

NITROPURE ON-SITE NITROGEN GAS GENERATOR

INTRODUCTION

Nitrogen forms about 78% of the Earth's atmosphere. This common non-aggressive gas has found usage in many modern industries including oil & gas, chemical, pharmaceutical, food & beverage, metal, electronics and others mainly for purposes of inerting, purging, mixing and blanketing.

Obtaining a ready supply of nitrogen gas can be quite problematic and expensive. Typical commercial gas supply methods include high pressure cylinders, liquid mini tanks or bulk storage vessels. However, each of these options has its own range of problems that needs to be solved.

1. Sourcing for supplier of nitrogen gas/liquid.
A reliable vendor has to be sourced and need to make sure that delivery is always on time when needed. Cost may varies substantially.
2. Procedures have to be established.
Require continuous monitoring and management of supply, with endless co-ordination of purchases, deliveries, payments and so on. Logistics can be a big hassle.
3. Issues of safety and handling.
Low temperatures and high pressure storage will create safety and health problems at work site. Special SOP has to be established to ensure safe handling at all times.
4. Evaporation loss / Wastage.
During re-filling of bulk storage tanks a certain amount of nitrogen will naturally be lost due to evaporation. The evaporation loss is typically between 3-5%, and this is money wasted.
5. Nitrogen gas purity.
Many large industrial users often procure the nitrogen in cryogenic liquid form. This typically has a nitrogen purity of about 99.9999%, while most applications require purity of only 95% to 99.9%. The effect of using higher purity then necessary is a substantial increase in cost which adds up in the long term.

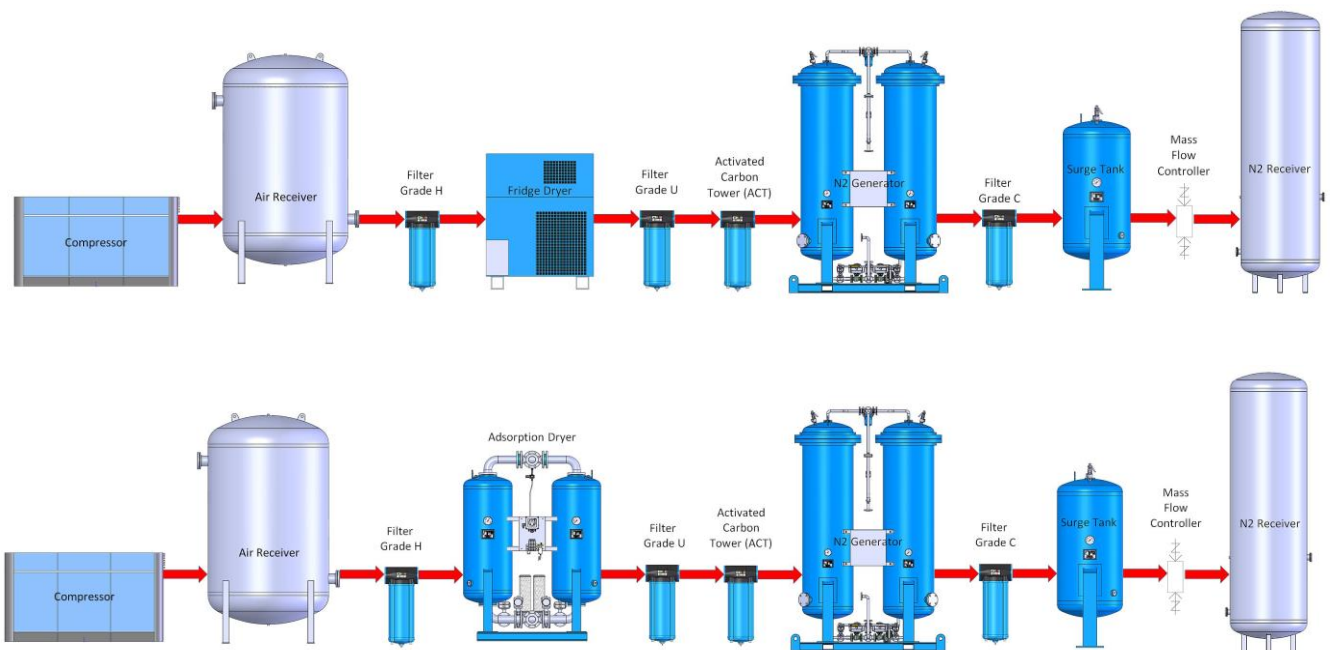


NITROPURE ON-SITE NITROGEN GAS GENERATOR

NITROPURE ON-SITE NITROGEN GAS GENERATOR SYSTEM – A BETTER SOLUTION FOR YOU

Being able to control your own nitrogen gas supply will reduce dramatically operational cost and allow you to manage your own destiny while offering lots of convenience and reliability of supply. You are independent from fluctuating 3rd party price policy, supply problems and also safety issues. On top of that you help the environment to reduce carbon foot print by eliminating supplies via trucks.

TYPICAL INSTALLATION LAYOUT



The **NITROPURE** on-site nitrogen gas generator is the perfect solution for you. The main commodity here is compressed air, which most factory has readily available. The **NITROPURE** is a simple (PSA) pressure swing adsorption system which works in conjunction with your compressed air system to produce nitrogen gas. Basically the unit consist of two vessels, and is controlled by an electronic controller. The two vessels is filled with carbon molecular sieve (CMS), a material which is capable of separating nitrogen gas from the compressed air, and operate continuously on alternative cycles to either generate nitrogen gas by adsorption or to regenerate the CMS (after it has been saturated) to provide uninterrupted supply of nitrogen gas directly to your work site by a simple network of piping.

NITROPURE ON-SITE NITROGEN GAS GENERATOR

The **NITROPURE** on-site nitrogen gas generators have many advantages over traditional nitrogen supplies:

- Convenient and safe. Enhanced safety without the need to store or handle high pressure cylinders.
- Continuous supply. Reduced downtime owing to an on-demand supply which is available 24/7.
- Cost savings. Low cost of ownership and operation. Typical return of investment of between 6 months to 3 years, depending on usage and specifications required.
- Quality supply. Availability of food grade nitrogen at consistent flow, pressure and purity.
- Easy installation. No need for expensive civil works prior to installation.
- Simple set-up. Operates from a standard factory compressor for even greater energy savings.

The **NITROPURE** can be custom-design and custom-built to meet your specific requirements. As a tool for customers in their decision to change from conventional commercial nitrogen supply to their own on-site generation, the following pages will provide realistic calculations of return of investment examples for the NITROPURE PSA systems compared to conventional bottle or bulk liquid supply. These are sample calculations for 3 different purities at 97%, 99% and 99.5%, with 6 examples each for different consumption level. Upon request, a calculation based on customer's actual demand and requirements can be prepared for their consideration of investing in the NITROPURE.

Purity Specified in Industrial Applications

Although on-site nitrogen generator can produce N₂ purities of up to 99.999%, users can realize significant financial and energy savings if they match the purity of the nitrogen to the actual purity required for their application. In many cases, customers are unintentionally using nitrogen purity beyond what is required for their application based on supplier's recommendation and consequently pays a very high premium for the 99.999% purity that they do not require. Indeed, for many applications, even a purity of 99.9% is not required. User should define their own nitrogen purity demand based on their specific application which can have a huge cost impact on the system selection.

NITROPURE ON-SITE NITROGEN GAS GENERATOR

NITROPURE N2 GENERATOR VS COMMERCIAL LIQUID/BOTTLED N2 BASED ON 97% NITROGEN PURITY RETURN OF INVESTMENT

NITROGEN CONSUMPTION

Nitrogen purity (%)	:	97.00%	97.00%	97.00%	97.00%	97.00%	97.00%
Total Nitrogen consumption (m3/yr)	:	80,000	200,000	400,000	600,000	800,000	1,200,000

USING NITROPURE N2 GAS GENERATOR

Estimated investment cost (RM)*	:	65,000	100,000	136,000	200,000	250,000	350,000
Required Nitrogen flow rate (m3/hr)	:	10	25	50	75	100	150
Required compressor capacity (kW)	:	3.5	7.5	15	22	30	37
Running hour per year (hr/yr)	:	8,000	8,000	8,000	8,000	8,000	8,000
Total electricity consumption (kW/yr)	:	28,000	60,000	120,000	176,000	240,000	296,000
Unit cost of electricity (RM/kW/hr)	:	0.40	0.40	0.40	0.40	0.40	0.40
Total cost of electricity (RM/yr)	:	11,200	24,000	48,000	70,400	96,000	118,400
Total cost of Nitrogen (RM/yr)	:	11,200	24,000	48,000	70,400	96,000	118,400

CASE 1

USING COMMERCIAL BOTTLED/LIQUID N2

Total Nitrogen consumption (m3/yr)	:	80,000	200,000	400,000	600,000	800,000	1,200,000
Commercial cost of Nitrogen (RM/m3)	:	0.50	0.50	0.32	0.32	0.32	0.32
Total cost of Nitrogen (RM/yr)	:	40,000	100,000	128,000	192,000	256,000	384,000

RETURN OF INVESTMENT FOR NITROPURE N2 GENERATOR

Savings from using NITROPURE (RM/yr)	:	28,800	76,000	80,000	121,600	160,000	265,600
Estimated investment cost (RM)*	:	65,000	100,000	136,000	200,000	250,000	350,000
Return of Investment ROI (yr)	:	2.26	1.32	1.70	1.64	1.56	1.32

CASE 2

USING COMMERCIAL BOTTLED/LIQUID N2

Total Nitrogen consumption (m3/yr)	:	80,000	200,000	400,000	600,000	800,000	1,200,000
Commercial cost of Nitrogen (RM/m3)	:	1.40	1.40	0.60	0.60	0.60	0.60
Total cost of Nitrogen (RM/yr)	:	112,000	280,000	240,000	360,000	480,000	720,000

RETURN OF INVESTMENT FOR NITROPURE N2 GENERATOR

Savings from using NITROPURE (RM/yr)	:	100,800	256,000	192,000	289,600	384,000	601,600
Estimated investment cost (RM)*	:	65,000	100,000	136,000	200,000	250,000	350,000
Return of Investment ROI (yr)	:	0.64	0.39	0.71	0.69	0.65	0.58

* For compressor, filter, dry & wet receiver, dryer, N2 generator & N2 storage tank, excluding piping & installation.

NITROPURE ON-SITE NITROGEN GAS GENERATOR

NITROPURE N2 GENERATOR VS COMMERCIAL LIQUID/BOTTLED N2 BASED ON 99.0% NITROGEN PURITY RETURN OF INVESTMENT

NITROGEN CONSUMPTION

Nitrogen purity (%)	:	99.00%	99.00%	99.00%	99.00%	99.00%	99.00%
Total Nitrogen consumption (m3/yr)	:	80,000	200,000	400,000	600,000	800,000	1,200,000

USING NITROPURE N2 GAS GENERATOR

Estimated investment cost (RM)*	:	65,000	125,000	150,000	210,000	300,000	500,000
Required Nitrogen flow rate (m3/hr)	:	10	25	50	75	100	150
Required compressor capacity (kW)	:	5	7.5	15	30	37	55
Running hour per year (hr/yr)	:	8,000	8,000	8,000	8,000	8,000	8,000
Total electricity consumption (kW/yr)	:	40,000	60,000	120,000	240,000	296,000	440,000
Unit cost of electricity (RM/kW/hr)	:	0.40	0.40	0.40	0.40	0.40	0.40
Total cost of electricity (RM/yr)	:	16,000	24,000	48,000	96,000	118,400	176,000
Total cost of Nitrogen (RM/yr)	:	16,000	24,000	48,000	96,000	118,400	176,000

CASE 1

USING COMMERCIAL BOTTLED/LIQUID N2

Total Nitrogen consumption (m3/yr)	:	80,000	200,000	400,000	600,000	800,000	1,200,000
Commercial cost of Nitrogen (RM/m3)	:	0.50	0.50	0.32	0.32	0.32	0.32
Total cost of Nitrogen (RM/yr)	:	40,000	100,000	128,000	192,000	256,000	384,000

RETURN OF INVESTMENT FOR NITROPURE N2 GAS GENERATOR

Savings from using NITROPURE (RM/yr)	:	24,000	76,000	80,000	96,000	137,600	208,000
Estimated investment cost (RM)*	:	65,000	125,000	150,000	210,000	300,000	500,000
Return of Investment ROI (yr)	:	2.71	1.64	1.88	2.19	2.18	2.40

CASE 2

USING COMMERCIAL BOTTLED/LIQUID N2

Total Nitrogen consumption (m3/yr)	:	80,000	200,000	400,000	600,000	800,000	1,200,000
Commercial cost of Nitrogen (RM/m3)	:	1.40	1.40	0.60	0.60	0.60	0.60
Total cost of Nitrogen (RM/yr)	:	112,000	280,000	240,000	360,000	480,000	720,000

RETURN OF INVESTMENT FOR NITROPURE N2 GAS GENERATOR

Savings from using NITROPURE (RM/yr)	:	96,000	256,000	192,000	264,000	361,600	544,000
Estimated investment cost (RM)*	:	65,000	125,000	150,000	210,000	300,000	500,000
Return of Investment ROI (yr)	:	0.68	0.49	0.78	0.80	0.83	0.92

* For compressor, filter, dry & wet receiver, dryer, N2 generator & N2 storage tank, excluding piping & installation.

NITROPURE ON-SITE NITROGEN GAS GENERATOR

NITROPURE N2 GENERATOR VS COMMERCIAL LIQUID/BOTTLED N2 BASED ON 99.5% NITROGEN PURITY RETURN OF INVESTMENT

NITROGEN CONSUMPTION

Nitrogen purity (%)	:	99.50%	99.50%	99.50%	99.50%	99.50%	99.50%
Total Nitrogen consumption (m3/yr)	:	80,000	200,000	400,000	600,000	800,000	1,200,000

USING NITROPURE N2 GAS GENERATOR

Estimated investment cost (RM)*	:	75,000	140,000	200,000	310,000	375,000	550,000
Required Nitrogen flow rate (m3/hr)	:	10	25	50	75	100	150
Required compressor capacity (kW)	:	5.5	11	22	30	37	55
Running hour per year (hr/yr)	:	8,000	8,000	8,000	8,000	8,000	8,000
Total electricity consumption (kW/yr)	:	44,000	88,000	176,000	240,000	296,000	440,000
Unit cost of electricity (RM/kW/hr)	:	0.40	0.40	0.40	0.40	0.40	0.40
Total cost of electricity (RM/yr)	:	17,600	35,200	70,400	96,000	118,400	176,000
Total cost of Nitrogen (RM/yr)	:	17,600	35,200	70,400	96,000	118,400	176,000

CASE 1

USING COMMERCIAL BOTTLED/LIQUID N2

Total Nitrogen consumption (m3/yr)	:	80,000	200,000	400,000	600,000	800,000	1,200,000
Commercial cost of Nitrogen (RM/m3)	:	0.50	0.50	0.32	0.32	0.32	0.32
Total cost of Nitrogen (RM/yr)	:	40,000	100,000	128,000	192,000	256,000	384,000

RETURN OF INVESTMENT FOR NITROPURE N2 GENERATOR

Savings from using NITROPURE (RM/yr)	:	22,400	64,800	57,600	96,000	137,600	208,000
Estimated investment cost (RM)*	:	75,000	140,000	200,000	310,000	375,000	550,000
Return of Investment ROI (yr)	:	3.35	2.16	3.47	3.23	2.73	2.64

CASE 2

USING COMMERCIAL BOTTLED/LIQUID N2

Total Nitrogen consumption (m3/yr)	:	80,000	200,000	400,000	600,000	800,000	1,200,000
Commercial cost of Nitrogen (RM/m3)	:	1.40	1.40	0.60	0.60	0.60	0.60
Total cost of Nitrogen (RM/yr)	:	112,000	280,000	240,000	360,000	480,000	720,000

RETURN OF INVESTMENT FOR NITROPURE N2 GENERATOR

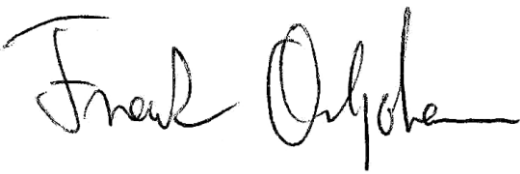
Savings from using NITROPURE (RM/yr)	:	94,400	244,800	169,600	264,000	361,600	544,000
Estimated investment cost (RM)*	:	75,000	140,000	200,000	310,000	375,000	550,000
Return of Investment ROI (yr)	:	0.79	0.57	1.18	1.17	1.04	1.01

* For compressor, filter, dry & wet receiver, dryer, N2 generator & N2 storage tank, excluding piping & installation.

NITROPURE ON-SITE NITROGEN GAS GENERATOR

We hope that the above write-up and sample calculations will help you in your decision process for an on-site nitrogen gas generator. If there are any more questions, please feel free to consult us at any time, we will be happy to help you. Thank you.

Best regards,



Airfilter Engineering (M) Sdn Bhd
Frank Ortjohann
Director

About Us

AIRFILTER ENGINEERING (M) SDN BHD

AIRFILTER ENGINEERING (AFE) was established more than 20 years ago in Malaysia as a manufacturer of compressed air and gas purification products. The company started off in 1993 with production of compressed air filters and elements, selling mainly to the small domestic market. Today Airfilter Engineering is an ISO9001 company recognised globally as a manufacturer of high quality products. The company produces an extensive range of products including filters, dryers, elements, separators, adsorbers, condensate drain, gas generators and others. These products meet the industries specific requirements for clean, dry and technically oil free compressed air and gas; conforming to the recommendations of the ISO8573 for air quality and complying with the requirements of the European Pressure Equipment Directives (PED 2014/68/EU) and various other international standards.

The company is situated about a half an hour drive from Kuala Lumpur city centre, and close to Port Klang. The factory is fully equipped for production processes relevant to our products, with minimal out-sourced activities for better co-ordination and quality control. Our products are always checked and tested for quality and safety before they are packed and delivered to our customers.

The company maintains a team of engineers who are responsible to regularly check and ensure our products comply with latest relevant international standards and to continuously implement improvements to the features, performance and quality of our products. New product ranges are introduced from time to time based on market feedbacks and requirements.

AIRFILTER ENGINEERING products are marketed worldwide through our global distributor network, together with our subsidiary office in Germany and associated offices in Malaysia and Singapore. We also work closely with machinery original equipment manufacturers (OEMs), example compressor and dryer manufacturers, supplying them with customised and privately labelled products.

For more information, please visit our website at www.airfilterengineering.com or contact us directly.