NEMCO LDAC

World Changing Technology for a Sustainable Future

What the Third Wave in Air Conditioning Technology Looks Like

A Total Makeover in Air Conditioning Technology
No more Toxic Chemical Refrigerants
No more Metal Boxes, Pumps or Compressors
No more Cooling Towers

Air conditioning systems are currently a major contributor to greenhouse gas emissions and the amount of air conditioning systems installed is predicted to double in the next nine years. Climate change is the most urgent and difficult problem humanity has ever faced. Climate change will involve not only a gradual increase in temperatures recorded but also an increase in the humidity levels, which will present more problems for conventional air conditioning systems. Air conditioning systems already use 15% of global electricity and huge amounts of fossil fuels, and are responsible for the peak loads on electric grids, causing brownouts and blackouts. Current electric refrigeration systems use toxic chemical refrigerants that are up to 2,000 times more harmful to the environment than CO_2.

Future air conditioning systems must eliminate the toxic refrigerants as laid out in the 2016 Kigali Refrigerant Ban. They must minimize electricity and fossil fuel use and use clean renewable energy sources. Air conditioning systems must also become a cleansing source for the indoor environment rather than a dispenser and spreader of diseases and indoor pollution. Effective control of both humidity and temperature will also be a key requirement with the increasing humidity levels. Future systems must also be much easier to maintain than the current overly complex systems.

NEMCO LDAC solves all the current and future foreseeable heating, ventilating and air conditioning issues.

The Development of and Science behind NEMCO LDAC (Liquid Desiccant Air Conditioning)

Grahame E. Maisey, P.E., has been a leader in sustainable building energy systems' development since the mid 1980's. In the process of developing energy conservation plans for facilities, he has instrument tested mechanical systems in over a hundred hospitals and a score of universities that have given him a unique insight into the actual as well as the theoretical working of many types and sizes of mechanical systems. Beverly Milestone, LEED AP, and Grahame started a consulting company in 1985, working for some of the largest architects and engineers in the US and performing energy studies. In 1992, they invented Energy Master Plans (EMPs) and improved them to positive energy buildings in 1995, where the whole life cycle performance of the energy systems in the building, facility or community is transitioned toward energy independence. Their EMP starts with lofty sustainable, high performance end goals and works back from them to the current performance, a method known as back casting.

Current air conditioning systems are a major energy, maintenance and indoor environmental quality problem for building owners and occupants and a major roadblock to energy independent buildings. They also use large amounts of electrical energy, currently 15% of global electricity, causing peak electrical loads and blackouts during hot weather, and account for over 25% of the peak electrical load on electric grids. Current commercial systems are often so complicated and complex in their effort to be energy efficient that they are difficult to commission and operate, and often are impossible to maintain. Air conditioning systems also often result in poor indoor temperature, humidity and air quality problems as well as transferring diseases and infections through the air systems.

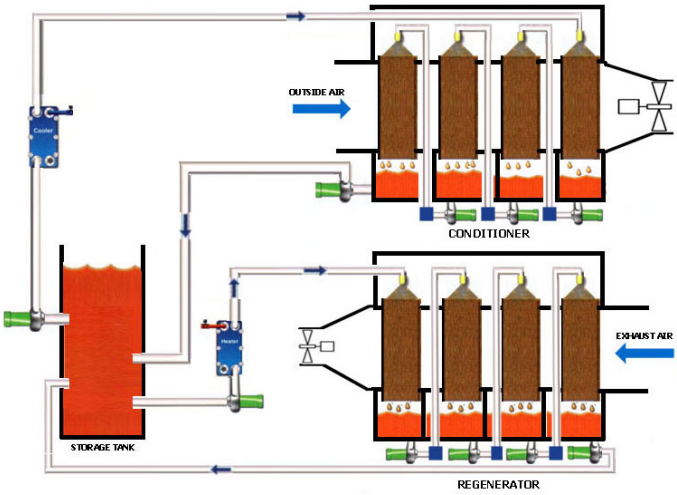
NEMCO LDAC Technology Specifications:

Use 65°F to 85°F cooling source (ground heat exchange/return chilled water/absorption refrigeration).
Use 80°F to 100°F warming source for 85°F to 98°F supply air (solar thermal/waste heat).
Use solar thermal for dehumidification and warming, and waste heat where available.
Minimize air pressure loss through the system to minimize fan power requirements.
Minimize pumping requirements.
Provide separate humidity and temperature control to create optimum indoor environmental conditions.
Clean, purify and sterilize the air using minimum conventional mechanical filtration.
Be capable of introducing 100% outside air without increasing electrical use.
Easy, preventive maintenance and predictive maintenance

NEMCO LDAC has uncovered the full potential of liquid desiccant air conditioning technology by back casting from sustainable, high performance end goals and developing a system that will meet all the above requirements.

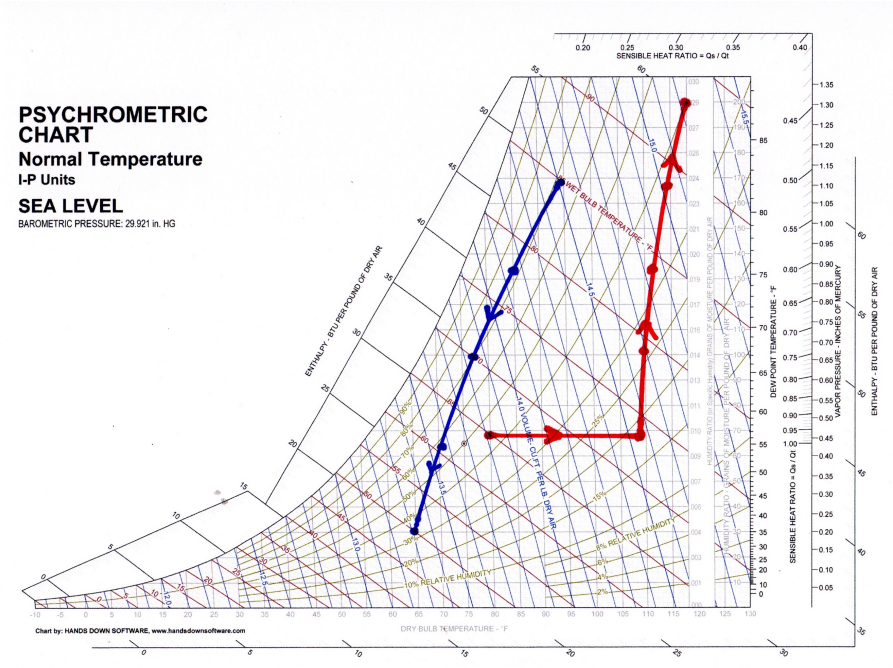
NEMCO Prototype

NEMCO PROTOTYPE



NEMCO Schematic Prototype

The above NEMCO prototype schematic shows the design for equal energy work load on each media section. The system uses 10 pumps and 8 heat exchangers for a system that is a maximum size of 2,000cfm. The major limitations caused by reusing the desiccant through 4 media sections, limits the efficiency, effectiveness and size and air cleaning performance as well as the added complexity of pumps and heat exchangers and lack of flexibility and adaptability. However, we consider this our prototype that provided the performance information we used to develop a totally new and better LDAC technology, NEMCO LDAC. Most LDAC systems in development use a low flow strategy, minimizing the amount of desiccant required in the system; NEMCO LDAC does not. Others also are looking for a membrane system to isolate the liquid desiccant from the air stream; we believe this is a very limited application and conceptual problems that are difficult to overcome in practice. NEMCO LDAC uses up to twice times the liquid desiccant of other LDAC systems.

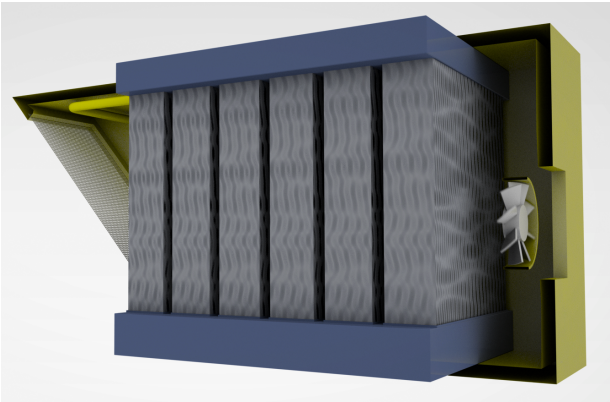


NEMCO Prototype Psychrometric Chart for Summer 100% OA

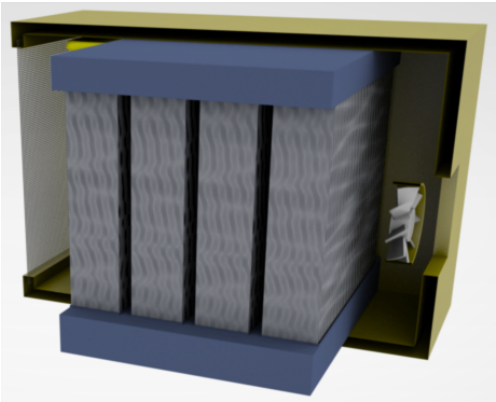
The psychrometric chart above shows the summer performance of the NEMCO prototype with 100% outside air at 95°F/85°F cooled and dehumidified to 65°F/50°F (33%RH). The conditioner uses 55°F cooling supply to produce the curve in blue and shows the near equal loads on each media section. The regenerator uses 140°F heating source to produce the curve in red. It shows the pre-heat and then almost equal loads on each media section.

NEMCO LDAC System

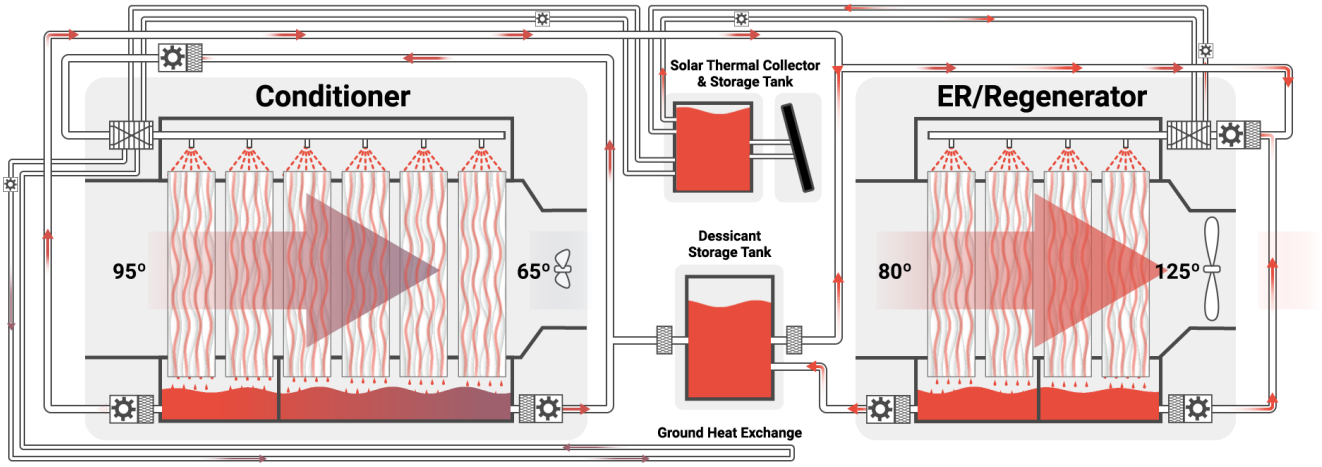
In developing the new NEMCO LDAC system, we went back to basics and adopted the back casting method, starting with lofty sustainable, high performance end goals, and worked unwaveringly toward all the end goals using a foundation of building science, engineering principles and LDAC physics. By doing so, we uncovered the full potential of Liquid Desiccant Air Conditioning with the patented NEMCO LDAC technology. The information provided from the NEMCO prototype gave us the data to develop our world changing technology ranging from large industrial size units to small room size units suitable for almost every application.



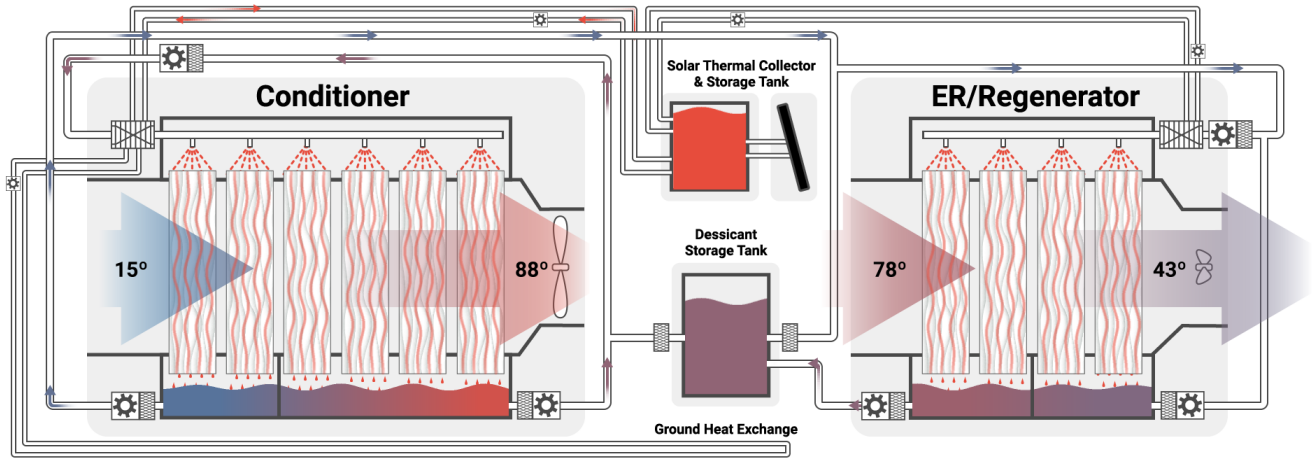
Commercial or Whole House Style Conditioner



Energy Recovery/Regenerator

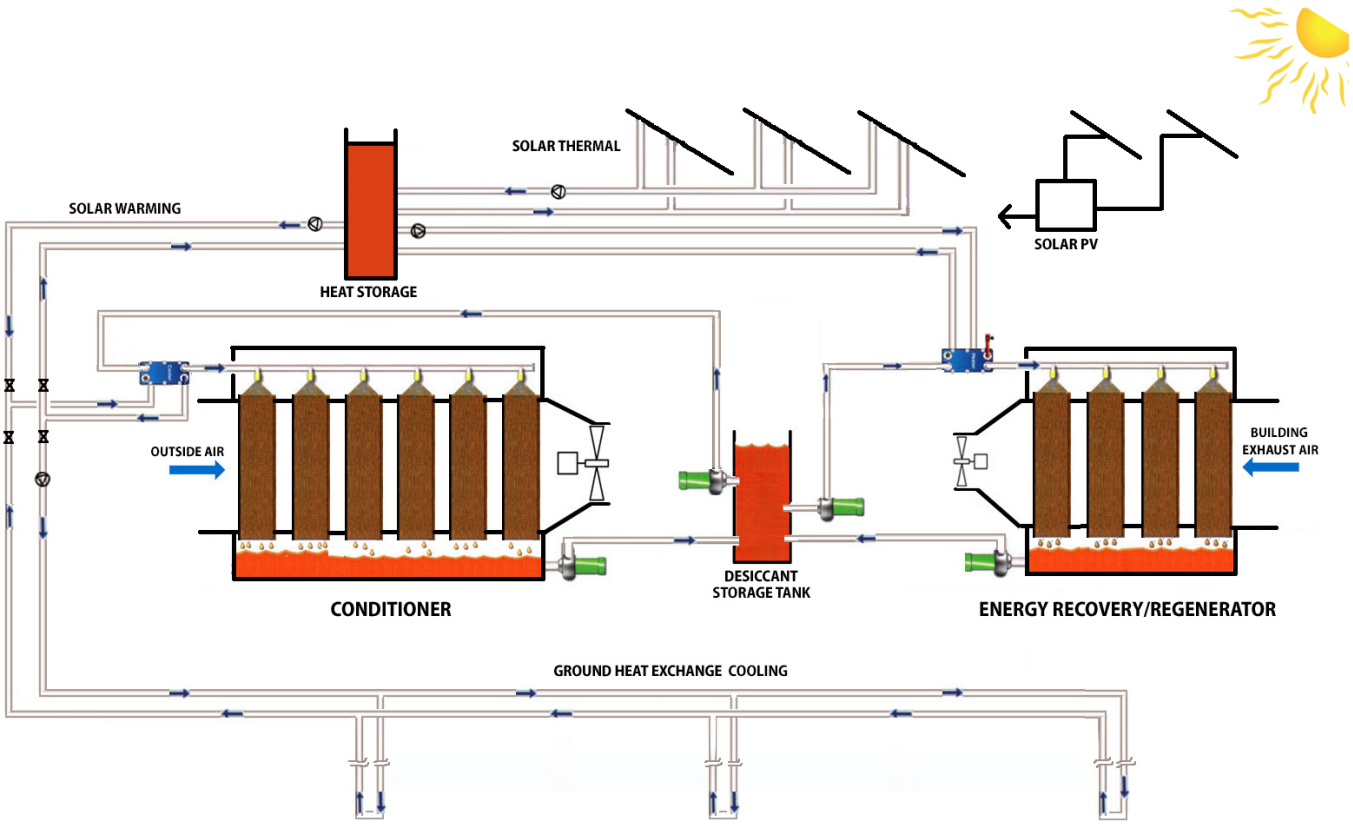


NEMCO LDAC Commercial Style Schematic showing 95°F/86°F, 100% Outside Air Including Ground Heat Exchange and Solar Thermal



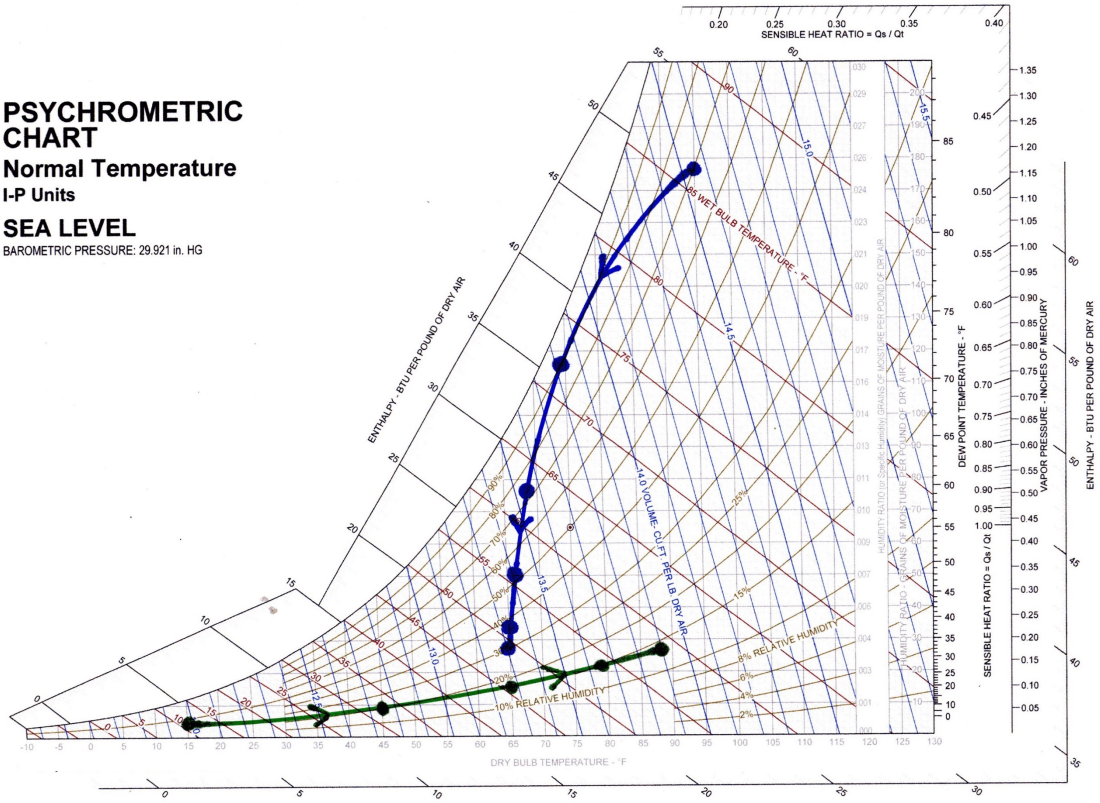
NEMCO LDAC Schematic showing 15°F/11°F

The schematic above shows both the simplicity and sophistication of the first high performance air conditioning unit capable of operating almost entirely on clean renewable energy sources. The almost unlimited amount of media depth that the conditioner and energy recovery/regenerator may have allows our system the capability of extreme efficiency and effectiveness. The system also has the flexibility in unit size from 500cfm to 100,000cfm. Division of the basins in the conditioner and the regenerator/energy recovery unit permits prudent use of the desiccant from storage while at the same time providing optimum energy transfer and maximum filtering, purification and sterilization of the air. The ability to have a 2°F differential between the cooling and warming source and the discharge air from the conditioner introduces the use of clean renewable energy sources worldwide as a 63°F supply temperature in the summer and 90°F in the winter is most achievable globally using clean renewable energy sources.



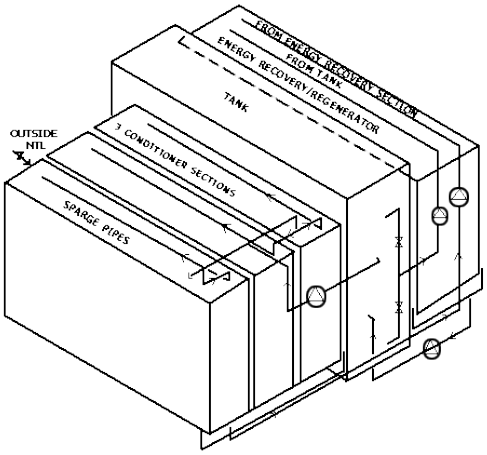
Schematic of NEMCO LDAC showing Solar Thermal, Solar PV and Ground Heat Exchange

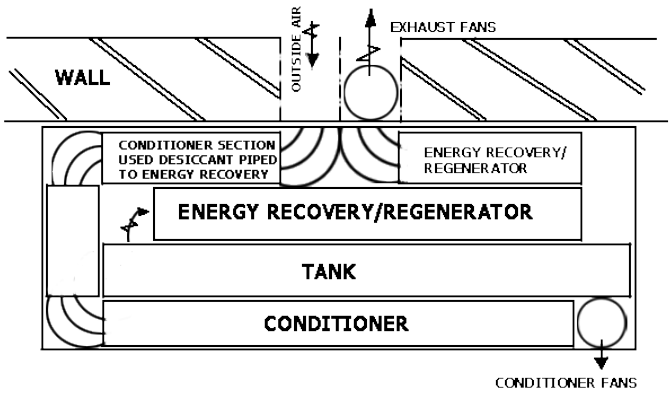
The above schematic shows how we use the ground heat exchange and solar thermal for the cooling and dehumidification



NEMCO LDAC Conditioner Psychrometric Chart for Summer and Winter 100% OA

The psychrometric chart above shows the NEMCO LDAC conditioner performance during summer in blue and winter in green. The summer 95°F/86°F air is cooled and dehumidified to 65°F/49°F (30%RH) using 63°F cooling source. Note that the initial media sections provide more energy transfer than the later sections and that the fifth section provides minimum energy transfer while the sixth section provides no energy transfer. The winter 15°F/11°F air is warmed and humidified to 78°F/59°F (14%RH) using 80°F warming source. Only 4 sections are used for energy transfer. The media sections not providing energy transfer at these conditions may be necessary at more severe conditions or may be there to provide more filtration, purification and sterilization and anticipate more severe weather conditions.





The drawing on the left is for a Unitary System that could be as small as 10cfm and as large as 200cfm. Unit shown is for a DOAS or window/wall unit 50-100cfm depending on height of unit. The drawing on the right is for a Unitary System that could be a wall or floor mounted Room or Zone Unit, 100-300cfm depending on height of unit.
Both systems could be a conditioner only with a central regenerator and storage systems, arranged much like the current VRF systems.

NEMCO LDAC patented technology is commercialization ready and will disrupt, transition and dominate the air conditioning unit market within 5 years.