SAND2007-4852C

Is Establishing a Natural Gas Strategic Reserve for the US Justified?

James Ellison
Andjelka Kelic
Thomas Corbet
Sandia National Laboratories
Critical Infrastructures Modeling and Analysis Group

-*The National Infrastructure Simulation and Analysis Center* (NISAC) is joint program at Sandia National Laboratories and Los Alamos National Laboratory, funded and managed by the Department of Homeland Security's (DHS) Preparedness Directorate.

- *Sandia* is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia National Laboratories

2005 Hurricane Season and Natural Gas

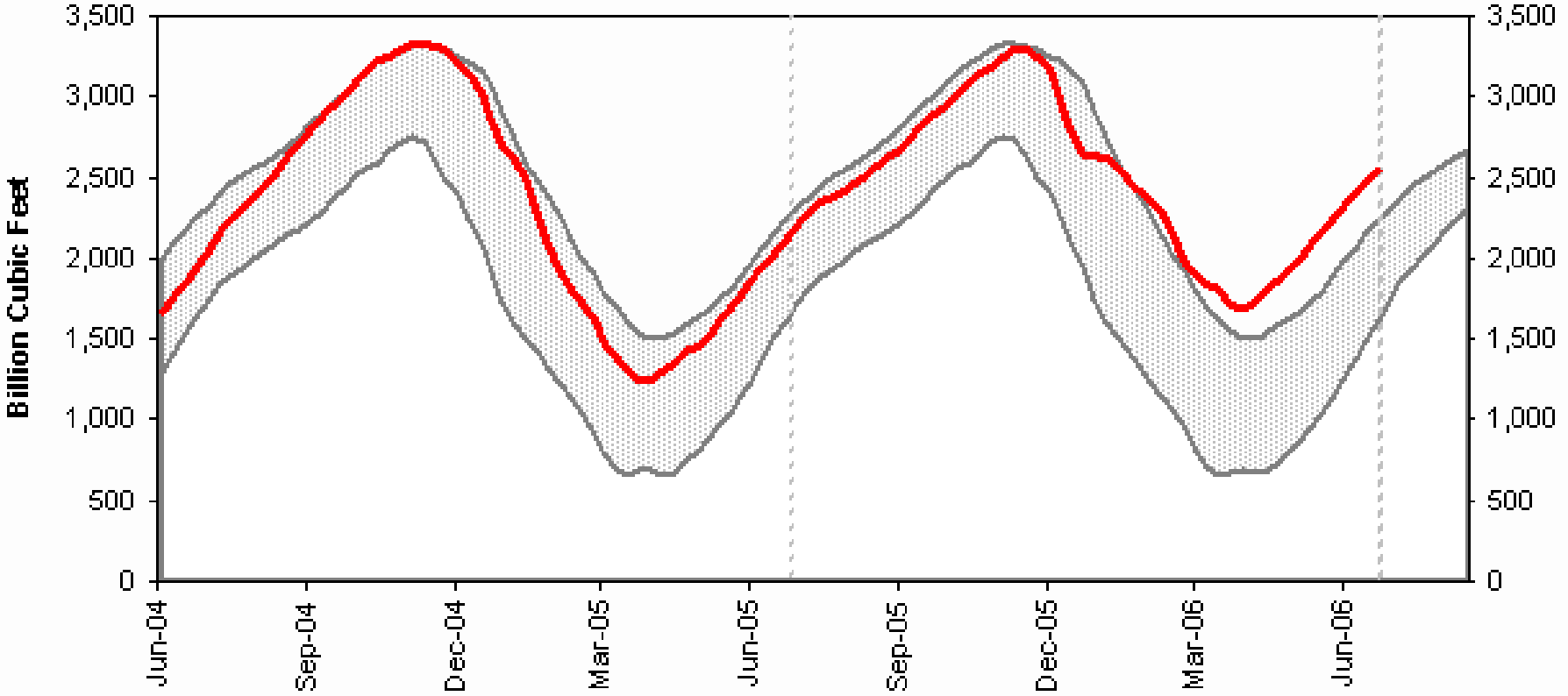
- Hurricanes Katrina and Rita caused about 800 Bcf of Gulf of Mexico gas to be shut-in
  - 22% of annual Gulf production
  - 4% of total US consumption
- NG prices skyrocketed to $15/MMBtu in immediate aftermath
  - However, no shortages developed
  - NG in storage in summer of 2006 at record levels
- A natural question is: would an NGSR have helped?

NGSR Topics for Investigation

- Two main issues:
  - How resilient is the current system
  - How would a NGSR impact the system
- Clarification
  - Resiliency – defining as the ability to supply gas at some clearing price
  - Price stability is not our policy goal
    - We are interested in whether NG is available after a disaster, not whether it costs more than people would like

Natural Gas in Storage in the US

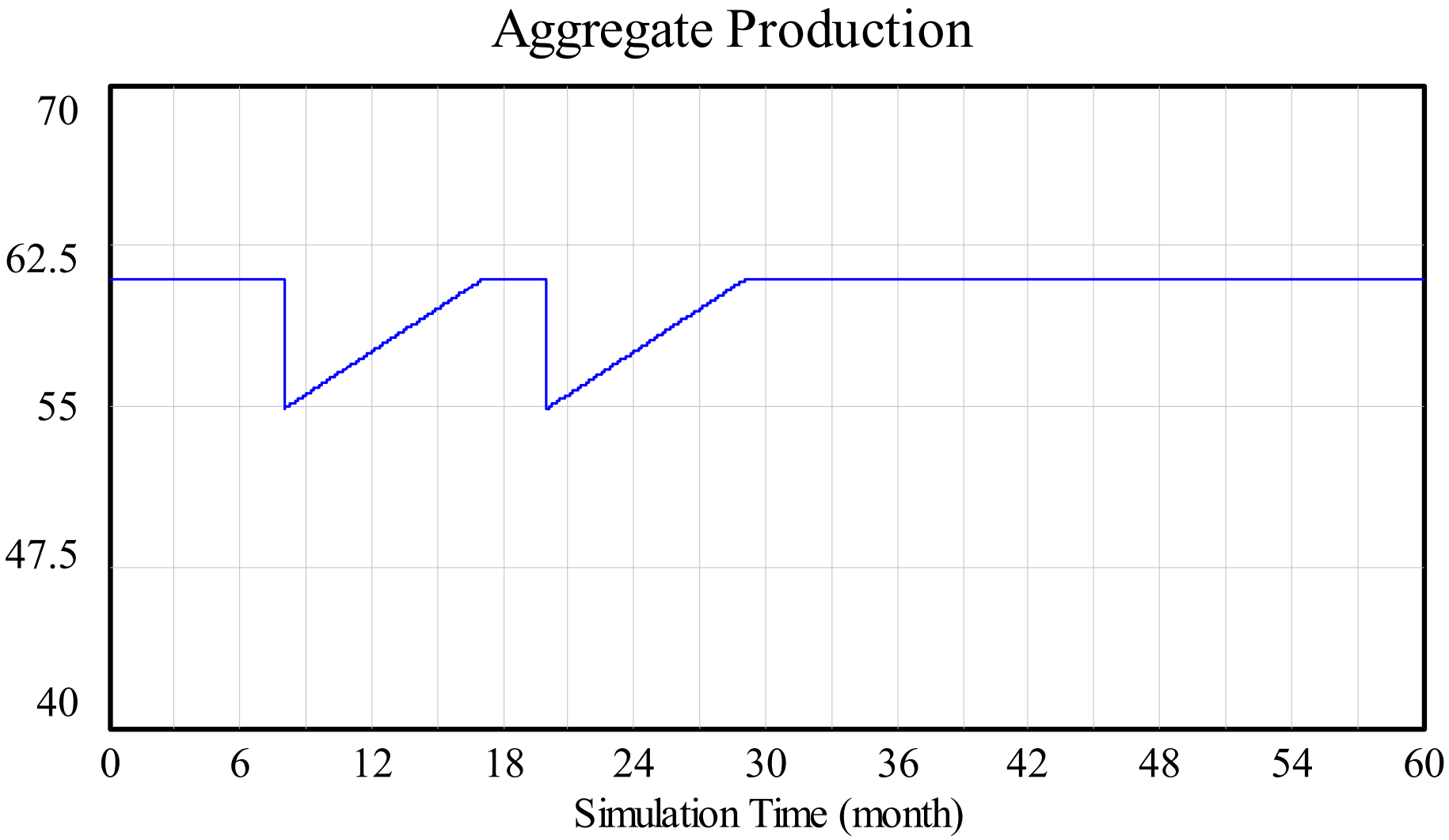
Working Gas in Underground Storage (red line) Compared with 5-Year Range (grey area – showing minimum and maximum storage volumes at the same time of year for 2001 to 2005)

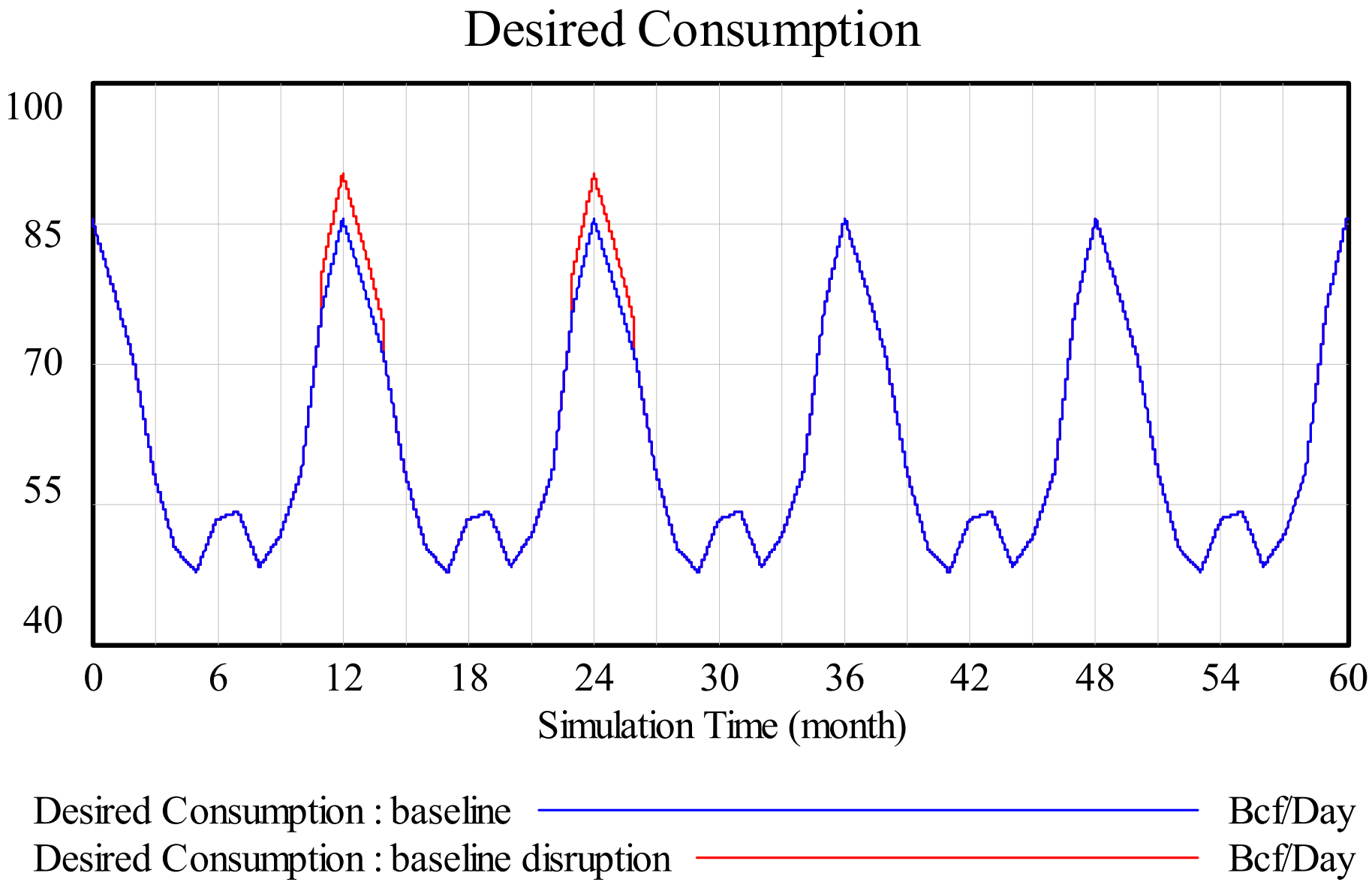


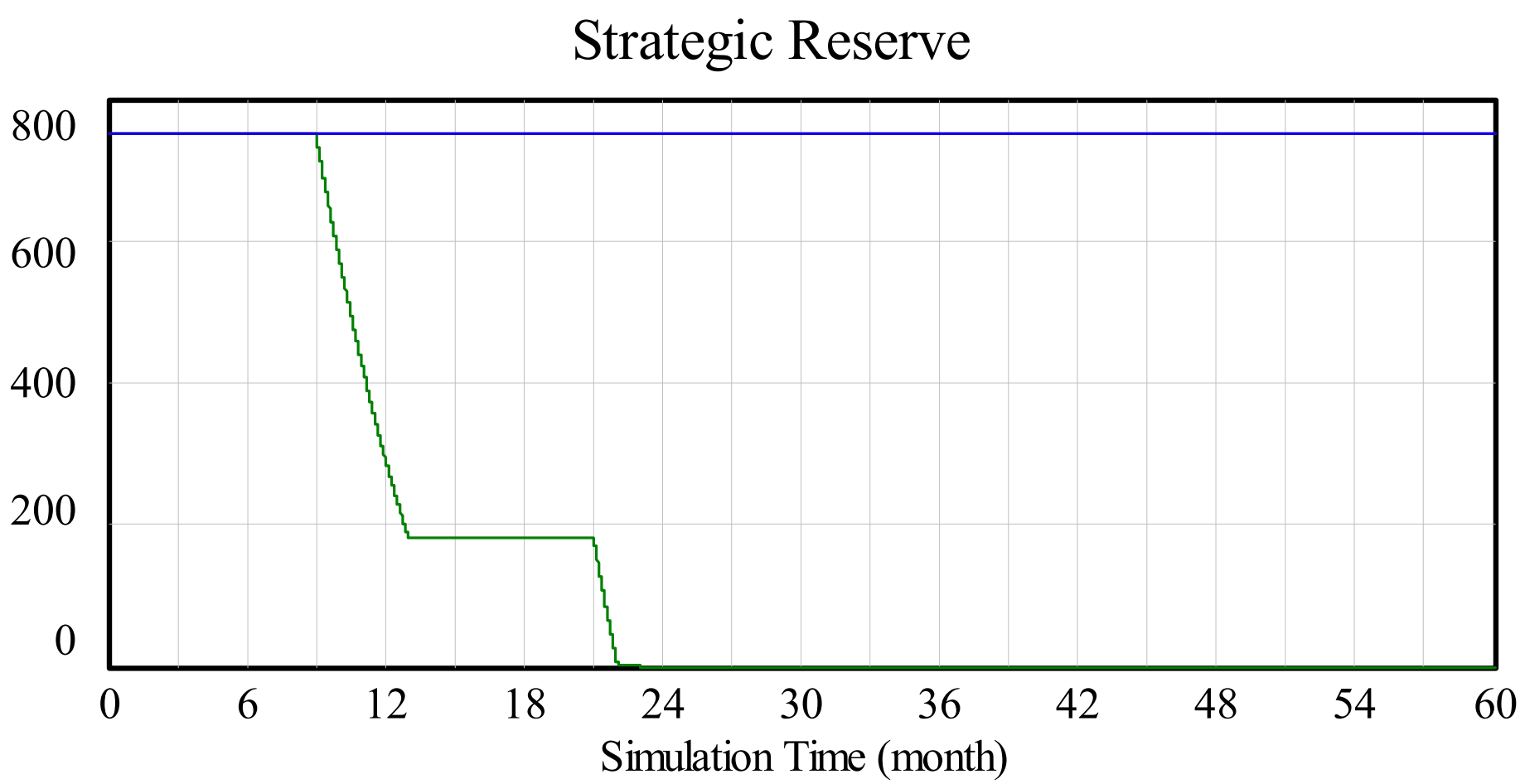
Source: EIA, at http://tonto.eia.doe.gov/oog/info/ngs/ngs.html

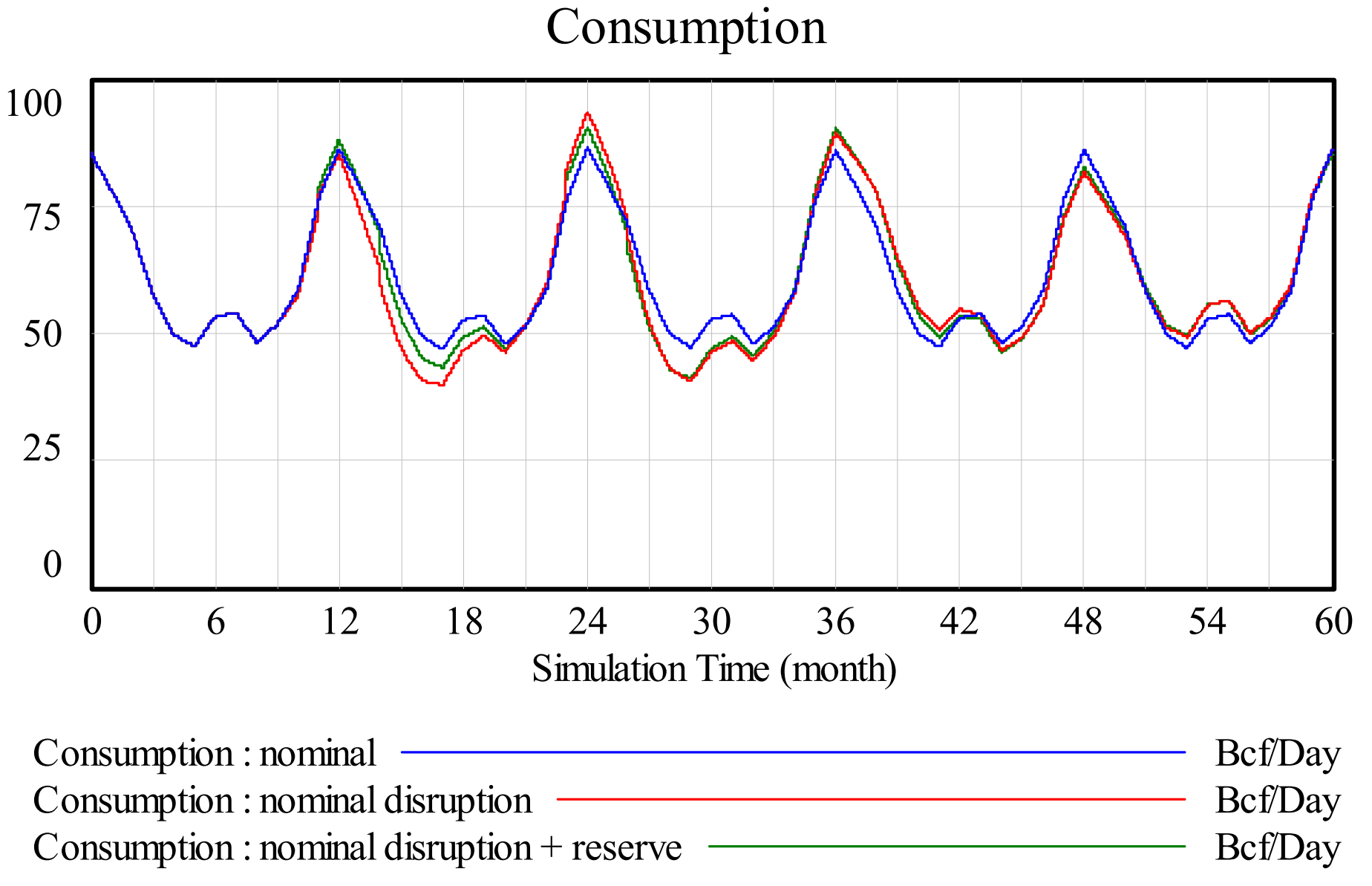
Devising a More Stringent Test

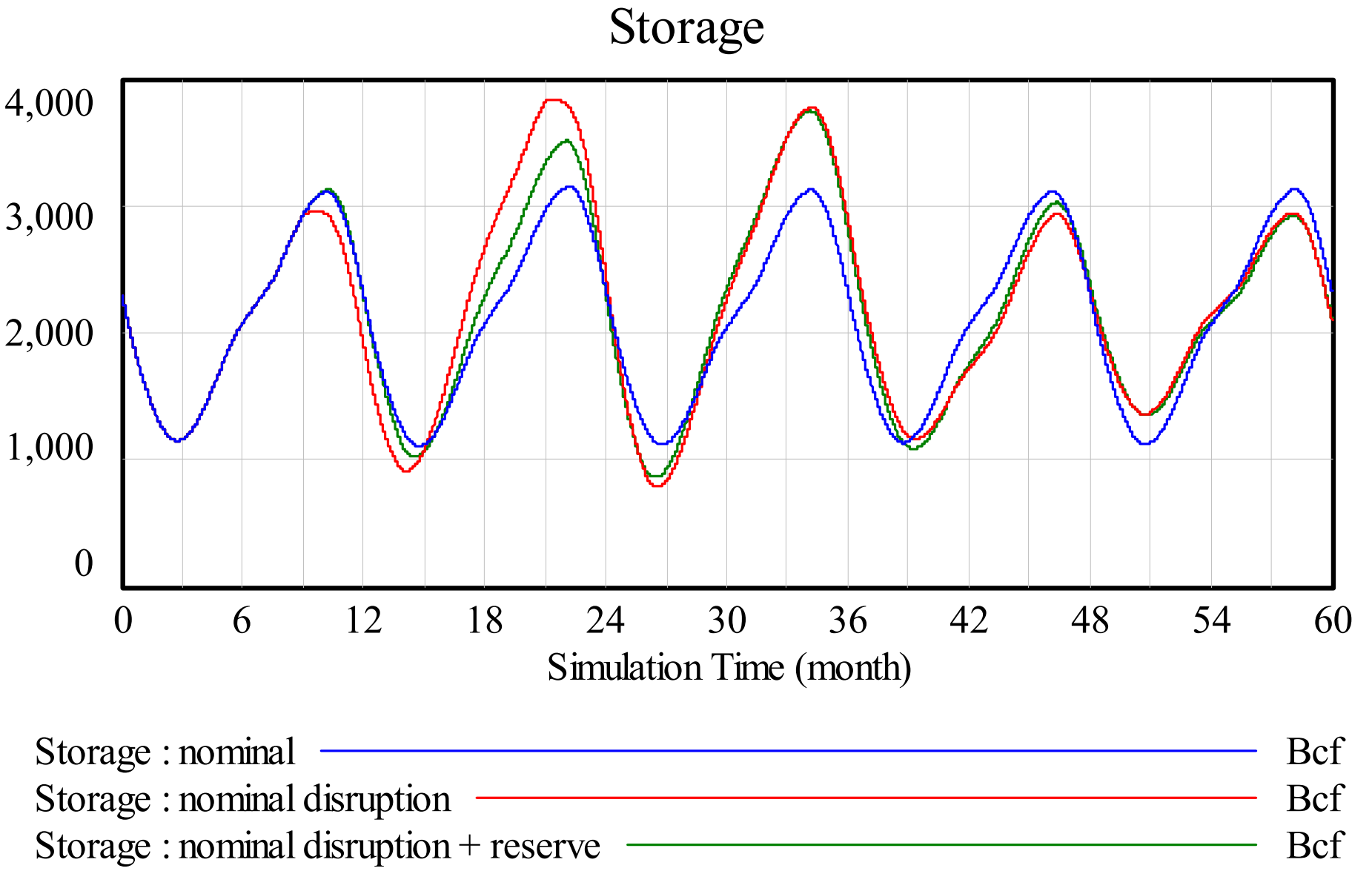
- Would the system be resilient to a 2005 Hurricane season followed by a cold winter
  - And then an immediate repeat of the same?
- Devised a simple aggregate model of US Natural Gas production and consumption to help answer

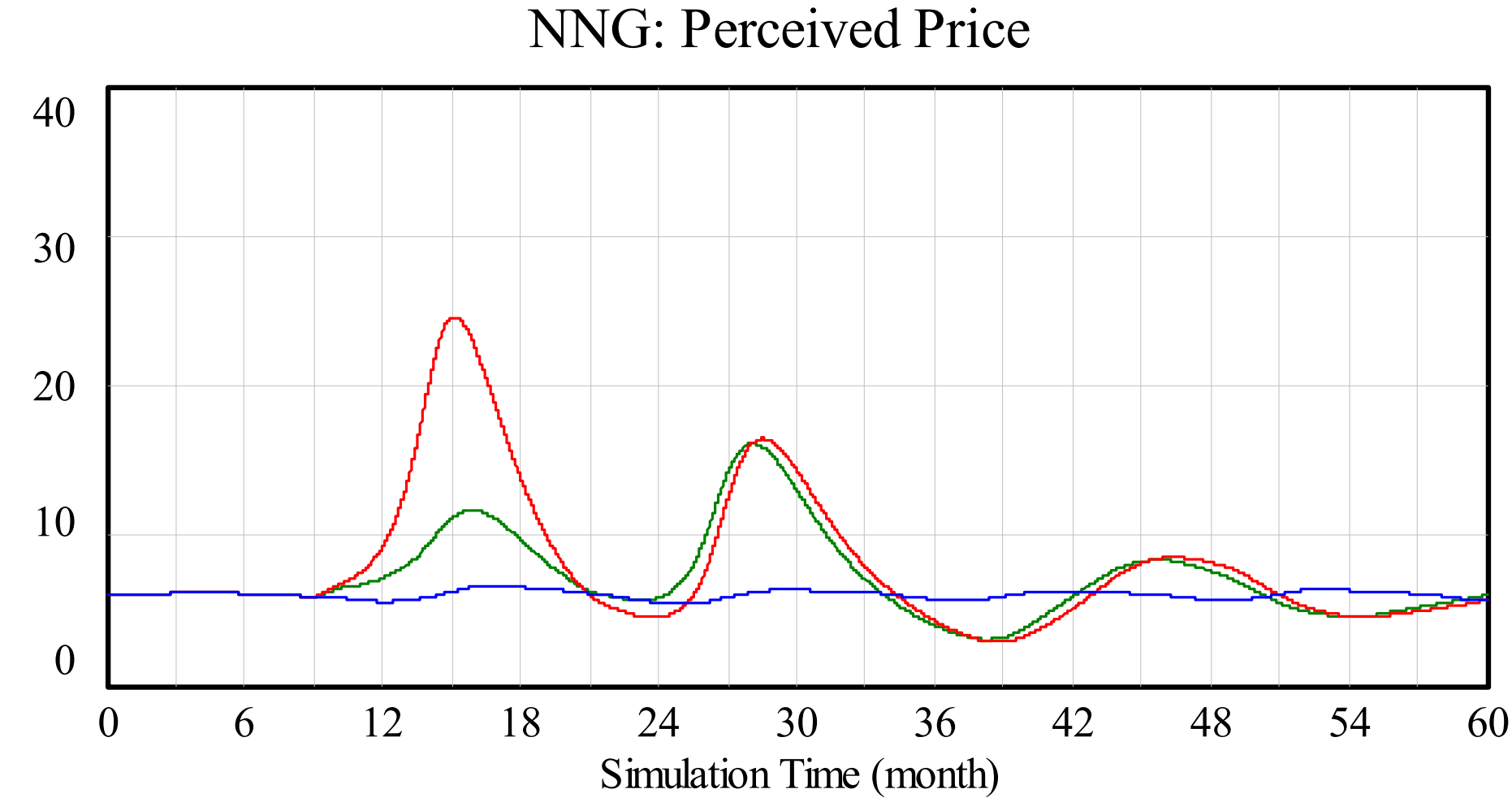

Aggregate Production
70
62.5
55
47.5
40
0
6
12
18
24
30
36
42
48
54
60
Simulation Time (month)
Aggregate Production : baseline disruption
Bcf/Day


Desired Consumption
100
85
70
55
40
0
6
12
18
24
30
36
42
48
54
60
Simulation Time (month)
Desired Consumption : baseline
Bcf/Day
Desired Consumption : baseline disruption
Bcf/Day


Strategic Reserve
800
600
400
200
0
0
6
12
18
24
30
36
42
48
54
60
Simulation Time (month)
Strategic Reserve : nominal
Bcf
Strategic Reserve : nominal disruption
Bcf
Strategic Reserve : nominal disruption + reserve
Bcf


Consumption
100
75
50
25
0
0
6
12
18
24
30
36
42
48
54
60
Simulation Time (month)
Consumption : nominal
Bcf/Day
Consumption : nominal disruption
Bcf/Day
Consumption : nominal disruption + reserve
Bcf/Day


Storage
4,000
3,000
2,000
1,000
0
0
6
12
18
24
30
36
42
48
54
60
Simulation Time (month)
Storage : nominal
Bcf
Storage : nominal disruption
Bcf
Storage : nominal disruption + reserve
Bcf


NNG: Perceived Price
40
30
20
10
0
0
6
12
18
24
30
36
42
48
54
60
Simulation Time (month)
"NNG: Perceived Price" : nominal
$
"NNG: Perceived Price" : nominal disruption
$
"NNG: Perceived Price" : nominal disruption + reserve
$

Parallels with the SPR

- Origins – 1973 Arab oil embargo
  - US support of Israel in 1973 Yom Kippur war
  - Wanted to create supply shock, show had clear leverage over US
  - Led to dramatic increase in world oil prices
    - And coupled with price controls, in US led to gas lines and shortages
- Congress authorized SPR in 1975
  - To discourage use of oil embargoes
  - To buy time for crisis to resolve itself, or for action to be taken
  - To blunt the power of oil exporting nations to “tax” consuming nations through supply shocks

Natural Gas and Oil Differences

- Out of 27.7 Tcf of NG consumption, North America imported 650 Bcf of LNG in 2004
  - About 2% of total consumption
  - So, no need to have stocks to tide US over in case of embargo, or discourage embargo
- Crude oil price increases – tax on US residents by petroleum exporting nations
  - Natural gas revenues remain in US
    - So, NG price increases are different, and may be of less concern to policymakers

NGSR Costs

- Construction costs for 750 Bcf in new storage capacity – about $5b US
  - 80% depleted reservoir, 20% salt cavern
- Base gas requirement – about 650 Bcf
  - Depleted reservoir – 50% base gas
  - Salt cavern – 25% base gas
- If take spot price of $6 / MMBtu,
  - Total cost of gas around $8.5b US
- Total NGSR cost, then, around $14b US

NGSR Details

- NG to fill NGSR would currently come from North American production
  - If tried to fill it in one year, would produce disruption similar to 2005 hurricane season
- Once NGSR is depleted, it must be filled again
  - Would not be available for a back-to-back supply shock

Conclusions

- The US natural gas system was resilient in the 2005 hurricane season
  - And would likely be resilient with a more stringent test
- With almost all gas produced in North America, an NGSR would not protect against embargoes
  - Filling it would take gas from other consumers
  - Could cause a shock as great as the one it was designed to prevent
- Would help to dampen price spikes
  - But not for supply shocks close together
  - Too much price suppression could be counterproductive
- As LNG imports to US increase over time, NG imports may resemble current oil situation
  - The NGSR concept would then merit further review