Application of Nitrogen			
Industry	**Brief Process Description**	**Gains to user**	**Typical Gas Consup.n**
(A)	**(B)**	**(C)**	**(D)**
Chemical Industry	Blanking in process plant / storages	Essential to eliminate	Dependent on plant size
	against oxygen moisture, etc & also pressure transfer of sensitive chemicals	oxidation, explotion, fire hazard	
Pharmaceutical Industry	(1) Blanking in process / packaging against oxidation, contamination.	(i) Prevent oxidation, contamination for product quality	-----do----
		(ii) LN availability more	Dependent on process
	(ii) Controlled low temperature in manufacturing process by indirect colling using liquid nitrogen	stable and similar to use compared to dry ice.	furmers design and size
Metal working,Engineering, Auto-mobile, Bearingmanufacturing	Nitrogen based controlled furnaceatmosphere in heat treatment process like annealing etc. of metals. Atmosphere of desired composition and character is made by selective addition of hydrogen as appropriate to specific heat treatment process and metal to be treated.	Alternative to generated Exothermic /Endothermic atmospheres using hydrocarbons (Kerosene, Diesel, LPG) as feed stock. Gains are improved end-product quality, no generator operation and maintenance, improved safety	Dependent on process, Furnance design and size.
Manufacturing of tools, Bearing, Rolls	Liquid nitrogen sub-zero treatment subsequent to hardening process to reduce retained austerite in the treated component	Improved product hardness and dimentional stability Liquid nitrogen application cn achieve lower tempreature, a limitation for carbondioxide and mechanical systems	0.3 to 0.5 kg. LN/kg steel
Continuous Casting in Steel Industry	Liquid of hot metal stream against atmosphere oxidation during continuous casting of special steels	Avoide surface oxidation and defects.	$3m^3$ / tonne of steel
Aluminum Industry	(i) Nitrogen - Chlorine mix degassing Process for hydrogen removal from molten aluminum	(i) Use of only chlorine or hexachloroethane tablets suffers from objecbie and corrosive furmers problem which is reduced to negligible limit by nitrogen mix	(i) 0.2 M^3 / tonne
	(II) Inerting Colling of aluminum extrusion die by passing gaseous or liquid nitrogen application	(II) Increased extrution speed and better product quality by avoiding oxide build up at die. Fewer die changes and reduced down time	(II) 10 to 40 M^3 / tonne

Powder Metallurgy	Atomising metal stream by nitrogen to produced powder metal for making perform or sintering, hot iso static processing to end - product	Fewer process steps, better mechanical properties and higher yield compared to conentional ingot process.	$3M^3$ /kg
	Shrink fitting of metal components nitrogen and allowing to expand for interference fitting to outer Component	Fast process. No damage to components due to distortion scoring metallurigical changes possible in conventional methods like heating outer components or force fitting inner	1kg Lu/kg
Research	Low temperature simulation	Easy temperature control and essential to attain lower temperature beyond the scope of	Process dependent
Oil & Gas	Oil - well stimulation using nitrogen at high pressure	Essential fast process compared to swabbing involving high cost by rig time	Dependent on individual well condition
Glass Industry	Nitrogen / hydrogen protective atmosphere for tin bath in glass sheet production by float method	Essential use	Plant size determination flow requirement.
Galvanized / tinned sheets	Nitrogen or Nitrogen - hydrogen protective atmosphere for galvanising / tinning of steel sheets.	Improved product quality	Plant size determination flow requirement
Rubber Plastic Industry	Moulded rubber and synthetic components cooled with liquid nitrogen embrittle equipment	Fast automatic operation compared to labour intensive Low rejection rate of finished product	0.5 to 1 kg / kg
Rubber Chemicals Plants Spices and other food items	Cooling of Grinding mill environment using liquid nitrogen to counter heat builed up in the system	Increased grinding mill throughput. Better ground product characteristics	0.5 to kg/ kg
Storage of Biologicals	Storage of blood, tissues, vaccine, virus, semen need controlled low temperature. Liquid nitrogen is used for storage and transportation to maintain desired temperature range.	Simpler to control temperature and an achieve lower temperature, a limitation	Product and temperature dependent

Frozen Food	Variety of marine products, meat poultry, convenience food, fruits are friozen / chilled for preservation. Direct liq. Nitrogen spray is used in tunnel cabinet freezer for the process. LN ideal for individual quick freezing (IQF) which considerably lowers dehydration and drip loss retaining nutrients and taste.	Lower capital investment compared to mechanical system and lower maintenance requirement. Value added IQF product retaining taste, flavour, colour and nutritional value with lower drip and dehydration weight loss.	Dependent on product, size, freezing , chilling temperature.
Food Transportation Instrument Refrigeration	Controlled liquid nitrogen spray inside insulated cargo chamber to maintain present tempreature appropriate to the food product during transportation	Simple to operate and control tempreture. Dependable alternative to mechanical refrigeration system susceptible to break down	Dependent on cargo size, insulation, target tempreture for product being transported
Plastic Film, magnetic tape manufacture	Liquid Nitrogn application for solvent recovery by condnsation and gaseous nitrogen for blanketing solvent vapour	Recovery of solvent fire hazard and pollution control	Dependent on production plant, design and size.
Civil Construction, Pipe line repair	Soil freezing for stabilization of ground for tunnelling shaft sinking etc. Also freezing of liquid to soild plug in pipeline for repare of pipe section, changing of valves etc.	Stabilisation for civil work, quick freezing and repare of pipeling to restore services rapidly	
Coal Mining	Nitrogen flushing in under ground coliery to control spontaneous heating and fire by	Can be adopted quickly using mobile LN and vaporisation system, salvaging of	