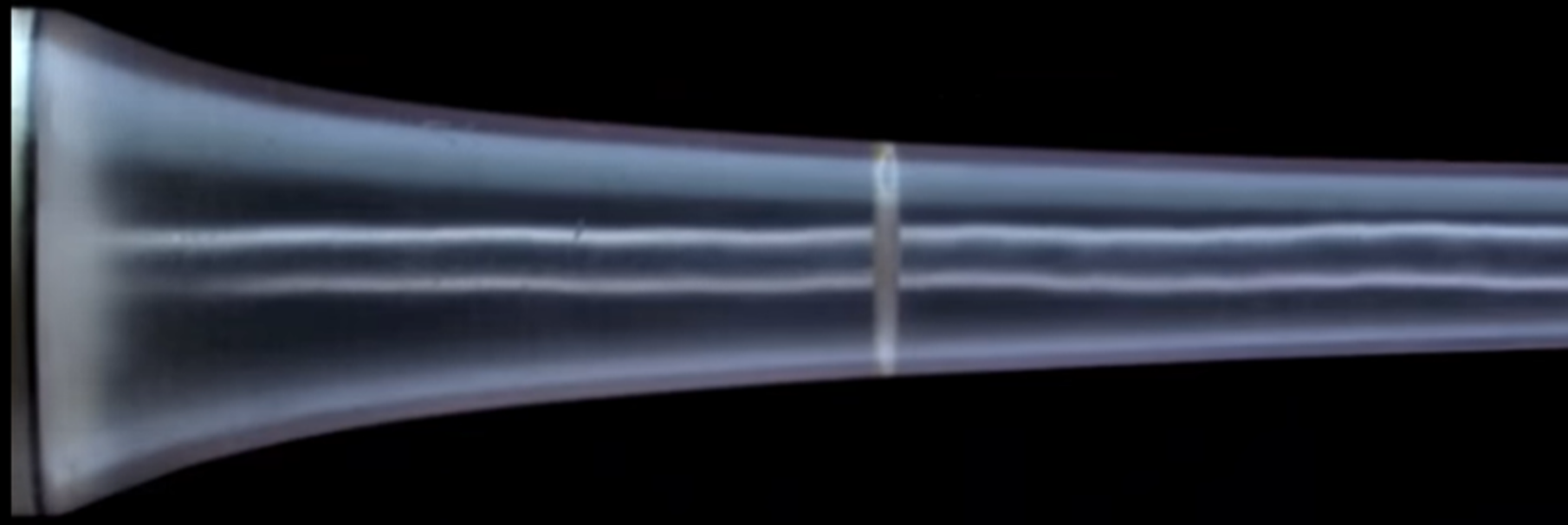
IVG-IR
BIOMIMETIC WATER TREATMENT SOLUTIONS
FOR IRRIGATION

OBSERVE AND BE INSPIRED BY NATURE

BIOMIMICRY?

A method of innovation which consists, when encountering a technical problem, to look at the models observed in nature for inspiration. The living has almost all the answers to the challenges that man has to face today.



"Nature is an infinite source of inspiration for engineering and the solutions we develop"

Our values

Our orientations and actions are in favor of responsible and sustainable development

Integrator of innovative technical solutions in the field of green technologies

Expertise

Water treatment
Irrigation
Waste management
Technical maintenance
Cooling towers

Clients

Tailor-made solutions adapted to everyone's specific needs

H2ovortex offers Nature Based Solutions
that meet both the environmental and financial challenges
industries face in the management of water consuming installations

Better managing your production facilities is:

Saving water

- The natural resources of rivers and aquifers are reduced
- 17 billion m3 / year used to cool power plants
- 3 billion m3 / year used for industry

Anticipating the increase in the cost of water

- The use of water in the processes represents an important item of expenditure which tends to increase
- The reduction in usage will lead to a reduction in expenditure

Reducing energy costs

- The increase in the cost of energy and the energy transition will lead producers to turn to less energy-consuming solutions

Respecting regulations

- Stringent health and environmental regulations

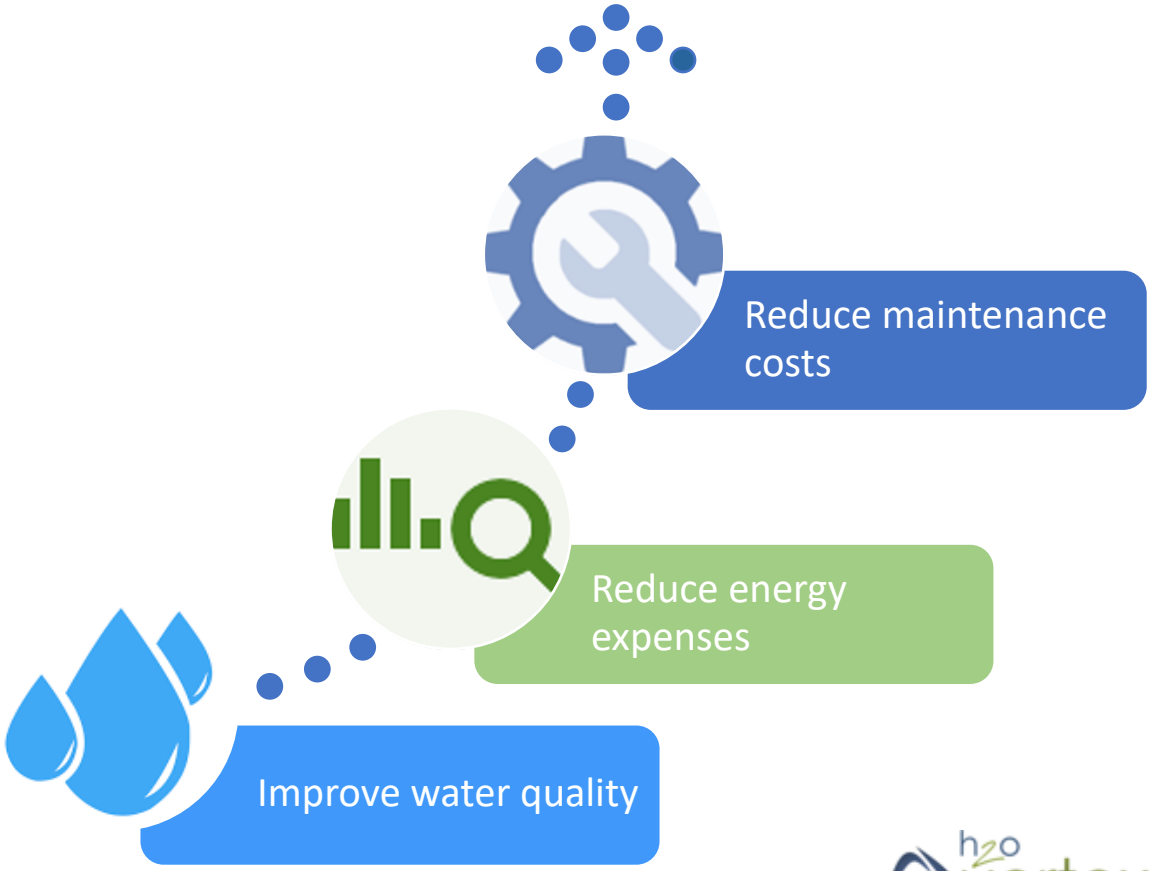
Reducing the use of chemicals

- Reducing the use of treatment products allows significant savings
- Reduce the release of pollutants

Optimizing maintenance

- Optimization of preventive and curative maintenance operations for installations
- Reduced cost of contracts

By means of our biomimetic technologies we enable you to increase the environmental and economic performance of your business



Patented, certified and awarded solutions in several countries

SWEDAC Certified

Pathema
Most Sustainable Water Cooling Treatments Provider 2019 Western Europe

Areas of application of our solutions

COMMERCIAL INDUSTRY

Cooling towers
Power stations
Industrial water treatment

ICE MAKING

Skating rinks
Food industry

AGRICULTURE

Irrigation
Crops
Aquaculture
Breeding
Slurry treatment

COMMUNITIES

Rivers, ponds
Treatment plants

WATER TREATMENT

Potable water
Performance improvement

Development, distribution
Certification, recognitions

Certifications, recognitions

- European Commission Horizon 2020 Matching Program
- Swedac Certified
- EPRI - Electric Power Research Institute study report: Study carried out from July 2016 to April 2020 in California on two sites equipped with cooling towers:

  https://www.etcc-ca.com/reports/cooling-tower-water-use-optimization-epicepri

- Report "The Use of Additives in Open Recirculating Cooling Systems" from the Dutch Ministry of Water
- DAkkS - Deutsche Akkreditierungstelle - accreditation on drinking water tests
- Certificate of conformity for food use - Food and Drug Administration
- IVG Cooling Tower Approved for Utility Incentives in USA
- SWEDAC Certified tes EPRI ELECTRIC POWER RESEARCH INSTITUTE / ISO Rijkswaterstaat Ministerie van Infrastructuur en Waterstaat DAkkS Deutsche Akkreditierungsstelle HORIZON 2020 MATChING

Certifications, recognitions

- 2020: Approved by DVGW W270 certification for its compliance with the PA2200 test
- 2020: Accepted in the European Horizon 2020 program for innovations in air-cooling towers

- 2019: Pathema: Receives the “Energy Innovator Award 2019” - the most virtuous supplier in the field of air-cooling towers in Western Europe

- 2015: REALice is referenced as part of the Utility Incentives in the USA and Canada - Recognized among the Top 20 Innovations by Esource

- 2011: Nominated for the “WWF Climate Solver”

- 2009: Nominated at the “Clean Tech Awards” in Sweden

Our solutions are recognized by energy producers in North America and approved for manufacturers to qualify for subsidies

CLEANTECH HUBS
INNOVATIONS BY SWEDEN
Sweden
Sverige

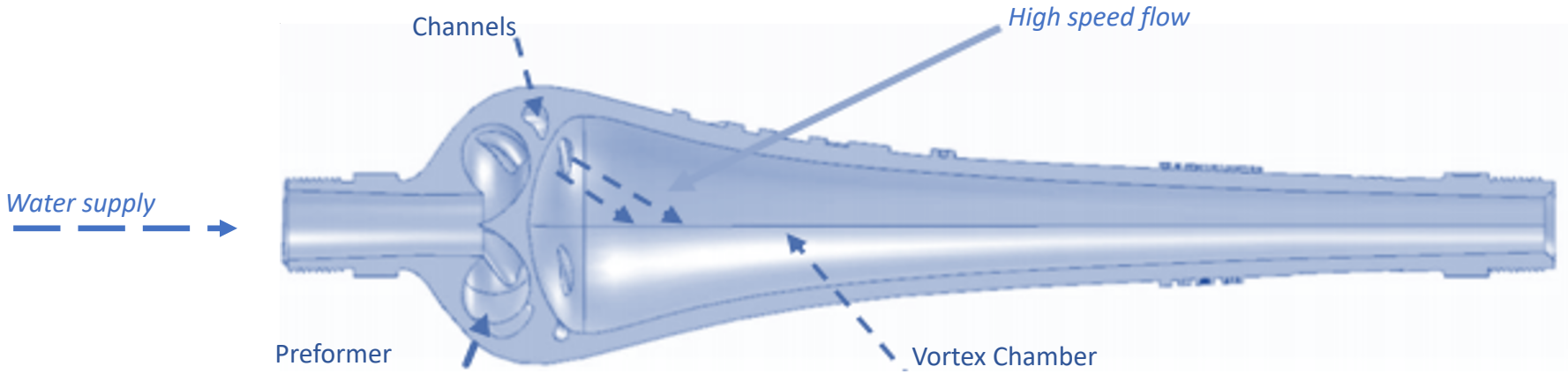
CV ENERGY INNOVATOR AWARDS 2019
Pathema
Most Sustainable Water Cooling Treatments Provider 2019 Western Europe

nationalgrid
NYSEG
TACOMA POWER
Xcel Energy
TORONTO HYDRO
BC Hydro Power smart
SoCalGas
A Sempra Energy utility
Efficiency Vermont
CenterPoint Energy
PSE PUGET SOUND ENERGY
EVERSOURCE

Vortex Process Technology Platform

Vortex Process Technology - VPT: The vortex shapes the flow of water passing through it

The technology creates a large vortex movement within the liquid with high pressure gradients and very low central pressure. Cavitation is performed in a controlled environment



Pre-former

Inlet of the vortex generator provides smooth outward direction of the flow through toroidal motion toward a set of well-defined channels.

Channels

The fluid is directed through a set of channels, each with vortex-forming geometry. Each channel delivers a very high velocity stream of vortex flow tangentially into a vortex chamber

Vortex chamber

Vortices from the channels form a strong and stable vortex flow causing a strongly reduced pressure along the vortex axis with a very low central pressure There is very high pressure at the periphery and almost vacuum in the center

VPT Techno

Focus on VPT: Transformation of the water inside the vortex chamber

STEP 1

The microbubbles in water are sucked into the chamber at very low pressure, they migrate to the center where the pressure is lowest, then are accelerated due to the pressure gradient.

The bubbles expand and combine in the center, which has very little pressure.

A powerful hydrodynamic force creates cavitation which changes the balance of the water and affects the calcium crystals in the water.

STEP 2

Controlled cavitation leads to the formation of limestone particles.

The process produces a micro zone at low pressure and high temperature (the solubility of $CaCO_3$ decreases), causing the reaction of calcium ions and dissolved carbonate and the formation of crystals of colloidal calcium carbonate. The cavitation phenomenon acts on the pH by increasing it.

STEP 3

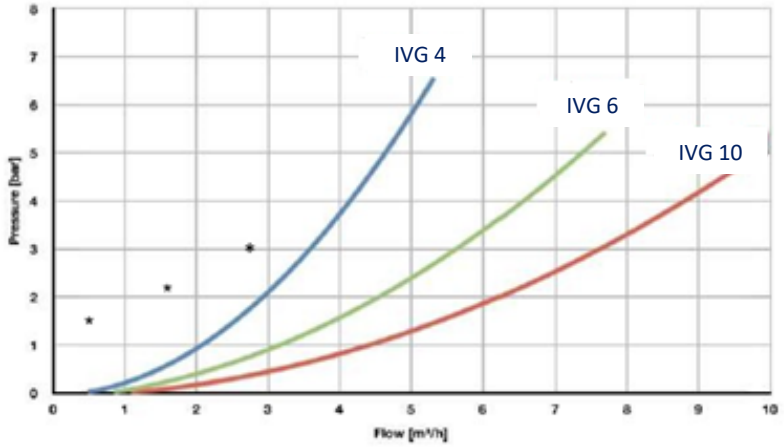
This phenomenon allows the particles to act as incubators so that the dissolved calcium and carbonate ions aggregate rather than attach to metal surfaces.

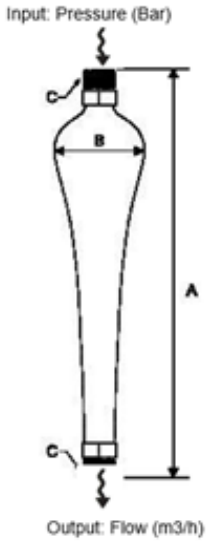
The limestone particles already formed fragment when they pass through pressure gradients undergoing shear forces.

STEP 4

Calcium bicarbonate ($CaHCO_3$) in water is forced to precipitate as calcite ($CaCO_3$) - mainly aragonite crystals with minimal scaling properties - do not crystallize on hot surfaces.

A range of standard solutions for multiple applications





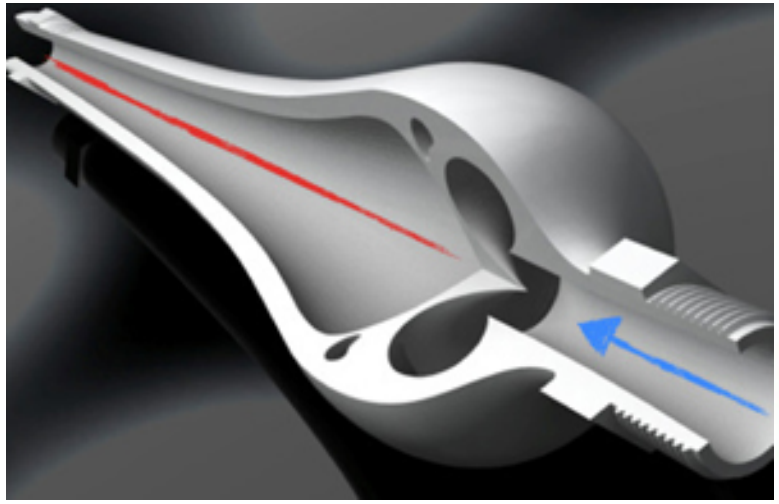
	Watreco IVG 4	Watreco IVG 6	Watreco IVG 10
			
Max pressure - 20°C	16 bar/232 PSI (PN16)	16 bar/232 PSI (PN16)	16 bar/232 PSI (PN16)
normal flow 3-5 bar	4m3/h / 1057 gal/h	6m3/h / 1585 gal/h	10m3/h / 2642 gal/h
max temperature	80°C / 176 F	80°C / 176 F	80°C / 176 F
Length (A)	376 mm	461 mm	544 mm
Diametre (B)	82 mm	96 mm	120 mm
Weight	0,32 kg	0,46 kg	0,93 kg
Connected to (C)	ISO 228-G1°	ISO 228-G1°	ISO 228-G1/4°

Easily integrated into processes and sized for the specific needs of the installation

- Vortex Process Technology (VPT) are made of PA2200 based on polyamide 12
- Standardized product range for a wide range of applications
- High resistance of equipment to pressure
- Usual service temperature -40C to + 80C (maximum mechanical resistance)
- Good chemical resistance * (report on request)
- Excellent consistent long-term behavior

- Equipment containing stabilizers against oxidation
- Numerous finishing possibilities (powder painting, metallization)
- Bio-compatible according to EN ISO 10993-1 and USP level 121C
- Approved for direct food contact European Directive 2002/72 / EC
- Freeform ® Manufacturing process

Vortex Process Technology - VPT




Efficiency

- Degas and eliminate microbubbles
- Degassing test: https://youtu.be/hPvBOmLx3gE
- Decrease in viscosity
- Increase in conductivity
- Increase thermal capacity
- Precipitation of calcium in non-adherent crystals
- Reduced corrosion

https://www.youtube.com/watch?v=ZWcBEPlj2-I

Installation Maintenance

- Mounted on existing plug and play installations
- No moving parts
- Minimal or no need to increase energy sources
- Temperature and pressure resistant materials (test reports available)

Integrated solutions

- Complementary technologies: UV lamps, electrolysis without chemicals, bactericidal filters, nanofiltration…
- Ventilation: Used to inject gaseous substances into the cavitation center of the fluid line / ex.
- The addition of an air hose provides a vacuum effect to draw the gases (or liquids) into the cavitation. The device acts as a combined static mixer and venturi type injector

AGRICULTURE - IRRIGATION

IVG-IR enables plants to use water more efficiently

By pumping water through the Industrial Vortex Generator, the water is continuously treated.

Environmentally friendly solution

Improved processes and efficiency

- Microbubbles of air present in water considerably affect its properties
- The water treated with the generator is vitalized, its viscosity is lowered and its molecules are structured so that the **plants absorb it more efficiently**
- **Pipe clogging is eliminated**
- Lower viscosity allows for better flow and reduces pressure on the irrigation system
- Easy to install and adaptable to irrigation systems of different sizes and types

Feedback and benefits observed on irrigation systems equipped with IVG-IR

The solution has been deployed on several pilot systems and the benefits have been measured in 4 independent studies (presented below)

Fertilizer savings

The use of fertilizers and chemical treatments are reduced

Improved production yield

Increased absorption of nutrients by plants

Increased plant growth

Better viability, weight Improved shelf life

Reduced maintenance costs

Less technical maintenance and replacement of parts due to scaling and clogging of networks

Feedback and benefits observed on irrigation systems equipped with IVG-IR

AL HAYER, Abu Dhabi: Cultivation of cucumbers

A test was carried out in collaboration between the Advanced Horticulture Company, Al Hayer, by Al Ain, Emirate of Abu Dhabi and H2vortex to study the effects of using the IVG-IR system on improving the productivity and other properties for growing cucumbers under local conditions in the Arab Emirates.

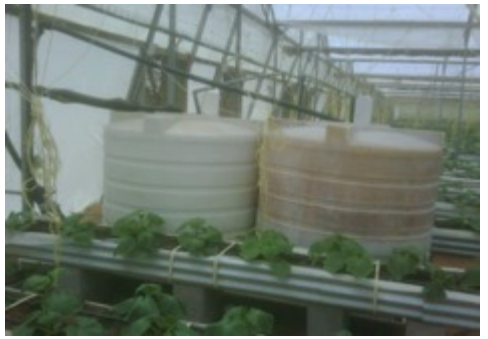
Test carried out by Food Safety Management Consultancy by Dr. Abdulla Ruwaida - detailed report available on request

Procedure and objectives of the study:

- Installation of a water tank treated with IVG-IR / 6 solution and untreated water tank (reference), from May to July 2011
- Comparison and measurement of the impact of the solution on the production yield of cucumbers See photos

Irrigation avec VGI-IR

Irrigation sans traitement



Feedback and benefits observed on irrigation systems equipped with IVG-IR

AL HAYER, Abu Dhabi Study Results:

- The IVG-IR culture generally showed better results than the reference culture (control) for all the parameters tested,
- The growth of the IVG-IR culture was slightly faster than that of the reference culture,
- The total yield expressed in **kilograms was 6.35% higher**,
- Cucumbers that were suboptimal or **rejected by the IVG-IR system were 19.75% lower**,
- The shelf life of cucumbers from the IVG-IR culture was much better than that of the reference culture when stored at low temperature.

In conclusion, the IVG-IR system has positive effects on:

- The growth,
- The yield of the plant,
- The quality,
- The shelf life of the product,
- The consistency and taste of the vegetable

Feedback and benefits observed on irrigation systems equipped with IVG-IR

Studies Development Research Center, Netherlands:

Cultivation of cucumbers

- A test was carried out by the Research Center on cucumber
- Installation of IVG-IR directly on irrigation systems

Results:

- Improved total yield,
- Significantly reduced rejects,
- Faster growth,
- Overall improvement in taste quality and shelf life

Feedback and benefits observed on irrigation systems equipped with IVG-IR

Swedish University of Agricultural Sciences: Early growth of tomato plants:

- A pilot study evaluated whether treatment with IVG-IR of irrigation water used on tomato plants had an effect on plant growth.
- Plant height, stem, width and internodal length were significantly different in tomato plants grown in IVG-IR process water compared to the untreated control.
- This study focused only on the early phase of plant growth and no other influencing factors were investigated.

SLU
Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences
Fakulteten för landskapsplanering, trädgårds- och jordbruksvetenskap

Effect of Vortex-processed Water on Tomato (*Solanum lycopersicum*) Plants

Effekt av vortex-behandlat vatten på tomat (*Solanum lycopersicum*) småplantor

Malin Vagnell

Feedback and benefits observed on irrigation systems equipped with IVG-IR

Studies Development Research Center, Netherlands: Growing paprika

- Paprika grown with IVG-IR treated water showed similar results to cucumbers
- Total return: **increased by 6 %**
- Discharges **decreased 19 %**
- Faster growth
- Overall improvement in taste quality

Feedback and benefits observed on irrigation systems equipped with IVG-IR

Audrey Wilkinson, Vineyards, Australia

- Implementation of the GVI-IR solution on vineyard irrigation systems
- Due to the soil's inability to absorb water, the vines in the test have never given grapes before.

- With the use of IVG-IR treated water - these vines produced abundant and high quality grapes.

- However, the performance has not been measured

Feedback and benefits observed on golf course irrigation systems equipped with IVG-IR

Technology dramatically increases water efficiency in golf course irrigation and results in greener, cheaper-to-maintain courses

Feedback has shown:

- Shorter irrigation time (up to 50%), which reduces irrigation costs and increases land availability,
- The increase in water absorption by soil and plants, even on water-repellent soils,
- Reduction of water consumption (up to 30%),
- Reduction of water wastage in runoff water,
- Improving results when the use of gray water / effluents is necessary
- Less brown spots and fungal growth on greens,
- Reducing the use of chemicals (wetting agents are no longer necessary), Greener golf courses

They trust us - testimonials

Client References

Heineken, NL Huntsmann, NL Friesland Campina, AMGEN, USA

Vriesoord, Den Bosch, NL LambWeston on, Kruiningen, NL Firma, Oostende, BE

Vitelco, Den Bosch, NL flevolof, PuYen Van Soest, Rijkevorsel, BE

Van Soest, Kesteren, NL Community Icerink, Breda, NL City of Hope, USA

VCA, Asten, NL MARRIOT Hotels, USA SMART DC, NL Grolsch, NL

AIR PRODUCTS, Gent BE

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