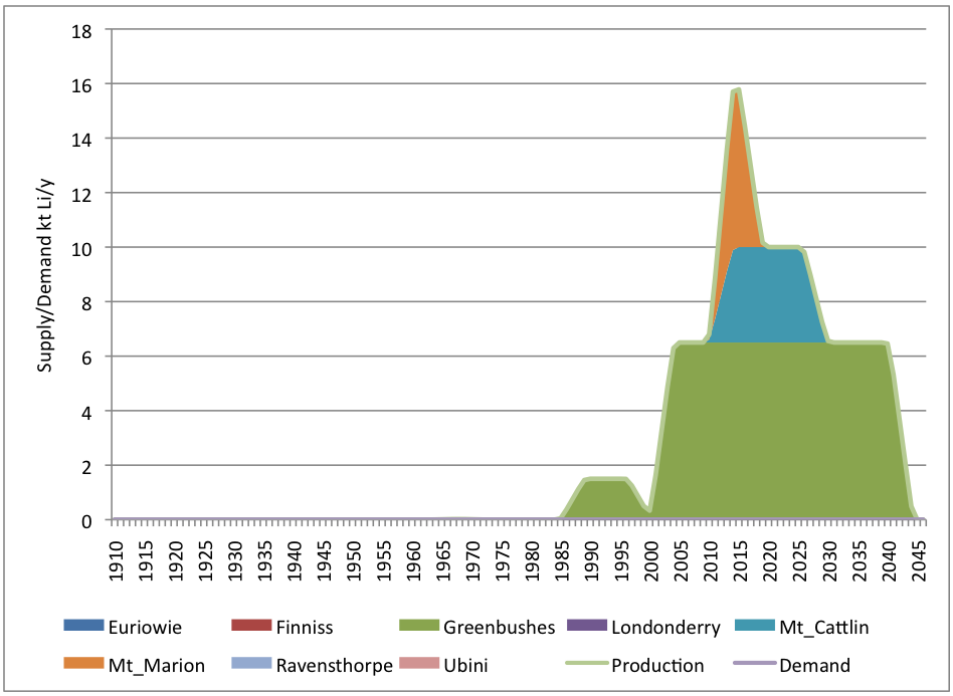

Figure 2. Australian lithium projection, based on actual mine data

The next step up in complexity is shown in the Australian black coal projection. In this example, realistic average mine sizes and lives when production began and finally ceases are inputted into the model, with a couple of disruptions to account for small glitches in the historic production statistics. The outputted results from these projections show that without any supply demand interactions, but many mines (or many oil or gas regions (OGRES)) then the production for a region is very similar in appearance to a Hubbert bell curve.

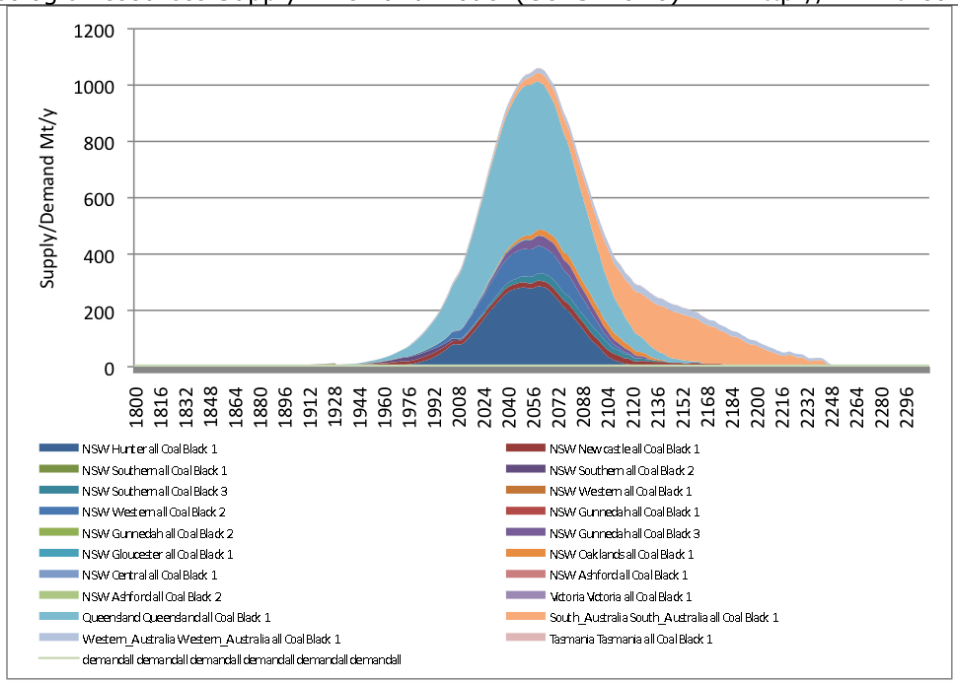

Figure 3. Australian black coal projection, based on modeled mines

The link also includes what I consider to be the most realistic fossil fuel projection from my PhD (Case 2 dynamic) as a very detailed working example of how the model works. It includes supply and demand interactions, fields' production for oil and gas, mines production for coal and unconventional oil production. After running the PhD example, the graph shown in Figure 4 is generated.

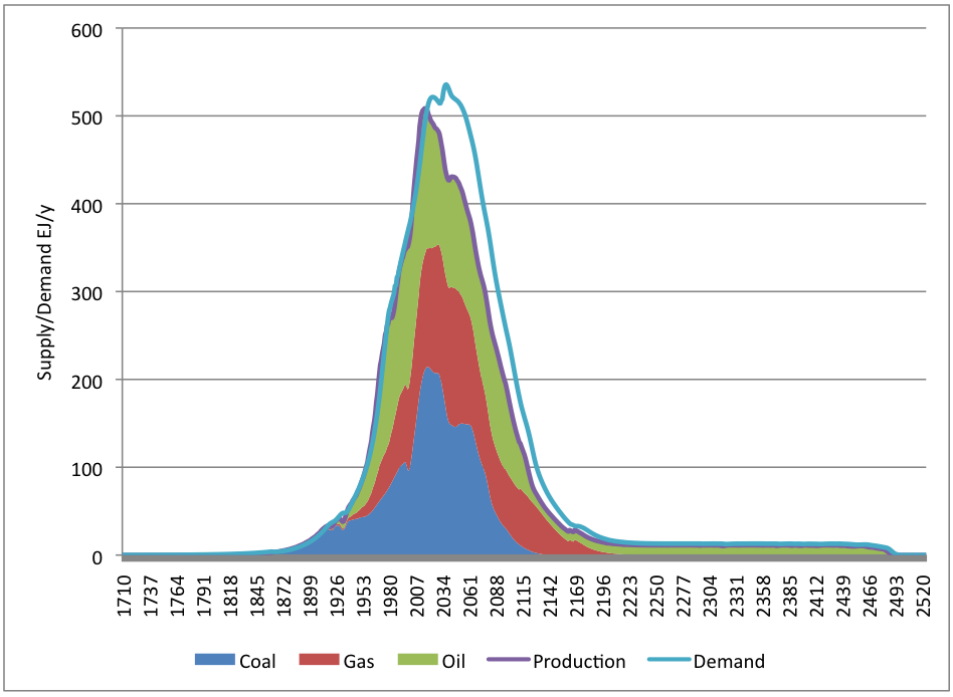

Figure 4. Graph based on PhD example illustrating Case 2 dynamic

There is a detailed illustrative step by step guide on how to install GeRS-DeMo, and Input.xlsm contains information on the model, and the inputs required as well as a blank input file ready for your use. The model currently only works on Windows 32 bit, and excel 2007/2010; it does NOT

work on excel 2003 or other operating systems. It is necessary to close other excel programs before running the macro.

I had considerable enjoyment creating the model and believe passionately in the need for detailed projections of key resources. I hope that you may consider using this model to develop your own projections of key resources, and I hope that the input sheet explains the inputs required in a clear fashion.