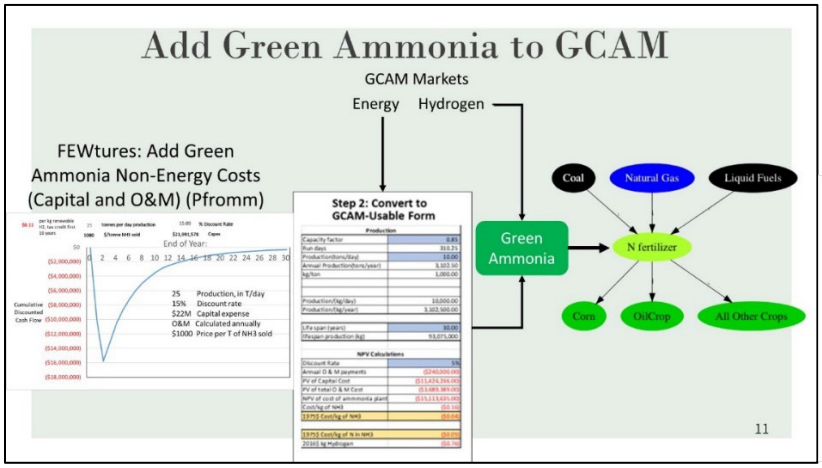
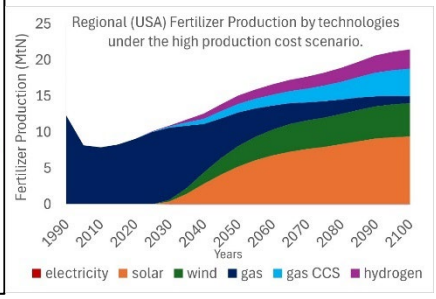
Global perspectives, local farms, and resilience to disruption – an NSF FEWtures project newsletter

Hello dear advisory group members! We here at FEWtures are excited to talk with you on Thursday October 17, from 1:00 to 2:30 CT. We are using this newsletter to give you a few images of what you will see at the meeting. Here we display the progress we have made in considering the potential impact of locally powered green ammonia in three ways: potential global adoption and results, a way to evaluate its potential on farm income, and whether it makes farms more resilient to some common disruptions. Two images are shown for each topic. You will see these images in the presentation tomorrow as well. We hope this preview will enable you to see what we can do better and spur conversation.

Global Perspectives

The evaluation is done with a model called GCAM, Global Change Analysis Model. This is one of several IAMs, Integrated Assessment Models, used worldwide to consider how energy, food, water and other global markets and production might change as global characteristics like population and climate change. Think of these models more like visioning tools able to evaluate pressures on markets instead of actual prediction tools. Student Nanaadom Nyarko, with advisor Robert Barron, is working to bring green ammonia into GCAM. As you can see, current results are suggesting a strong impact from green ammonia, if the costs of green ammonia prove to be valid. These results do not account for market and political manipulation by current industries trying to maintain their dominance.

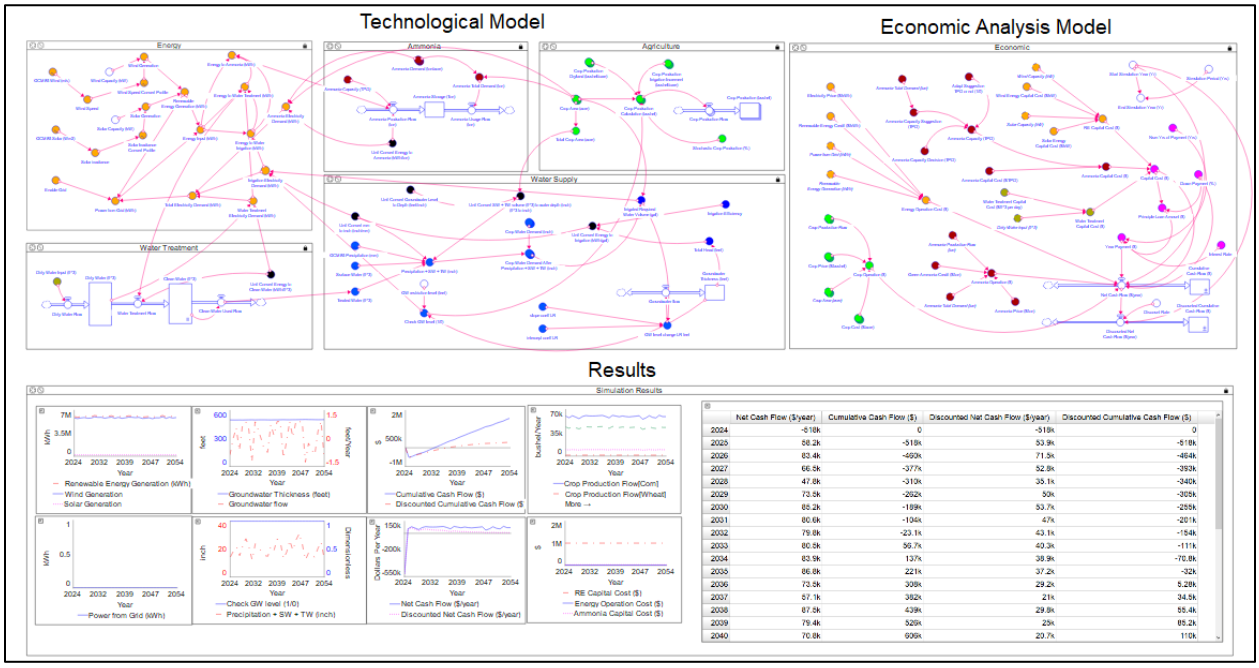




Local Farms

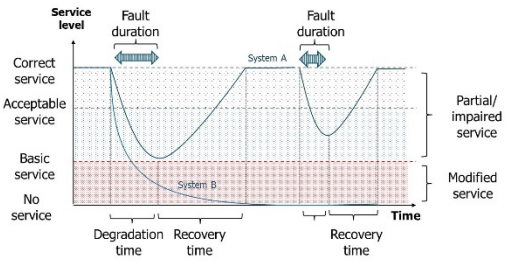
The FEWture Resilience program will be available to run online – you will get a demonstration during the meeting. The program provides an integrated representation of the FEW system with local renewable energy available as an option to produce local green ammonia for fertilizer and to treat water for irrigation. The overall program as programmed in software called Stella is shown below.

Stella allows for iterative feedbacks. So, for example, if the groundwater level falls too far adjustments are made to dryland farming. Student Xuebo Liu, who is advised by Hongyu Wu, will discuss the FEWture Resilience program.

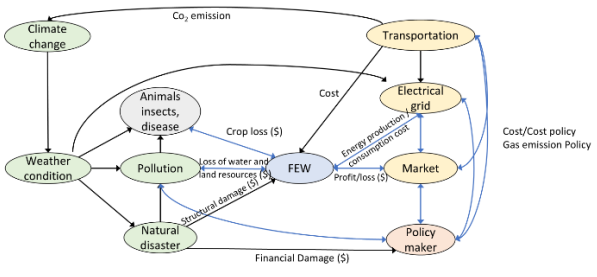


Resilience to Disruption (Faults)

The FEWture Resilience model and expertise of the FEWtures team has been used to develop an abstraction of the system that can be evaluated using graph theory. This is a different way to consider a system than the literal way we are used to. What is importance in Graph Theory are what are called distances between nodes (essentially jumps and whether they are one way or two way) and the degree of connectedness. This is a different way of considering system resilience and vulnerability. It is discussed by Amir Modaressi of the Mathematics Department at California State University, North Ridge.



The FEW External Fault Model with Graph Theory



Comment from AG member Michael

From Michael: My numbers were too high, but here they are: CCGT 1.35 m3/MWH, wind 0.232 m3/MWh, solar .663 m3/MWh. Add around 0.5 m3/MWh for BESS storage to both wind and solar. here is the paper: Das, J., A.U. Rehman, R. Verma, G. Gulen, M.H. Young. 2024. Comparative life-cycle assessment of electricity-generation technologies: West Texas case study. Energies. 17, 992, doi:10.3390/en17050992.