

Will the Gas Network Carry the Coldest Day?

Projecting the design day from the throughput and weather a utility already holds, and solving the network against it main by main

PRODUCT

Grid Data Enhanced Analytics

AUDIENCE

Gas planning engineers, gas operations leaders, capital planning teams

The day the plan is built for

Every gas distribution utility plans for a day it hopes never comes: the design day. It is the coldest day the utility commits to serving under its own planning standard, and it is the day that settles capacity arguments. On that day, furnaces and boilers across the territory run hard at the same time, and the morning peak hour stacks on top of an already heavy day.

The question for planners is simple to ask and hard to answer. If the design day arrived this winter, would the network deliver? Would every district regulator still see enough pressure at its inlet? And if not, which main runs out first?

The answer drives capital. A main that can't carry the design day needs reinforcement, and reinforcement takes years to plan, permit and build. A utility that discovers its limit during a cold snap has discovered it too late.

Why it's hard

The design day has not happened, or not recently. Design conditions are colder than most winters. The load on that day has to be projected from how the system behaved on milder days, which means building a demand model from history.

The data lives in different places. Throughput at gate stations and district regulators arrives through SCADA. Weather history sits somewhere else. The network itself, with its lengths, diameters and materials, lives in GIS. The hydraulic model, if there is one, often belongs to a single specialist and gets run once a year.

A demand model can be confidently wrong. Give a model a summer of data and it will still project a winter it knows nothing about. Without heating-season history, there is no evidence of how load responds to cold. A number comes out anyway, and nobody should size a main on it.

A daily total doesn't size a pipe. Pipes run out of room in the peak hour. The design day's total has to become a peak-hour load before a hydraulic answer means anything.

"The system passes" hides the next problem. A pass or fail for the whole network doesn't tell the capital planner which main is closest to its limit, what that limit is, or how much load growth is left before it binds.

Principles of a good approach

1. **Build demand from the utility's own history.** Use the throughput and weather the utility already records, so the projection reflects its own customers and its own climate.
2. **Refuse when the history can't carry the projection.** If the data doesn't cover enough cold weather to support a projection, say so and stop. A refusal with a reason is worth more than a design-day figure with no footing.
3. **Plan for the peak hour, not only the day.** Project the design day's peak hour and test the network at that load.
4. **Use a real hydraulic solve.** Pressures and flows should come from solving the actual network, not from rules of thumb about pipe size.
5. **Report headroom main by main.** For each main, show how much more load it can take, which constraint it will hit first, and how close that is.
6. **Order the list for reinforcement.** Lead with the main that runs out first.
7. **Let planners ask "what if."** Load growth changes the answer. Planners should be able to test a growth rate and see how many years each main has left.
8. **Look for corroboration.** A main that is constrained in the hydraulics and also stands out in unrelated evidence, such as its leak history, has earned a place at the top of the list.

What it looks like in Grid Data Enhanced Analytics

Grid Data Enhanced Analytics (GDEA) joins the utility's GIS network model, SCADA telemetry and AMI data into one live, solved picture of electric, gas and water networks, with real power-flow and hydraulic solvers. Its gas capacity analytics build on that picture in two steps.

First, the demand model. GDEA builds a weather-driven demand model from the throughput and weather history the utility already holds. The planner sees how daily load has tracked the cold, measured in heating degree days, and the design-day demand and peak hour the model projects for the design conditions the planner sets. When the history can't support a projection, for example because it doesn't cover enough cold weather, GDEA doesn't produce one. The page shows the refusal and its reason where the figures would be.

Second, the capacity study. GDEA solves the network against the design-day peak hour and reports whether it carries the load. For every main, it reports headroom: how much more load the main can take before it reaches a limit, and which constraint it will hit first. The table is in reinforcement order, with the main that runs out first at the top. A load-growth control lets the planner try a growth rate and see how many years each main has before its constraint binds.

One main, several witnesses. GDEA also carries the utility's hydraulic findings and its graded leak register. When the main at the top of the headroom list is also the one the hydraulic solve flags as constrained, and the one with the worst leak history, those are separate analytics built on unrelated evidence, all pointing at the same asset. That agreement makes a reinforcement or replacement case easier to make and harder to dismiss.

GDEA is monitoring-only. It reports which main runs out first and why. The utility's planners decide what to build, and when.

ILLUSTRATIVE EXAMPLE (HYPOTHETICAL)

A gas planning engineer prepares the utility's winter capacity review. GDEA's demand model, built from the utility's own throughput and weather history, projects the design day and its peak hour. The capacity study shows the network carries today's load comfortably but not the design day: a handful of mains fall short. At the top of the reinforcement list is an older cast iron main feeding a growing district. At the design-day peak hour, it could not deliver what that district needs. The next main down runs out for a different reason. The engineer tests modest load growth and sees that the cast iron main has no years to spare. The same main has the worst leak history on the system and is already flagged in the hydraulic findings. The engineer brings all three views to the capital planning meeting. Meanwhile, a colleague runs the model for a newly acquired service area with only a summer of data. GDEA declines to project a design day and says why, and the team schedules the study for after the heating season.

Questions to ask any vendor

- Is design-day demand built from our own throughput and weather history?
- What happens when our history can't support a design-day projection? Does the product say so, or produce a number anyway?
- Does it project the design day's peak hour, not only the daily total?
- Is capacity checked with a real hydraulic solve of our network?
- Does it show headroom for every main, and which constraint binds first?
- Is the result ordered for reinforcement planning?
- Can planners test load growth and see how many years each main has left?
- Can it show hydraulic results next to leak history for the same main?
- Do the decisions about what to build stay with your planners?

Closing

The design day is the promise a gas utility makes to its customers on the worst morning of the year. Knowing whether the network keeps that promise, which main gives out first, and how much growth is left, turns a once-a-year study into a planning tool the whole capital program can use.

Learn more about Grid Data Enhanced Analytics at perinimble.com/grid-data-enhanced-analytics/, or talk with our team at perinimble.com/contact/.

ABOUT PERINIMBLE

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