



# The Ultimate Guide to Nitrogen Generation

How to Save Thousands Per Month in Nitrogen  
Gas Cost while also Improving Your  
Productivity, Safety, and Green Footprint

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# What is Nitrogen Generation (GN2) at the Most Basic Level?...It is the Separation of Air to Capture Nitrogen.

- Components of Air That Need to Be Separated

- Nitrogen – 78%

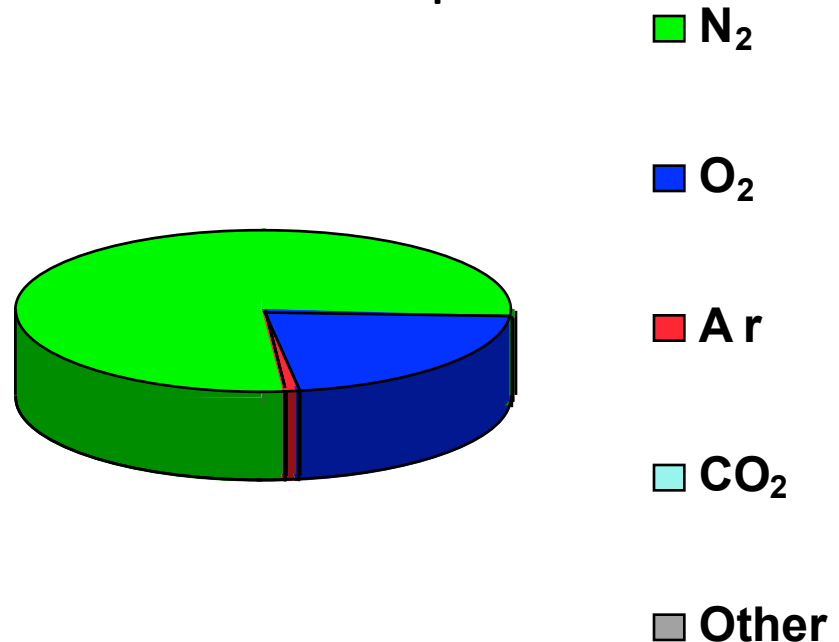
- Oxygen - 20.9%

- Argon - 0.9%

- CO<sub>2</sub> - 0.03%

- Other Trace Gasses

- Hydrogen, Helium, Neon, Krypton and Xenon

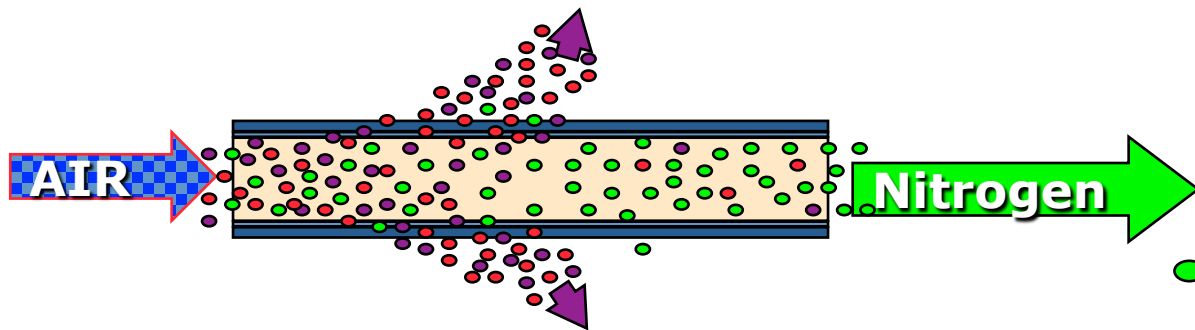


# Three Ways to Separate Air to Make Nitrogen

- For Onsite Generated Nitrogen
  - 1) Membrane Separation
  - 2) Pressure Swing Adsorption (PSA)
  
- For Traditional Liquid Nitrogen
  - 3) Cryogenic / Fractional Distillation of Liquid Air (used by industrial gas companies in their manufacturing facilities)

# The “Membrane” Way to Separate Air:

- Hollow Fiber Membranes
  - Mechanical Process
  - Typical Purities
    - 95% thru 99.5% (5000 ppm O<sub>2</sub>)
      - 99.9% (1000 ppm O<sub>2</sub>) flows below 500 scfh
      - 99.99% (100 ppm O<sub>2</sub>) is Achievable (requires a lot of energy)

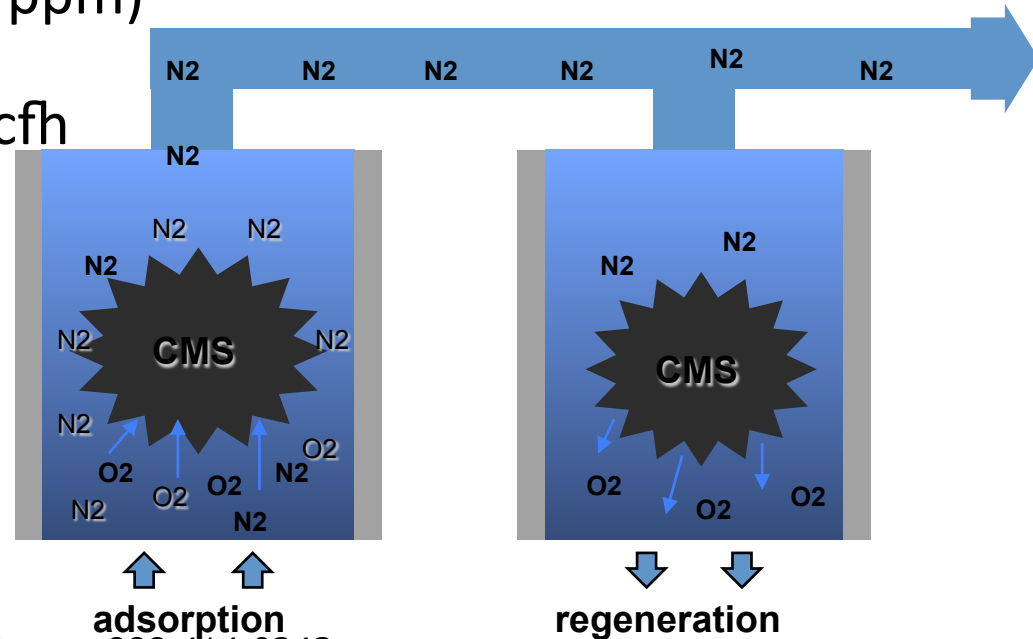


# The “Pressure Swing Adsorption” (PSA) Way to Separate Air

- Uses Carbon Molecular Sieve (CMS) to Adsorb O<sub>2</sub> Molecules

– Typical Purities

- 95% thru 99.999% (10 ppm)
- Flow rates to 20,000 scfh



# Common Nitrogen Generation Applications

- Laser Assist Gas
- Laser Beam Purge
- Inerting / Blanketing / Storage
- Pipe Purging
- Beverage Dispensing
- Beer Making & Dispensing
- Modified Atmospheric Packaging (MAP)
- 3D Printing
- Laboratory
- Tire Filling
- Electronics
- Sprinkler Systems

# Industries with Nitrogen Generation Applications

- Metal Fabrication
- Food Packaging
- Heat Treat
- Oil and Gas
- Restaurant / Bar
- Brewery
- R&D Centers and Labs
- Construction
- Auto Service
- Electronics Manufacturing

# Membrane Nitrogen Generator Installation



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# Pressure Swing Adsorption (PSA) Nitrogen Generator Installation



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# Myths and Misconceptions

## The Big Generator Watch Outs

- There are not many true experts when it comes to N2 generation.
- The Gas company wants to sell you liquid gas, not generation, so be careful taking advice from them...it will be biased and incomplete....and likely geared to steer you away from generation.
- OEM production equipment sales people can be helpful, but usually only have surface level knowledge about generation. We typically know the nitrogen issues and opportunities associated with various production equipment better than the OEM sales guys....use this guide to begin your education...and then get on the phone with us to help you address your unique situation.
- Yes, first generation generators by big and small vendors were sometimes unreliable, but don't let that stop you today... this problem / opportunity was the reason we started our company 10+ years ago, to fix and fill this void with a focus on bullet proof reliability and proper sizing for generators.

# More on Reliability:

## The Key to Generator Success

- Via any proposal or analysis, the cost savings, productivity improvements, and ROI of generation can look great on paper and in spreadsheets.
- However, the key to delivering on these wonderful calculations is precise generator tuning for your unique application (hard to do) and a rock solid generator build quality that never goes down in any demanding environment (also, hard to do).
- Proven by millions of hours of reliable uptime, and admittedly but proudly with bias,...we feel the most bullet proof generator precisely tuned for your application is without a doubt a Liberty Systems Generator...a system that has been virtually perfected via 10+ years of hands on experience with more than 1,000 installations across diverse industries....designed by engineers who were in-the-field mechanics and electricians, with bulletproof reliability, and maximum cost savings payback being our dual goals.
- Our simple reminder to managers, engineers, techs, and buyers... don't bet your career on less than bullet-proof generator reliability. The wonderful cost savings potential of nitrogen generation can quickly be turned upside down by an unreliable generator brand causing chronic application down time and/or frequent use of backup liquid nitrogen.

# What are Typical Gas Cost Savings of Generating vs. Buying Liquid Nitrogen?

via a reliable generator, precisely tuned for your application, by a vendor who knows what they are doing...typically thousands of dollars per month

- Generate vs. Buy via Bulk
  - \$0.50 - \$0.75 per ccf less to generate
  - \$2.00 - \$6.00 per hour less to generate
  - Bulk gas also subject to 15%+ hidden gas waste caused by storage venting
- Generate vs. Buy via Mini / Micro Bulk
  - \$1.00 - \$1.25 per ccf less to generate
  - \$10.00 – 12.50 per hour less to generate
  - Micro Bulk gas also subject to 15%+ hidden gas waste caused by storage venting
- Generate vs. Buy via Dewar
  - \$2.00 - \$2.50 per ccf less to generate
  - \$20.00 - \$25.00 per hour less to generate
  - Dewar gas also subject to 15%+ hidden gas waste caused by storage venting
- Generate vs. Buy via Cylinder
  - \$3.00 - \$3.50 per ccf less to generate
  - \$30.00 - \$35.00 per hour less to generate
  - Cylinder gas typically does not have the venting issues seen with the larger storage formats.

# What are Your Productivity Improvements?

via a reliable generator, precisely tuned for your application,  
by a vendor who knows what they are doing

- Potential to increase feed rate or speeds
- Production is Not “Shut Down” due to your gas supplier venting your gas to atmosphere prior to depressurizing your tank to refill your Bulk or Micro Bulk Tank
- Staff can focus on what they do best rather than switching out cradles of cylinders or Dewar tanks
- Have a 24/7 supply of generated nitrogen, never run out, never be dependent on truck delivery schedule.

# What is the Impact on Production Quality?

of a reliable generator, precisely tuned for your application,  
by a vendor who knows what they are doing

- With proper implementation and tuning strategy...processed parts will meet, exceed, and/or maintain your current quality requirements.

# What is the Impact on Safety?

of a reliable generator, precisely tuned for your application,  
by a vendor who knows what they are doing

- Reduction of risk and potential liability of your staff changing out and handling high pressure cylinders or dewars.
- Cradles of 2400 psig cylinders are no longer stored inside your facility further reducing risk.

# What is the Impact on Your Green Footprint?

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by a vendor who knows what they are doing

- There is no longer a need for a Diesel vehicle to transport liquid nitrogen, dewars or high pressure cylinders to your facility.
- This reduces CO<sub>2</sub> emissions and carbon footprint by a factor of 2.77 kg per gallon of diesel taken off the road
- **EXAMPLE**
  - a diesel truck carrying nitrogen gas
    - Truck gets 6 miles mpg
    - 2.77 kg carbon per gallon of diesel
    - 25 miles to your facility
    - $25 \text{ miles} / 6 \text{ mpg} = 4.15 * 2.77 \text{ kg carbon} = 11.5 \text{ kg}$
    - The avg. carbon footprint per delivery is 11.5 kg
      - This carbon no longer emitted with on-site nitrogen generation



# What About My Gas Contract?

- There are simple, but effective strategies to maintain compliance with an existing industrial gas contract while bringing on your own nitrogen generator.
- Gas contracts rarely stop a good nitrogen generation project, there is usually a way to have your GN2 cake and eat it too, within the confines of your existing gas contract!
- Gas companies want to sell liquid gas, be careful relying on their guidance when assessing the feasibility of generation.

# About Liberty Systems

We help businesses overcome liquid gas cost challenges via our independent gas advice, and fast payback solutions using nitrogen generators, gas mixers, gas surge limiters, and air systems. . We guarantee proper sizing, and are known as the most reliable machine in the generator equipment industry.

At 1,000+ systems installed, over 15 years, across North America and globally, some clients include Koch Industries, Racine Metal Fab, John Deere, Hohmann & Barnard, Ratermann Mfg, and Praxair. And are the recommended nitrogen generator by countless production equipment OEMs across many verticals.

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# Action Shots From The Field



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# What to do next?

## ...Get Q&A, Cost Savings, and Quote Assistance from Our Helpdesk

Get all your questions answered by a nitrogen generator applications engineer and...

- Nail down technical issues and trade-offs so you have all the info you need.
- Determine your gas cost savings opportunity to stop wasting money now.
- Discover what generator design details will give you the reliability you need.
- Receive a budget-friendly quote on an ultra reliable system that meets your exact needs

Get Assistance from the Liberty Helpdesk Now.

+1. 888.414.0243 or [GetHelpNow@lsn2.NET](mailto:GetHelpNow@lsn2.NET)

*"Selecting the right generator is very challenging, the guys at Liberty spent extra time answering all my questions."*

Plant Manager, Racine Metal Fab



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