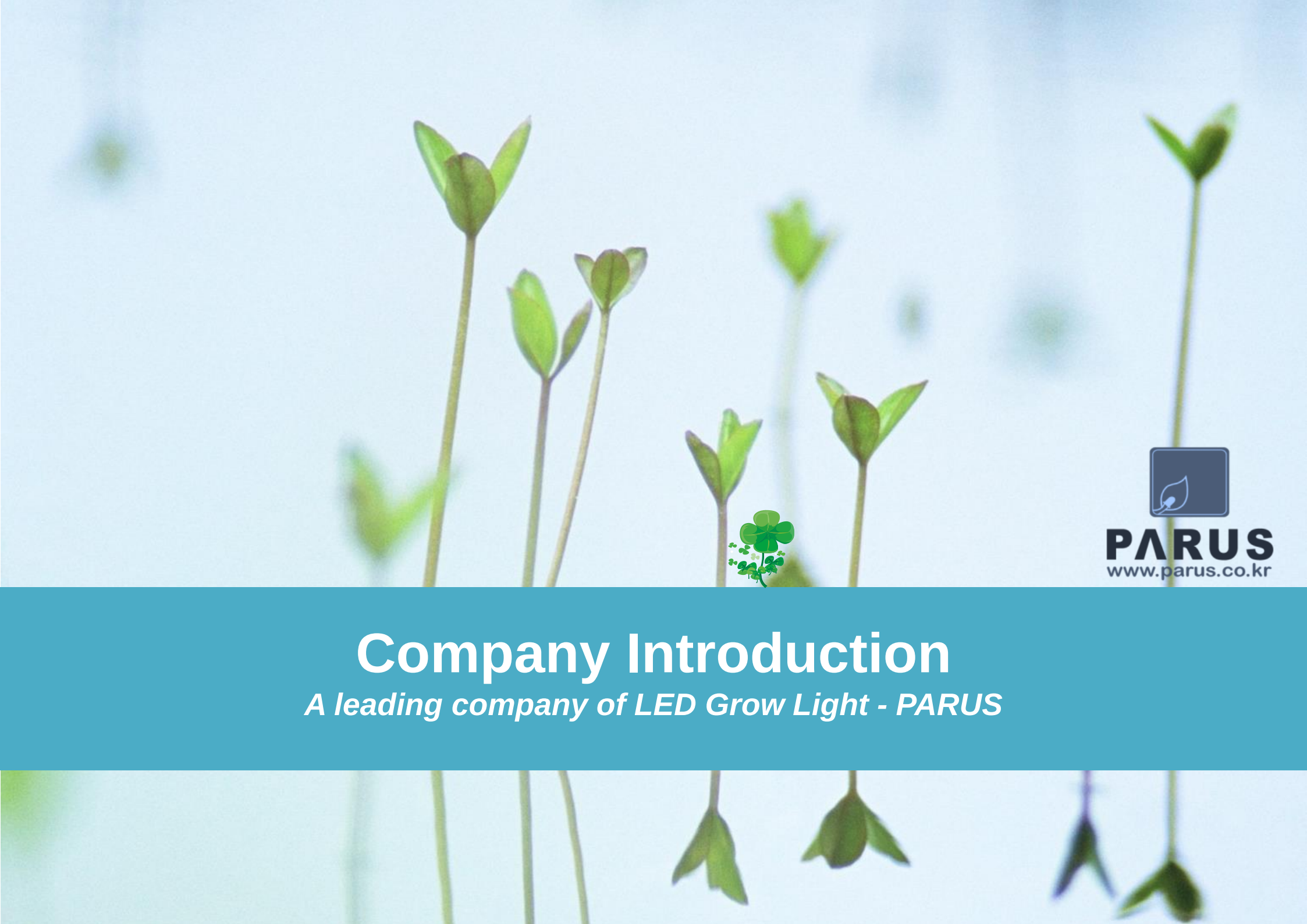
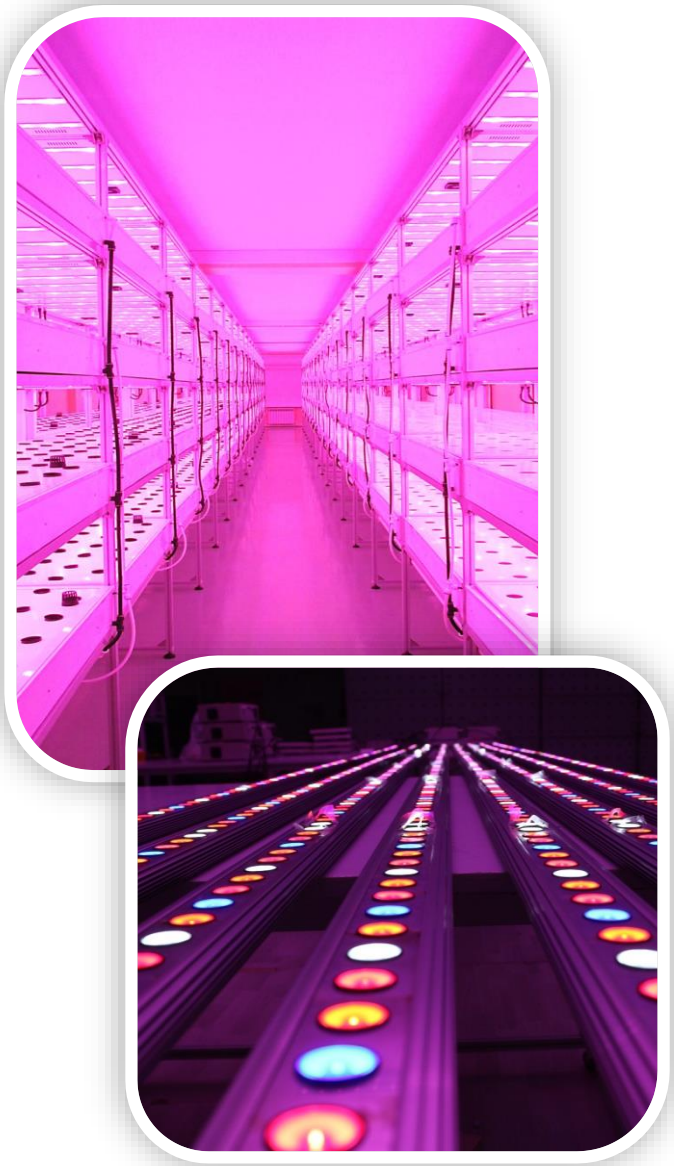


Company Introduction

A leading company of LED Grow Light - PARUS

PARUS
www.parus.co.kr



A professional LED grow light company

Since 2003

Dream feeds creativity and creativity actualize a dream. New ideas have changed the world and make our dreams come true.

PARUS knew the world trend, focused on environment & energy saving and conducted the researches & development, based on LED & solar systems in 2003. Starting with super-energy saving electrode less lamps, PARUS produced LED Lighting & LED Light box and products were exported to more than 27 countries. With its advanced technology, PARUS solely supplied the entire LED lightings and advertisement systems to Singapore Changyi International Airport, which was selected at the best airport in the world in 2007. Also, the company's technology was accepted for the supplies and installation of the railway station's advertisement and lighting system in Beijing China, before the Olympic Games in 2008.

PARUS developed & produced 1st generation LED Grow Lights in 2008 and succeeded in the plant factory system & 2nd generation Grow Lights in 2010. With this momentum, PARUS upgraded to 3rd generation Grow Lights in 2013.

Now

Based on the accumulated technology and know-how, PARUS is now producing the 4th generation LED plant culture system as a leading company in the world market. As a result of long and continuous study, PARUS has acquired lots of patents on LED Grow Lights and related products. For over 15 years, PARUS has set up the worldwide sales network – PARUS-EUROPE, PARUS-NORTH AMERICA, PARUS-RUSSIA, PARUS-MIDDLE EAST, PARUS-AFRICA etc.

Future

PARUS will never be content with this stage of development to maintain the leading position in the field of plant grow lights, and will continue to pursue higher development for "Environment Friendly Energy Saving Future", "Pursuing technology which human and plants want".

History of PARUS

Establishment of PARUS

Construction of R&D Centre and main factory in Shanghai, China

Development of LED Commercial Lighting

Conclusion of a product supply agreement with Japanese Bonheur Group

Development of Super energy saving LED Grow lighting

2003

2006

Establishment of LED technology development institute
LED Grow light components and plant factory system

Patent registration LED GROW Lighting

Development of LED Grow linear (PFL Series)

Establishment of Korean factory CheonAn. PARUS LED Co, Ltd

Development of solar systems Using LED

Development of Consumer products (LED grow lighting)

2008

Acquisition of CE certificate on entire products

Acquisition of cUL, UL certificate on RA & PFL series

Development of LED Plant factory system (Aeroponics)

Patent Registration Plant factory system

2010

Development of LED Active cooling system

Registration of LED heat radiation and processing technology

2012

Establishment of Russia Corp. (Marketing & Sales) PARUS Grow light Co, Ltd

Development of RA series 150w, 250w, 350w Replacement of HPS

Patent registration for plant culture LED lighting devices

Development of container type plant factory

Development of Plant factory system(remote control system)

2015

Establishment of PARUS EUROPE with Varipar, Holland

Development of RA700 COB Replacement of HPS1000W

Development of LED lighting on Water cooling system for PFL series and RA series

Development of WCIII technology, Grow white LED (High CRI)

2018

History of PARUS Research & Development

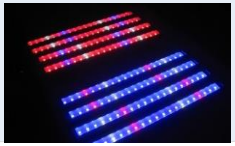
Have been providing products stably for 15 years with experienced know-how and technology

~2003

First generation
Round LED

2003~2007

Second generation
SMD



2007~2012

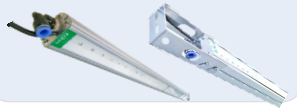
Third generation
Hi-Power & COB

2013~2016

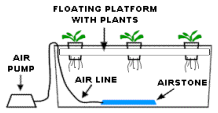
Fourth generation
LED COB Top-Lighting

2017~2018

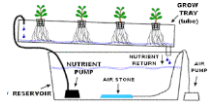
Fifth generation
High efficiency LED,
WCIII series, D-RBCII Series



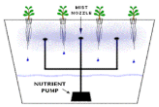
D.F.T



N.F.T



Aeroponic



Wavelength
R&D chamber

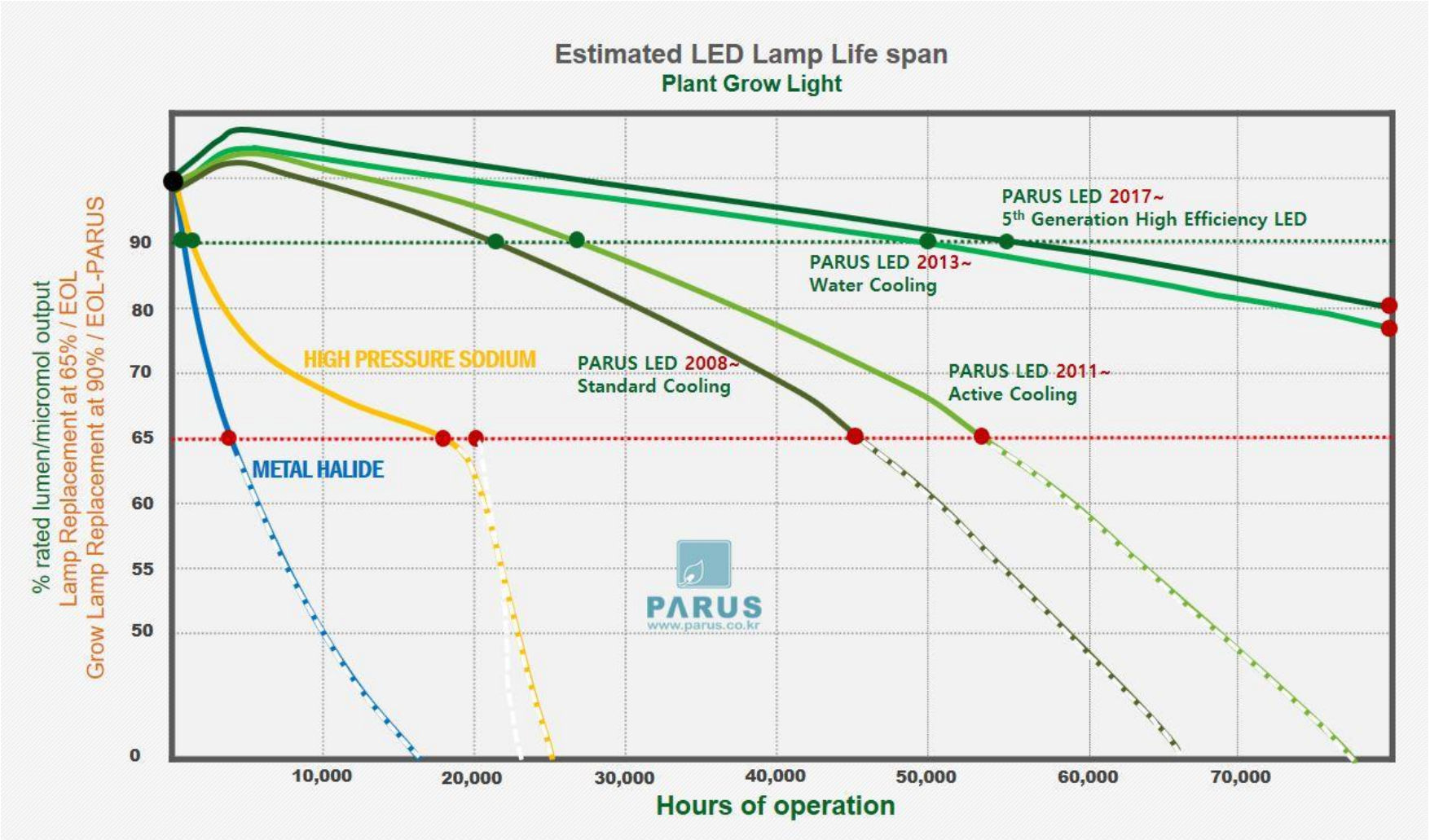
Wavelength
R&D chamber

Wavelength
R&D chamber

New Wavelength
RBW

New Wavelength
Grow White (High CRI)

History of LED Grow light's Life span



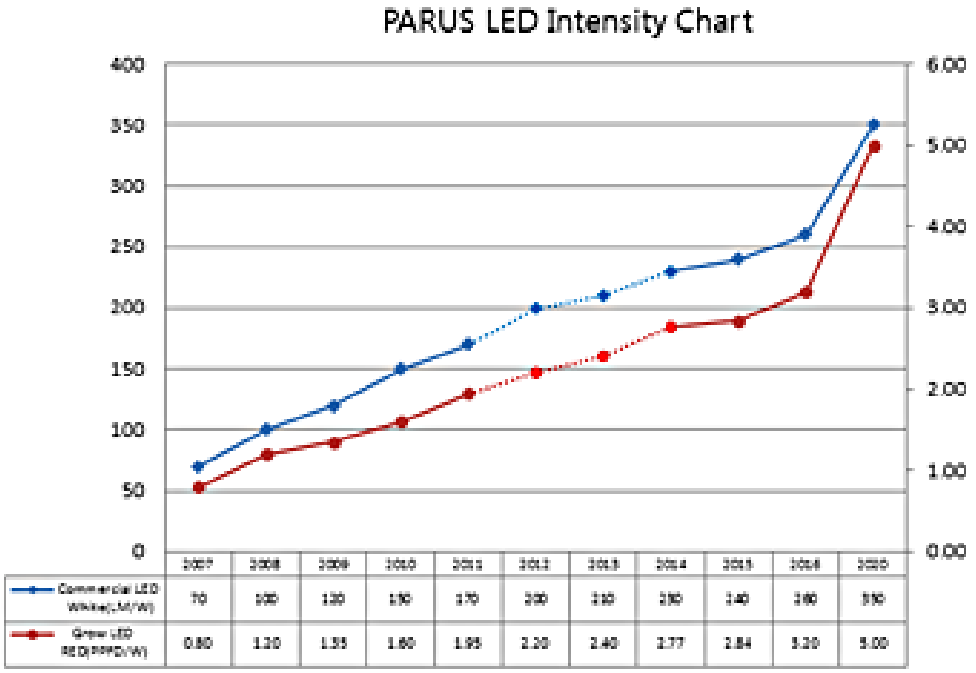
Commercial lamp life cycle
Lamp replacement at 65% / EOL

METAL HALIDE : 5,000hrs
HIGH PRESSURE SODIUM : 18,000hrs
PLANT GROW LED : 82,000hrs

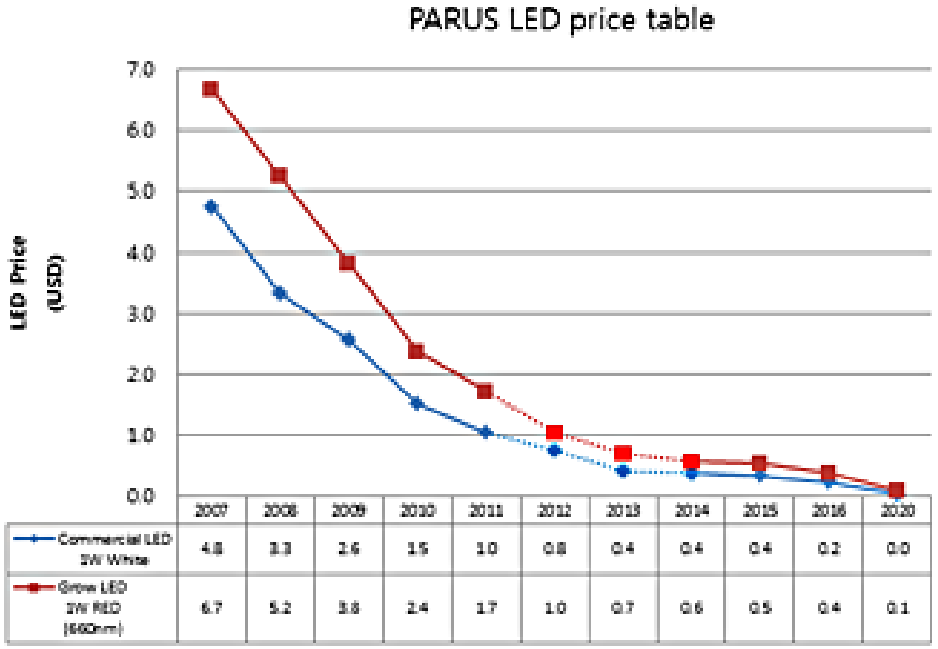
Plant Grow Lamp life cycle
Grow Lamp Replacement at 90%

METAL HALIDE : 1,000hrs
HIGH PRESSURE SODIUM : 1,500hrs
PLANT GROW LED : 82,000hrs

History of LED Grow light intensity & Price (2007-2018)



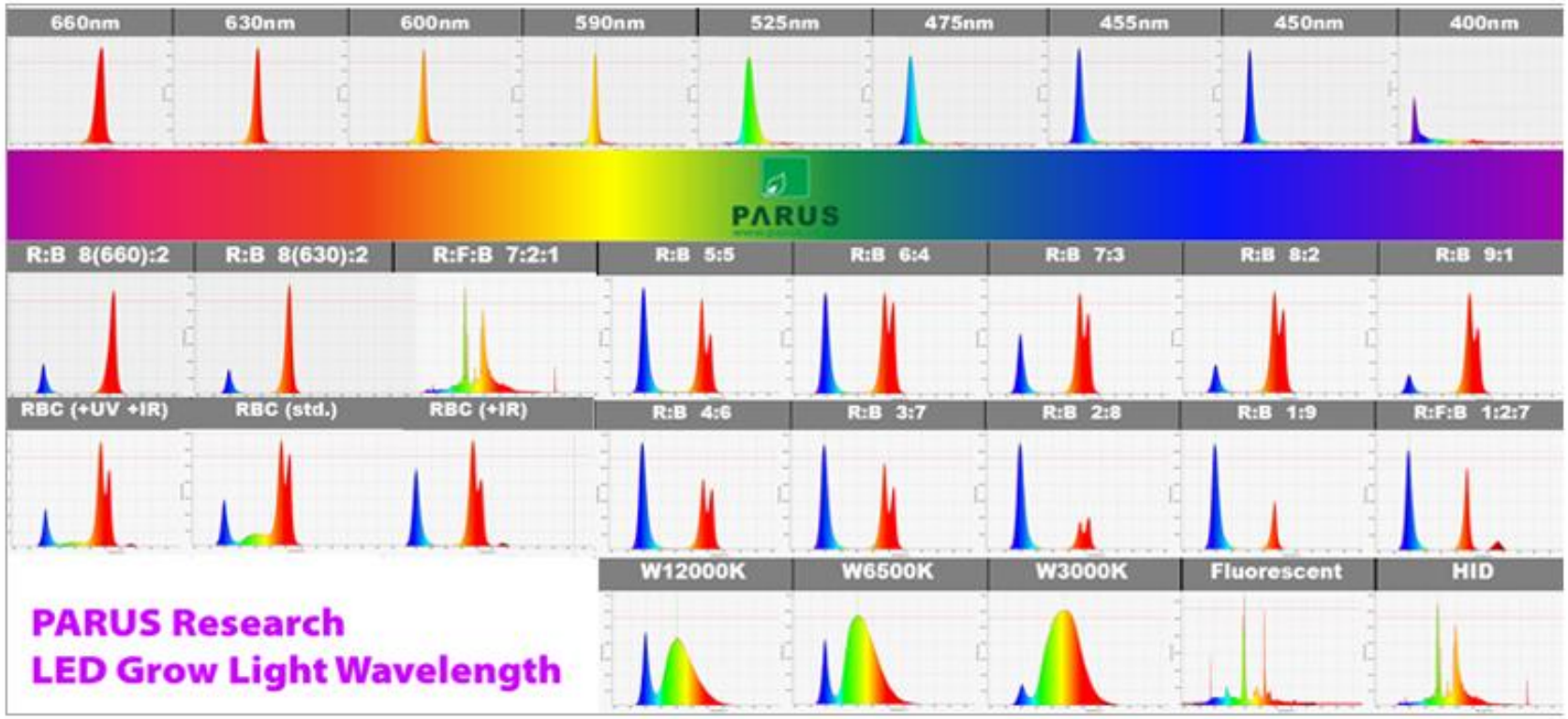
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020
Commercial LED 5W White(LM/W)	70	100	120	150	170	200	230	250	240	260	350
Grow LED RED(PPFD/W)	0.80	1.20	1.35	1.60	1.95	2.20	2.40	2.77	2.84	3.20	5.00



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020
Commercial LED 5W White	4.8	3.3	2.6	1.5	1.0	0.8	0.4	0.4	0.4	0.2	0.0
Grow LED 2W RED (660nm)	6.7	5.2	3.8	2.4	1.7	1.0	0.7	0.6	0.5	0.4	0.1

Research of the wavelength for growing plants
A comprehensive test using LED and General lights

Most of the plants photosynthetic characteristics is similar though, it is essential to research the optimal condition of growing plants in terms of productivity and energy saving.
The optimal wavelength absorbed by plant varies by its species, so it is very important to test response of a target plant to different wavelength and find appropriate wavelength for growing that plants.
PARUS R&D center developed the analyzing system, which makes comparison tests using same species with different wavelength to find out optimum and new better one.



Plant preparation

Plant : ***Dill Kerstin*** (seed info. : Sweden, 2012)

Germination — **2013. 6. 8 ~ 6. 17**
For this period seeds were placed in PMF-TC80, temperature was maintained at 20°C

Planting (plug) — **2013. 6. 17**
After planting, kept them under hydroponic system. Stabilizing, Adapting to hydroponic condition.

Transplant — **2013. 6. 22**
Seedlings were moved to wavelength analysis system.

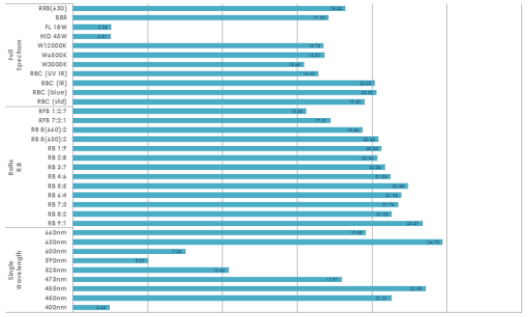
Wavelength analysis system

*Specially designed system for **wavelength analysis***
Different LED lights** of one comparing group have **same wattage.
See the light setting table on the next page.

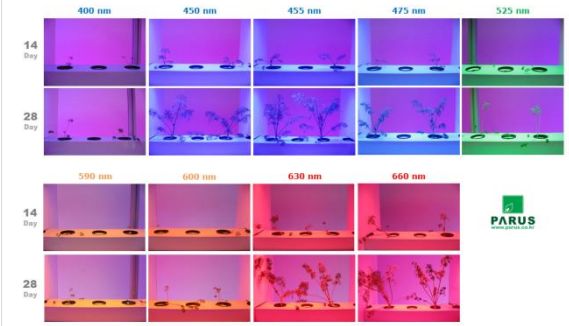
Environmental condition

Lighting period		16 hrs (on time 8:00 ; off time 24:00)
Hydroponic system		N.F.T
Nutrient solution	**EC**	2.5 mS/cm (± 0.3)
	pH	5.7 (± 0.3)
	DO	10 ppm (± 1.0) oxygen supplied by air pump
	Temp.	24 °C (± 0.5)
	cycle	2 min (circulation) / in every 30 minutes
Climate	**Temp.**	24 °C (± 1.0)
	RH	60 % (± 5)
	CO_2	400 ppm

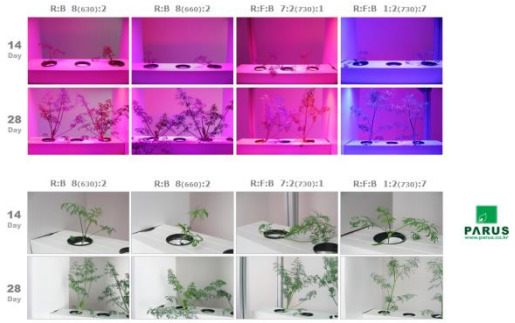
PPFD / Watt

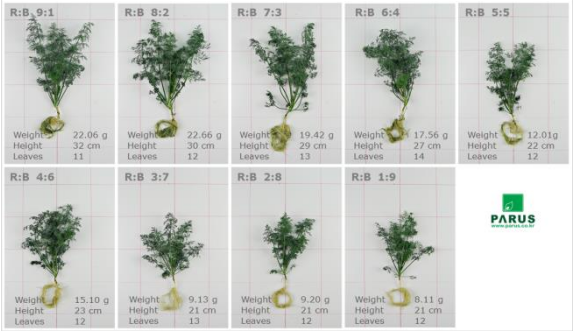


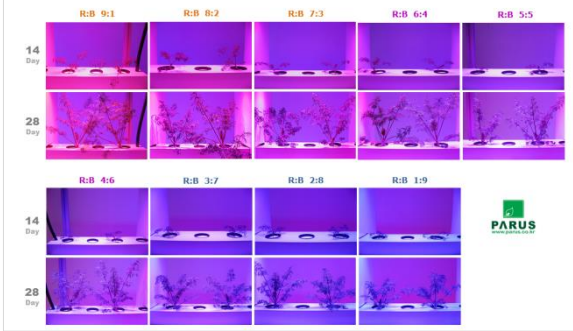
LED Single Wavelength Analysis
400nm ~ 660nm - 7watt



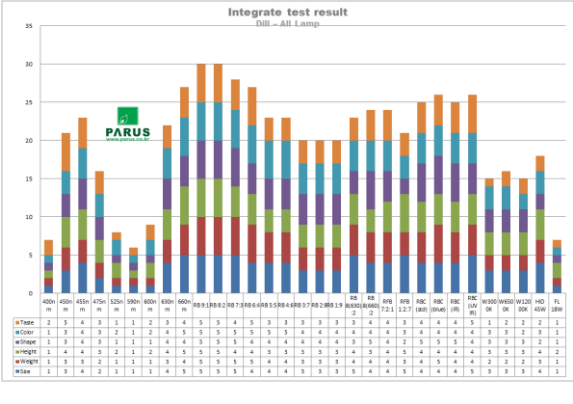
LED Ratio of light quality (Red : Blue) Analysis
9:1 ~ 1:9 - 10watt

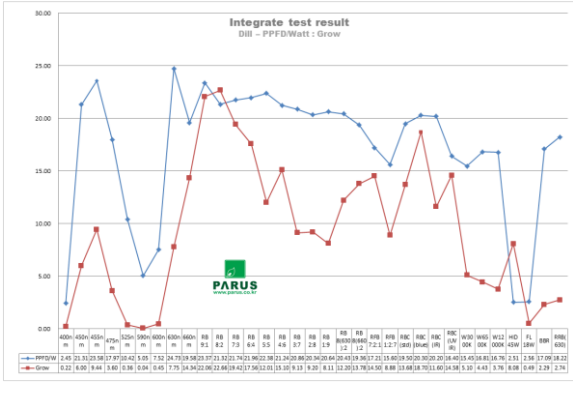






Full spectrum Analysis
LED RBC Spectrum





Configuration of the optimum LED wavelength for each plant

The data is calculated with application of data in the wavelength analysis system in order to identify optimum growth wavelengths, lighting intensities, pulses, and duty rates, etc.

20~30 days are taken.

Application test for each plant

Based on the obtained data, the culture test is conducted in order to configure other data related with culture.

20~40 days are taken.

Application to a plant factory

Automatic culture is performed by the control system when the configuration data is formatted and inputted in the control PC.

Variety of cultivation of the plant factory system

N.F.T nutrient culture research laboratory

Aeroponic nutrient culture research laboratory

Research of mushroom growth with LED

Analysis of the optical absorption characteristics of mushroom can present a solution for efficient production and energy savings.

Research of LED wavelength use of fish light

LED fish-luring light
In response to the specific wavelength, fishes gather towards it.
A LED fish-luring light was developed through this principle, fishing boats uses fish lights to capture specific fishes.

PARUS LED fish-luring light

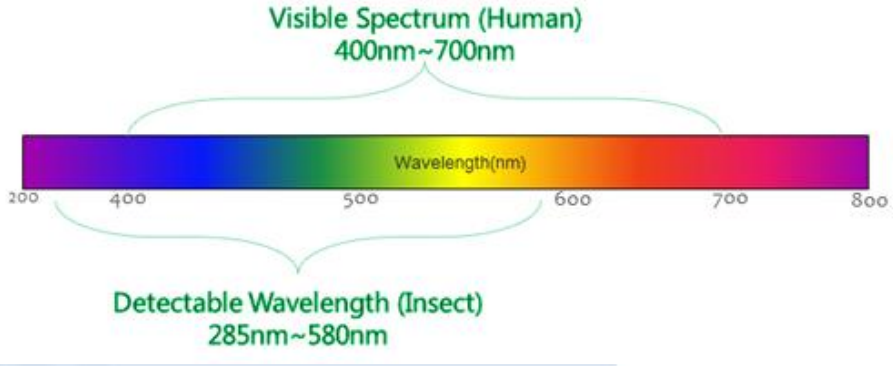
Insect vision and sensitivity to wavelength LED Pest control

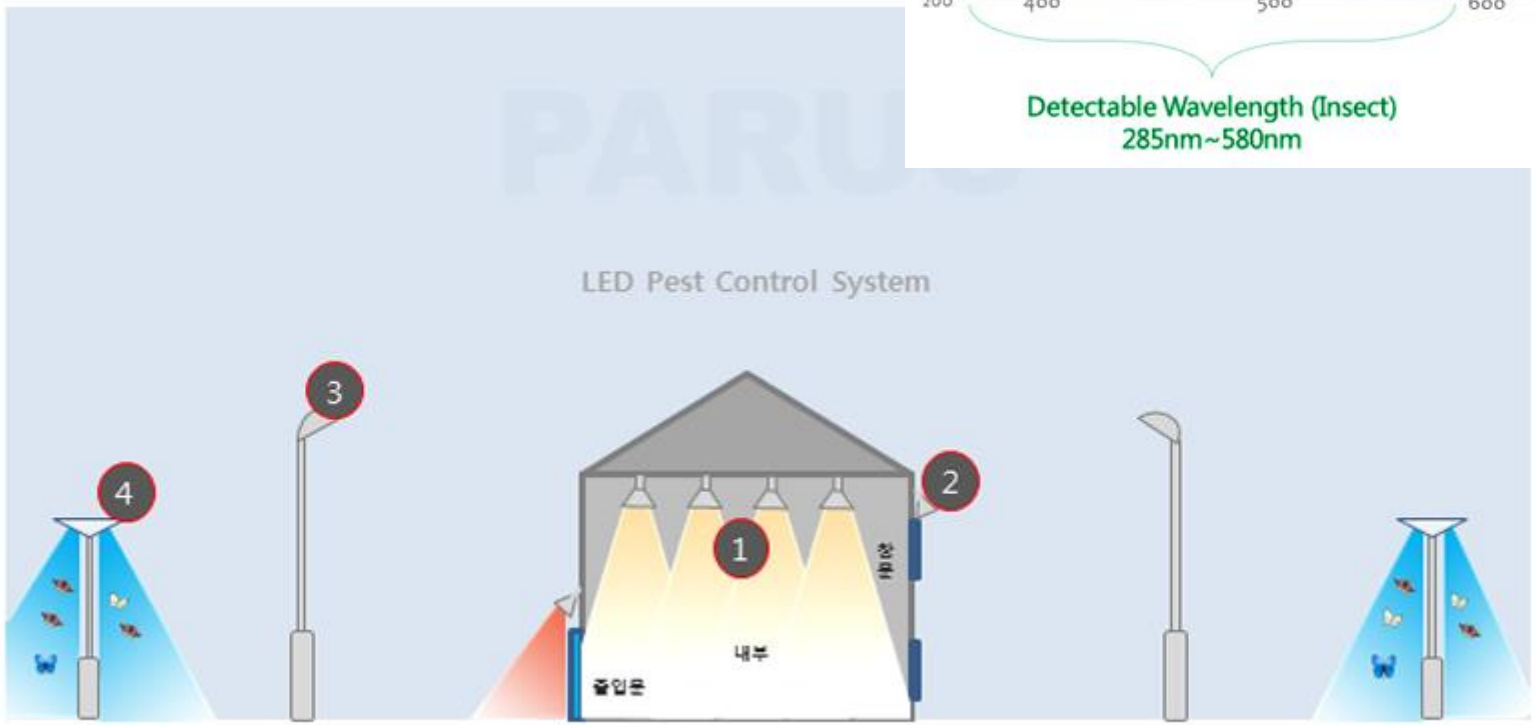
Human eyes can detect visible spectrum known as rainbow color, define the color of objects by reflection of light – mixture of wavelength.

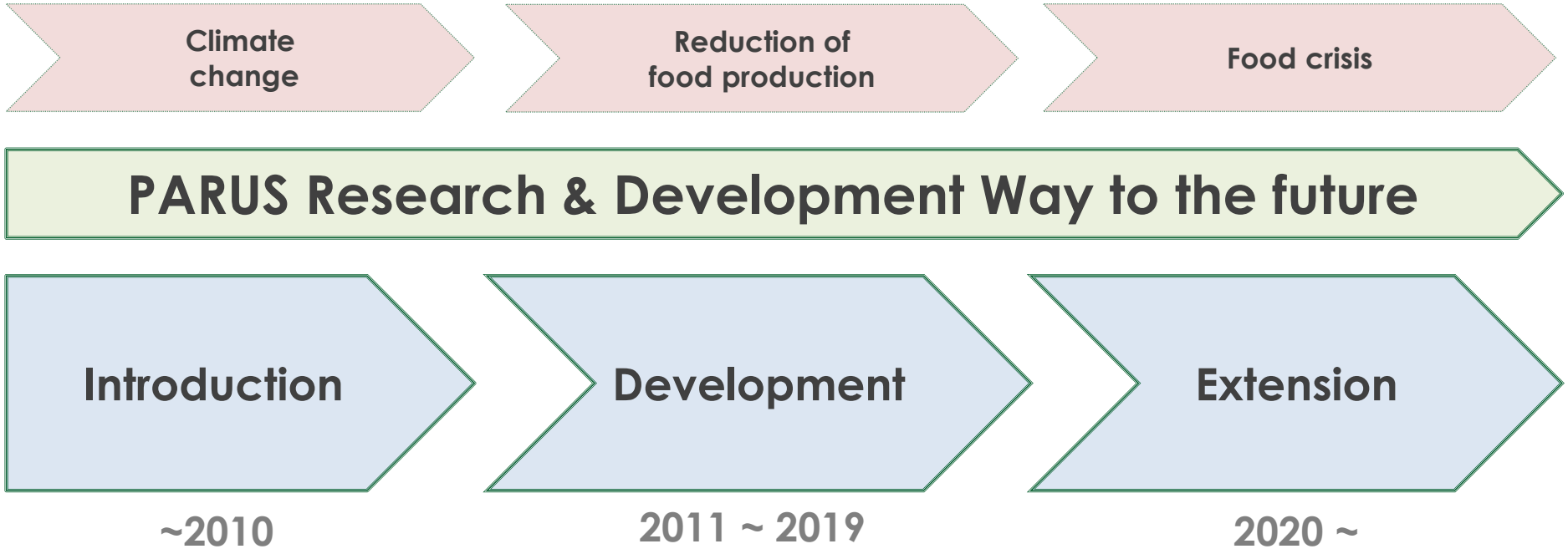
Wavelength detection of insects:

A range of wavelength detected by insects is a little different by the kinds of insects though, most of insects can detect a certain range of wavelength: 285~580nm. Insects response to this range of light, even very low intensity, and gather to light in the distance.

For example, some lamps have lots of insets around while the lights on, but some are not. It is related to wavelength combination that each lamp has, insects are attracted and gathered to lamps which their favorite wavelength composed.







Research of LED Light

- Improving the efficiency of LED grow light
- Technology for reducing maintenance costs
- Automatic control management system

Research of plant factory cultivation

- Plant-specific quantitative data of growth
- Technology to shorten the production cycle
- Methodology to increase antioxidant content
- Development of variety of plants
- Development of Eco friendly nutrient solution

Main business area of PARUS

Home & Office (Consumer&Marketing)

ATUM Series

LUCIS

iSUN

TERA

PGL-E06

PGL-E18

Green house (TOP-Lighting LED)

RA Series

PGL-DRBC

PFL Series

RA WC Series

Bulb Series

PPS

Plant Factory (Linear type LED)

Aeroponic

Hydroponic

Container

Café Farm

PFL Series

PGL-BOX

Technology Greenhouse Lighting

38% increase in production
Grown under PARUS
LED light

Grown under the other
company's LED light

PGL-D-RBC 2400

28~30% increase in production
compared with using HPS

PGL-PFL 600 2line

Technology Greenhouse Lighting

Compare Testing

(Greenhouse)

LED grow lighting

Testing Report - Canada

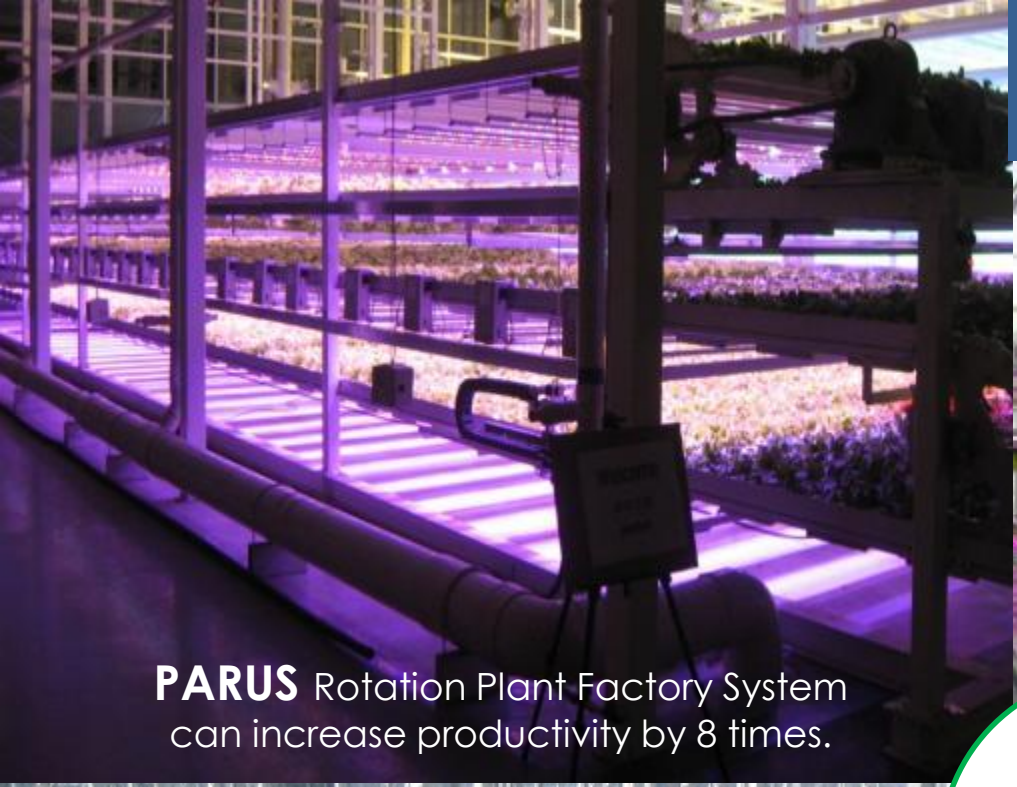
LED Lamp Design

Old
HPS 600Watt
Wavelength

New
PARUS LED 80Watt
Wavelength

For more information, contact us.
sales@parus.co.kr

Technology Rotation Plant Factory



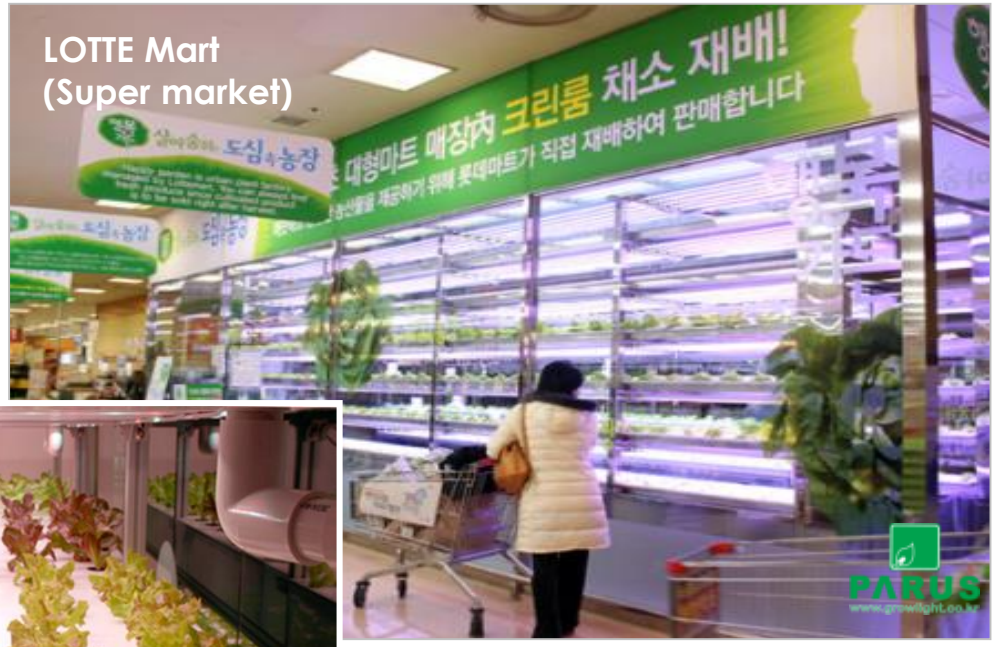
PARUS Rotation Plant Factory System
can increase productivity by 8 times.

PARUS
Rotation
Plant Factory
System

For more information, contact us.
sales@parus.co.kr

Technology Plant Factory (commercial)

HYUNDAI Department store
(Restaurant)



LOTTE Mart
(Super market)

POSCO the #
(Apartment)

Subway Station

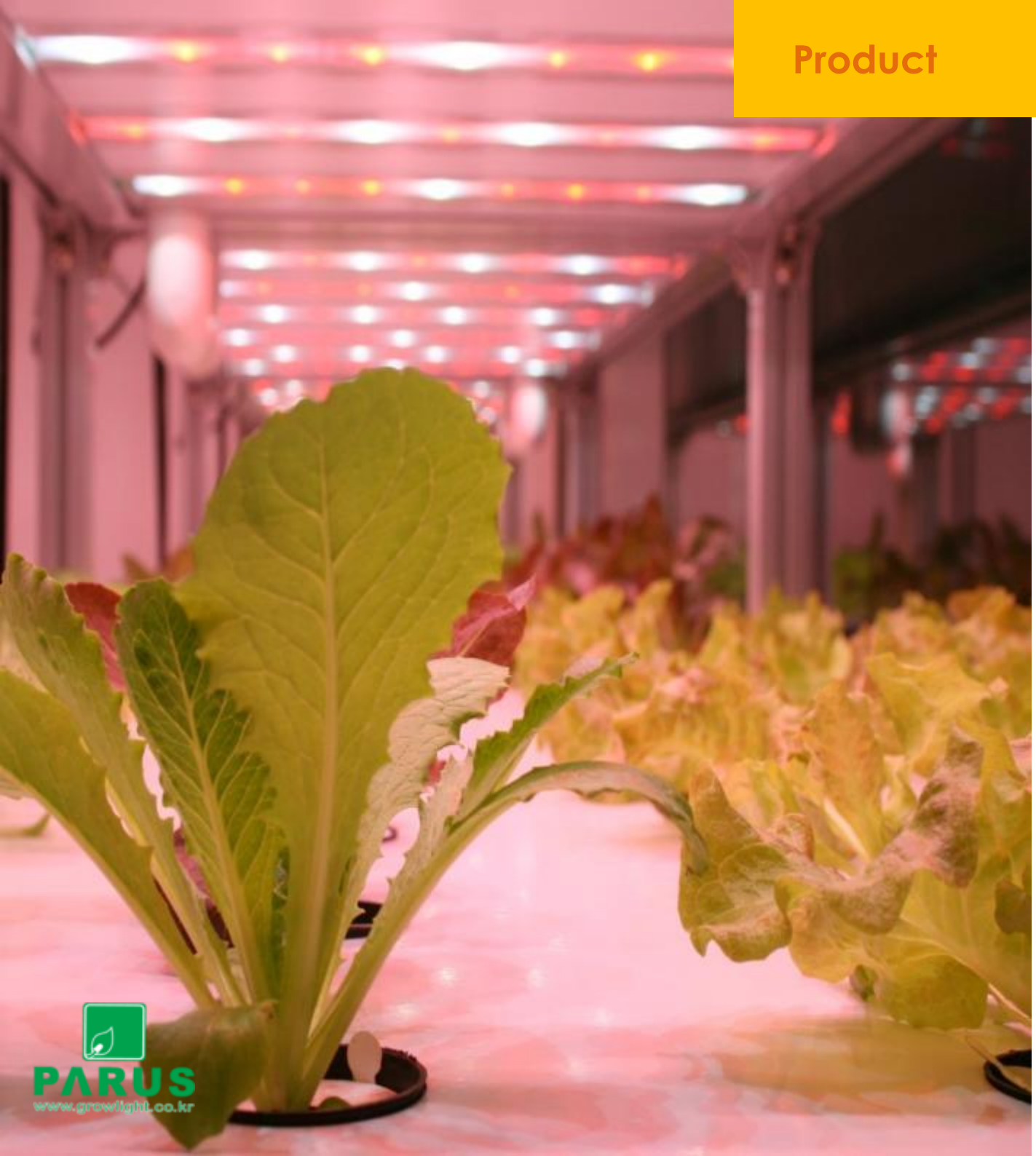
Technology **Container** Plant Factory

- External material : Aluminum(chose Color)
- Inside : Floor(Aluminum), other(Stainless Steel)
- ISO Standard
- Available temperature : -50℃~+50℃

For more information, contact us.
sales@parus.co.kr

Product

Plant Factory System



Plant Factory System

Café Farm
Mini Plant Factory System

Product Mini Farm for Home & Office


PMF-M30


PMF-M20


PMF-M10


ISUN 7W & 25W

Product Greenhouse & Plant factory Lighting

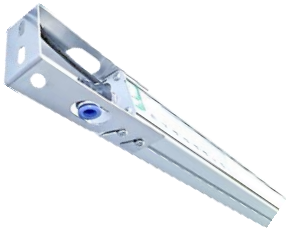
PFL Series

PGL-E18

RA Series

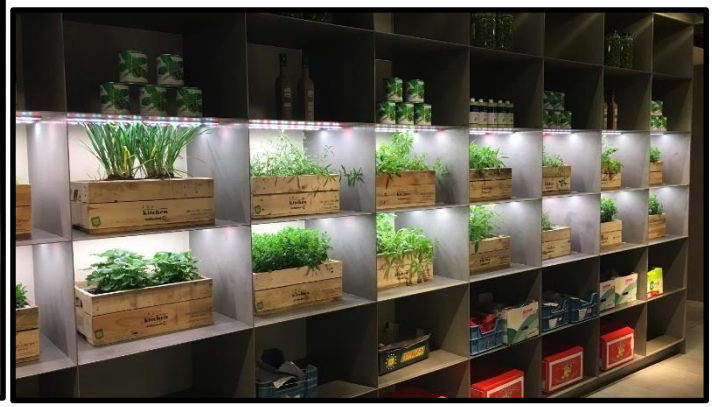
PGL-B18

PGL-D-RBC



PGL-B07

Case Studies 1_Holland_Bijenkorf Amsterdam_T5 series



-Applied model :
T5 RBW, 7-15watt, 600-1200mm length available

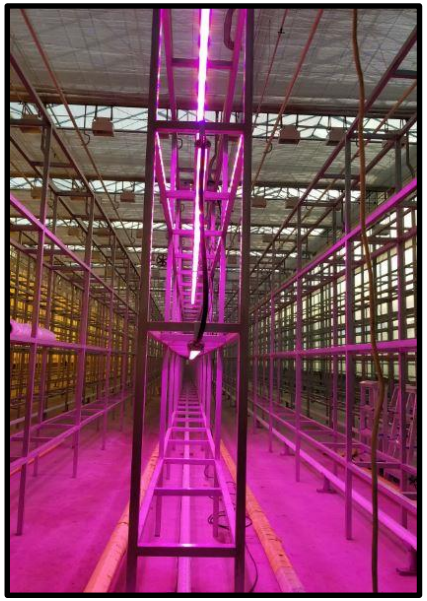
Case Studies 2_Holland_Utrechts restaurant_PFLs series

-Applied model :
PFLs RBS/RBW/RBF/BBR, 30-60watt, 600-1500mm length available

Case Studies 3_Holland_Rabobank Greenwall_PFL series

-Applied model :
PFL RBS/RBW/RBF/RBC, 80-160watt, 1200-2400mm length available

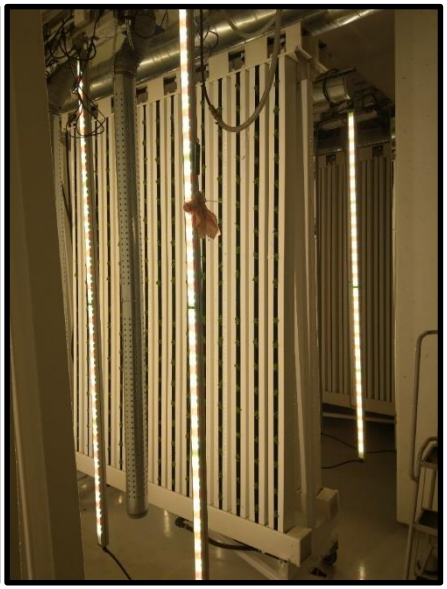
Case Studies 4_Russia_Mosagrow_PFL WC series



-Strawberry Multilayer System

-Applied model :
PFL WCIII-RBS/RBW/RBF/RBC, 80-240watt, 1200-2400mm length available

Case Studies 5_Sweden_Plantagon_DRBCII series

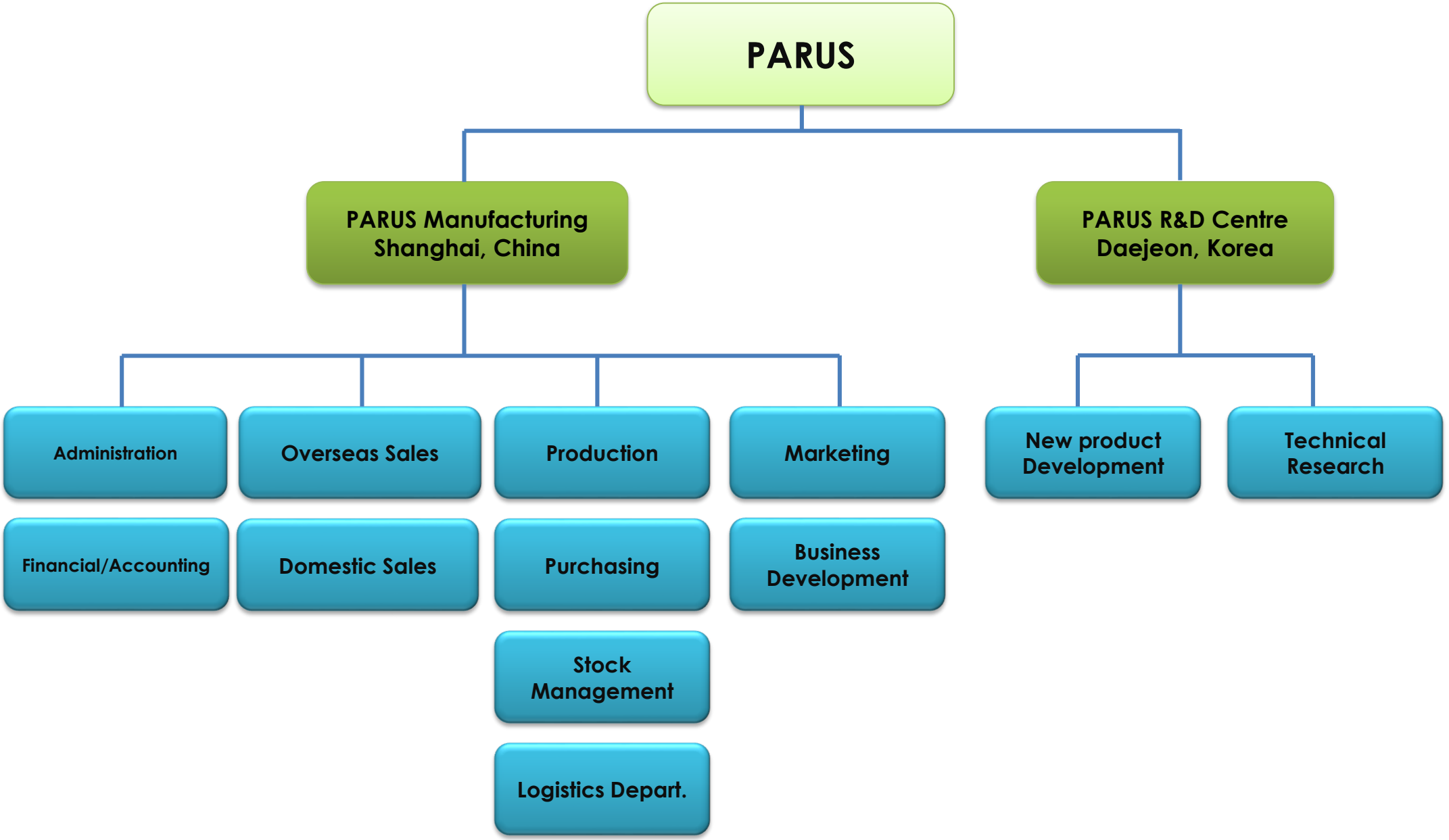


-Applied model :
DRBCII- RBS/RBW/RBF, 150-600watt, 1500-3000mm length available

Case Studies 6_Denmark_Spectrum Cannabis_RA series

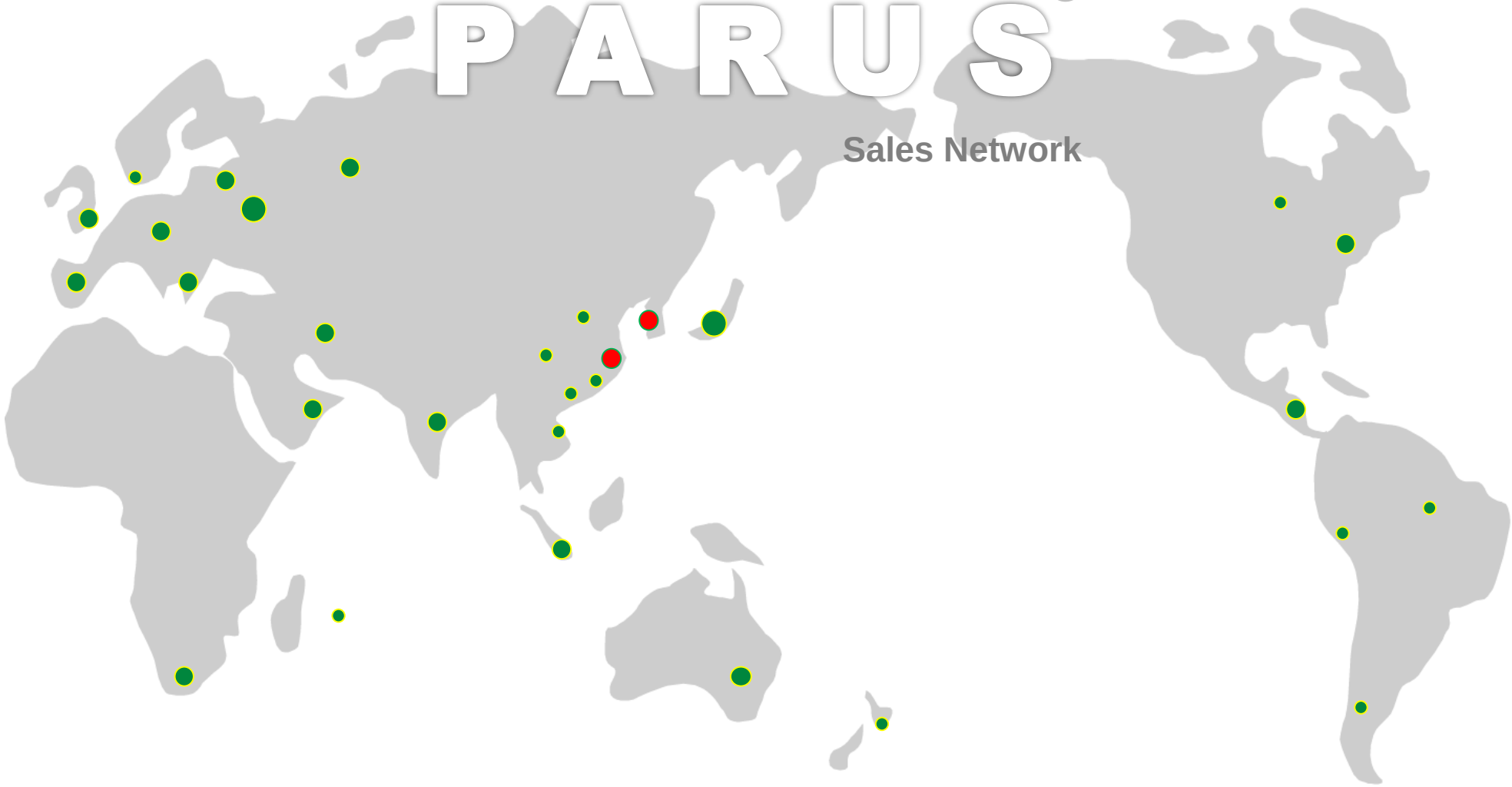
-Applied model :
RA Series RBS/RBW/RBF/RBC, 150-700watt,
WC Technology available

PARUS Organization



PARUS®

Sales Network



PARUS Head Quarter : Shanghai, China

PARUS R&D Centre: Daejeon, Korea

Authorized PARUS distributor

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