An Analysis of the UV-C Market and its Potential in the - COVID Era.

Research project

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Preface and background

Enclosed is a presentation on the UV-C industry and its potential in the global market during the Covid-19 pandemic.

I wrote the report as a visiting consultant in the Hungarian office of Boston Consulting Group, where I worked for 4, 8- hour work weeks. Teaming up with two of my friends, both Hungarian - Americans and bilingual, made the job much more focused and fun. We worked long-distance, them in Connecticut and I in Budapest, focusing on different aspects of the topic.

In the presentation, we attempt to analyze the potential for companies that produce UV-C lamps to move into application manufacturing and provide more technology to aid the world in its fight against Corona.

We used BCG Matrix as a research method to discover what applications would prove the most beneficial to invest manufacturing power in, and which applications would be the most sought-after among the different businesses in the food, travel, and housing industries.

Miki Sauska

We focused on three questions:

What are the new UV-C applications that could fight the spread of COVID?

How Is the UV-C industry changing?

What are the growth opportunities for UV-C companies?

UV-C radiation is a known disinfectant that has been used extensively for more than 40 years

UV-C is the strongest form of UV radiation …

Low energy,

UV-A

- Longest wavelength UV radiation
- Black-light lamps in this spectrum

UV-B

- Middle section of UV spectrum
- Commercial (sun beds) and medical applications

High energy,

UV-C

- Shortest wavelength
- high energy radiation
- Not common on Earth due to ozone layer

In our focus

… known as an effective disinfectant

UV-C can penetrate cell membranes

Damages the DNA/RNA of organisms, prevents cell division

Proven effective against viruses and most other known pathogens

UV-C disinfection is a promising technology, but only under specific circumstances

Benefits

Non-Toxic

- No chemical residues
- Safe for humans without direct exposure
- Safe to use for food products

Effective

- No damp surfaces after use which could facilitate fungal growth
- Proven to work against most pathogens

Flexible

- Can be deployed in stationary, portable or autonomous equipment
- Can be operated at any time

Affordable

- Easy to operate, can save on training and labor costs
- Reusable for multiple disinfection cycles

Constraints

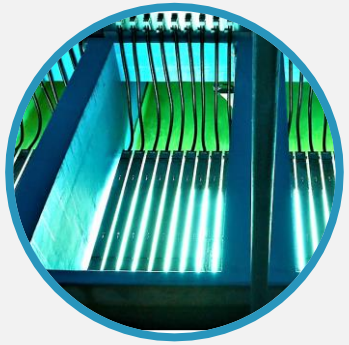
Potentially harmful

- Direct exposure to skin and eye can be damaging
- Needs to be handled with care

Need Calibration

- Dosage needs to be calibrated for exact application
- Only said to be effective if it achieves 6-log reduction (killing 99.9999% of organisms)

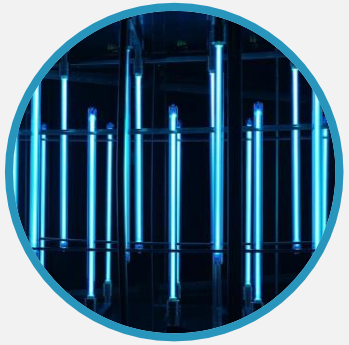
Three main markets for UV-C are water, surface and air



Water

- Drinking water
- Wastewater
- Pool/Spa
- Aquariums

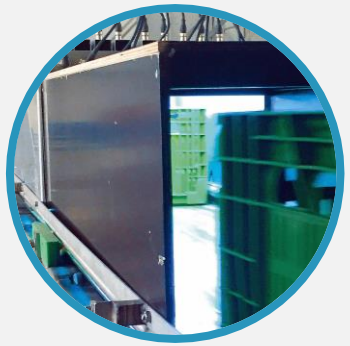
70%



Air

- Upper air disinfection
- Air duct disinfection
- Portable air disinfection
- Built-in solutions

30%



Surface

- Conveyor belt type
- UV-C fixtures for smaller surfaces
- Portable Air + Surface
- Fixed Air + Surface

COVID-19 highlighted many use cases where UV-C can be an effective solution

Air

Slaughterhouses were the origin of Covid-19

The air cooling system used in a German slaughterhouse helped spread the coronavirus among hundreds of workers, a hygiene expert said Wednesday, a day after the mass outbreak triggered renewed lockdowns in the area.

German slaughterhouse's cooling system 'helped spread virus'

Reviving the hospitality industry with non-toxic lamps

Air-conditioning spread the coronavirus to 9 people sitting near an infected person in a restaurant, researchers say. It has huge implications for the service industry.

Shira Feder Apr 21, 2020, 5:49 PM

Surface

Import/Export trade raises concerns

Coronavirus: China's freeze on imported salmon stirs concern about wider impact on European food trade

- The European Commission says China has not banned salmon imports, but supermarket shelves in Beijing have been cleared of foreign fish and meat
- Traders say imports were frozen after the virus was discovered on chopping boards used for imported salmon at Beijing's Xinfadi market

Hotel Industry requires sanitation

Coronavirus: Tenerife hotel with hundreds of guests locked down

25 February 2020 Share

The Economic Impact of COVID-19 on Hospitality: $534M Lost a Day

APRIL 29, 2020 BY GWEN BURROW

People will need to trust public transportation again

How one man spread coronavirus to NINE other people on his bus in China: Scientists find the deadly virus can travel four times the 'safe' distance and linger in the air for over 30 minutes in confined places

UV-C has proven effective against COVID-19

"It's a well-proven, extremely safe technology that is underused and often misunderstood. No one doubts the efficacy of germicidal UV in killing small microorganisms and pathogens. I think the bigger controversy, if there is any, is misperceptions around safety."

Dr. Edward Nardell, Professor at Harvard Medical School

"An effective tool that should now be considered for a variety of settings, such as schools, nursing facilities, jails and homeless shelters."

Shelly Miller, Professor at the University of Colorado, Boulder

"Although it's not perfect, it probably offers the best solution for direct air disinfection in the current pandemic."

David Sliney, Faculty Member at Johns Hopkins University and longtime researcher on germicidal UV

“Our test results show that above a specific dose of UV-C radiation, viruses were completely inactivated: in a matter of seconds we could no longer detect any virus”

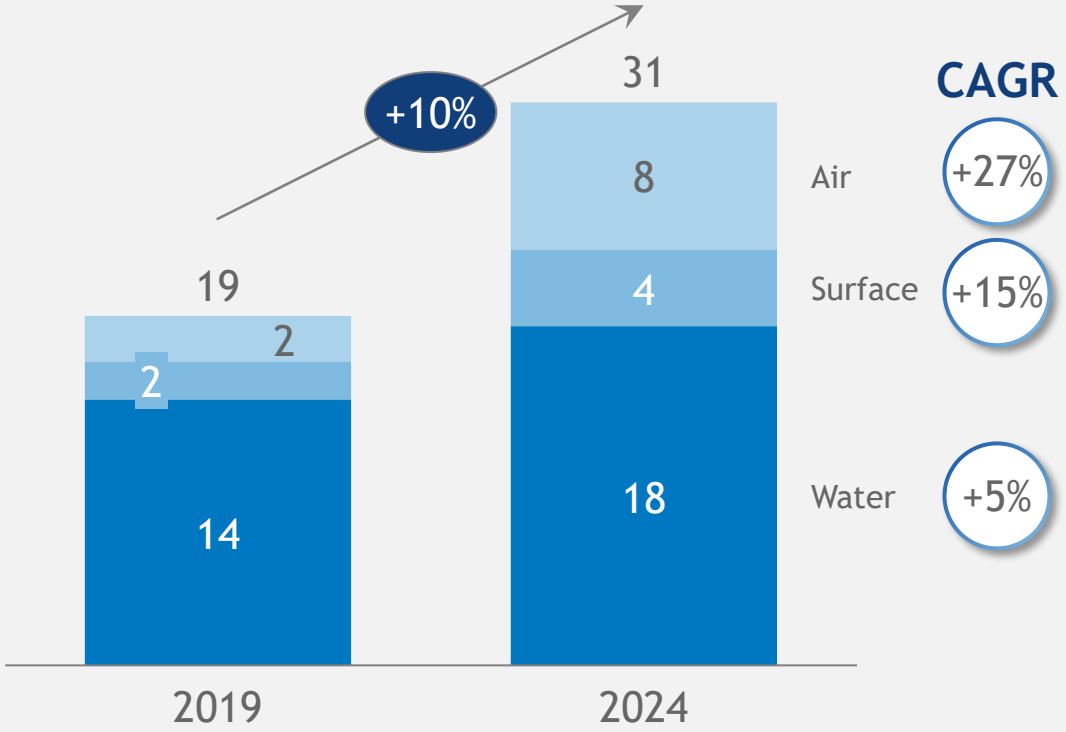
Dr. Anthony Griffiths, Associate Professor of Microbiology at Boston University School of Medicine

UV-C Market is expected to grow by 10% with double digit growth in the air and surface segments

Preliminary

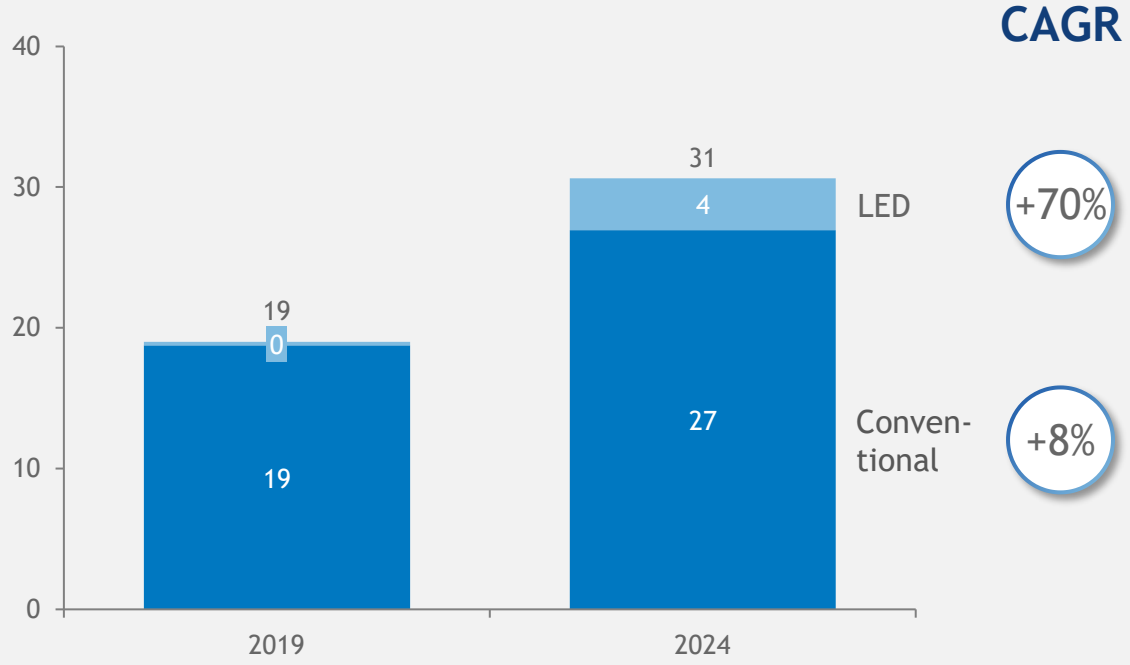
Double digit growth in air and surface segments

Projected volumes by segment (million)



Dynamic growth in LED, but conventional lamps remain dominant

Projected volume by technology (million)



We focused on three questions:

What are the new UV-C applications that could fight the spread of Covid-19?

How is the UV-C industry changing?

What are the growth opportunities for UV-C companies?

5 key strategic trends for companies that need to be addressed to be successful in the new context

Material manufacturing

1

Conventional lamp market is shrinking fast and driving critical suppliers out of the market

Lamp manufacturing

2

Sudden increase in volumes and operation at capacity

3

Increased versatility of new customers and products

Application manufacturing

4

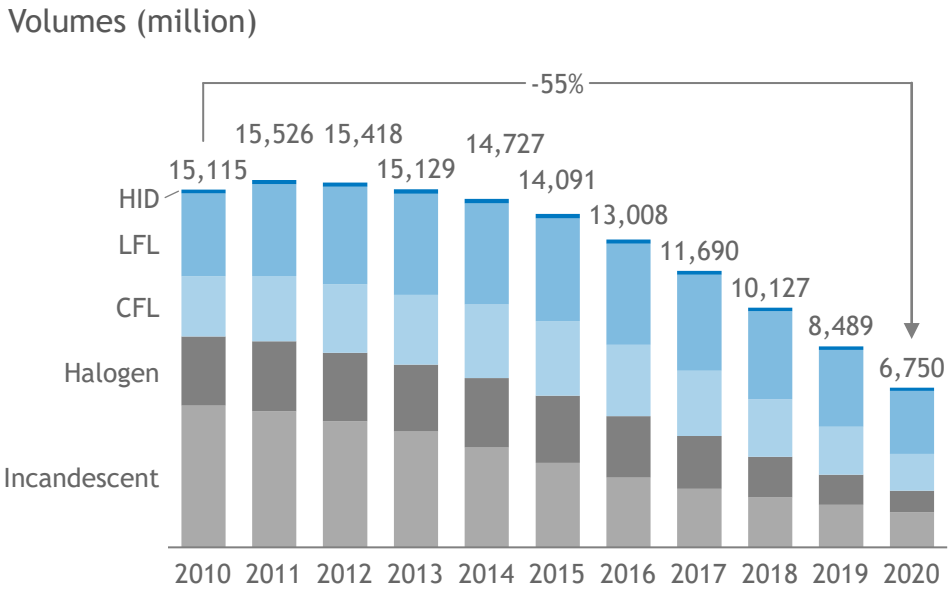
New use cases provide opportunity for widening the market

5

Shift from a matured market to a growing market

Trend 1: Conventional lamp market is shrinking fast and driving critical suppliers of the UV-C segment out of the market

Conventional lamps market volume halved in the last ten years



Smaller firms in the parts manufacturing segment leave the market…

- Declining volumes as the overall conventional lamp segment is shrinking
- No incentive to further maintain or invest in the manufacturing assets
- Portfolio streamlining leads to divestiture in lamp part manufacturing

… providing a "forced" opportunity for backward integration

- Increasingly hard to find suppliers for special parts
- Market trend is to insource critical parts manufacturing

Manufacturers should proactively scan the market for opportunities to ensure stable supply of critical parts

Trend 2: Sudden increase in volumes and operations running at capacity

Short-term: Run at maximum capacity

Mid-term: Adjust capacity to new needs

Typical challenges

Shift requirement

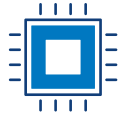
- Not enough shifts
- Skills required for maximum capacity always present (due to vacations, etc.)

Maintenance

- Regular maintenance schedule may prevent maximum utilization

Capacity Upgrade

- Current maximum capacity not sufficient for future growth



New technologies

- Current production technology and infrastructure needs to keep up with modern trends

Manufacturers should review their operations to meet the demand in the short and mid-term

Trend 3: Increased versatility of new customers and products

Serve existing customers

Ensure service level and Quality

Existing clients will expect the same treatment as before, otherwise reputation is in danger

Keep delivery times

Slower turnaround times could lead to existing clients turning to competitors

Cater to new customers and needs

Flexible product options

New applications will require products with new specifications

Design & Engineering Support

Applications need to be designed around the UV-C source

Ensure Short Time to Market

Lamp manufacturing speed should not be a bottleneck

Calibration and Testing

Lamps need to operate at peak efficiency in the intended use case

Manufacturers should review their capacities and processes to best manage the increased load and serve the customers capturing the growth

Trend 4: New fields provide opportunity for widening the market

Water

Already established market; COVID-19 did not change the landscape

Segments booming due to COVID-19 driven new use cases

Air

UV-C air disinfection device used in UK hospital amidst COVID-19 pandemic

FDA-approved UV-C air purifiers used in hundreds of hospitals and healthcare facilities in the US

Surface

NYC pilot project: Subways disinfected with UV-C lamps

Buses in Shanghai cleaned with UV-C

Manufacturers should evaluate the opportunities to move into the application space

Trend 5: Shift from a matured market to a growing market

Pre-COVID-19

- Stable Environment
- Few small players
- Moderate growth

- Maintain reputation for reliability and do well under existing conditions

- Focus on running the operation effectively

Post-COVID-19

- High volatility
- New entrants with high potential
- Dynamic Growth

- Explore new areas and react to changing market conditions

- Focus on capturing growth opportunities

Manufacturers should review their organization's, roles & responsibilities to ensure proper fit for the new market context

We focused on three questions:

What are the new UV-C applications that could fight the spread of Covid?

How Is the UV-C industry changing?

What are the growth opportunities for UV-C companies?

Five strategic priorities for manufacturers to capture growth in the post-COVID UV-C market

Material manufacturing

1

Proactively scan the market for opportunities to ensure stable supply of critical parts

Lamp manufacturing

2

Review operations to meet the demand in the short and mid term

3

Review capacities and processes to best manage the increased load and serve the customers capturing the growth

Application manufacturing

4

Evaluate the opportunities to move into the application space

5

Review organization, roles & responsibilities to ensure proper fit for the new market context

We selected the application topic as a focus for the research project with the highest potential

Material manufacturing	Lamp manufacturing	Application manufacturing
1 Proactively scan the market for opportunities to ensure stable supply of critical parts	2 Review operations to meet the demand in the short and mid term	4 Focus Evaluate the opportunities to move into the application space
	3 Review capacities and processes to best manage the increased load and serve the customers capturing the growth	

5 Review organization, roles & responsibilities to ensure proper fit for the new market context

Our approach to evaluate the opportunities for manufacturers to move into the application space

Long list

- Scanned the market for new use cases in the air and surface segment
- Compiled a long list of use cases spanning different market areas and sizes.

Prioritization

- Evaluated items on the long list based on the following criteria:
  - Market attractiveness
  - Right to win
- Ranked use cases based on combined evaluation to define a shortlist

Short list

- Detailed shortlisted use cases
- Included viwe on potential competitors and customers

Next steps

- Developed go to market concept
- Elaborated on the oranizational, manufacturing, branding and distribution elements

Long list: We have identified a nearly 30 use cases with potential in the post COVID-19 environment

	Logistics & Retail	Travel & Public Transport	Homes	Office	Industrial & manufacturing
Air	• Parcel disinfection in Logistics centers • Disinfection at checkout aisle • Fresh food counter disinfection (Fruits & Vegetables or butcher) • Disinfection locker for returned and tried-on clothes • Overnight disinfections of Logistic centers	• Airport luggage disinfection • Potential for fixtures in Metro Systems and tops of buses. (?) • On-demand fixtures on airports • Overnight disinfection of unused public transport vehicles	• Disinfection box for household items • Overnight fixtures placed in lighting to deep clean rooms.	• On-demand disinfection for courier items • Disinfect rooms one-by-one through cleaning staff	• Disinfection of manufactured products before packaging • Disinfection of food items in temporary storage • Disinfection of warehoused items, especially perishable food
Surface	• Disinfection of Air in Retail spaces • Disinfection of Air in Retail spaces with pre-existing H-VAC units.	• Active air disinfection on public transport vehicles • Disinfection of public transport stations • Buses, Metros, and Planes can use trolley system of UV-C tech to disinfect with minimal crew.	• Home air disinfection without an a/c system • Disinfection of Air in Homes and residential complexes with H-VAC systems	• Room disinfection in offices without air conditioning • Room disinfection in offices with air conditioning	• Workshop disinfection • Large scale disinfection of industrial plants through H-VAC systems.

Prioritization: Based on market potential and right to win we have shortlisted 6 uses cases

Right to win

- Level of Customization
- Concentration of Buyers
- New Customers

Market potential

- Number of customers
- Number of lamps
- Expected penetration in 5 years

Prioritization: "Do now" combines high market sizes and Right to Win

Main focus

"Do now"

- Large scale disinfection of industrial plants through H-VAC systems.
- Disinfection of air in homes/residential complexes with H-VAC systems.
- Disinfection of manufactured products before packaging.
- Disinfection of air in retail spaces with pre-existing H-VAC units.
- Room disinfection in offices with air conditioning.
- Shopping cart disinfecion

"Do later"

- Fresh food counter disinfection (Fruits & Vegetables or Meat Department).
- Airport luggage disinfection.
- Parcel disinfection in Logistics Centers.
- Disinfection of warehoused items, especially perishable food.

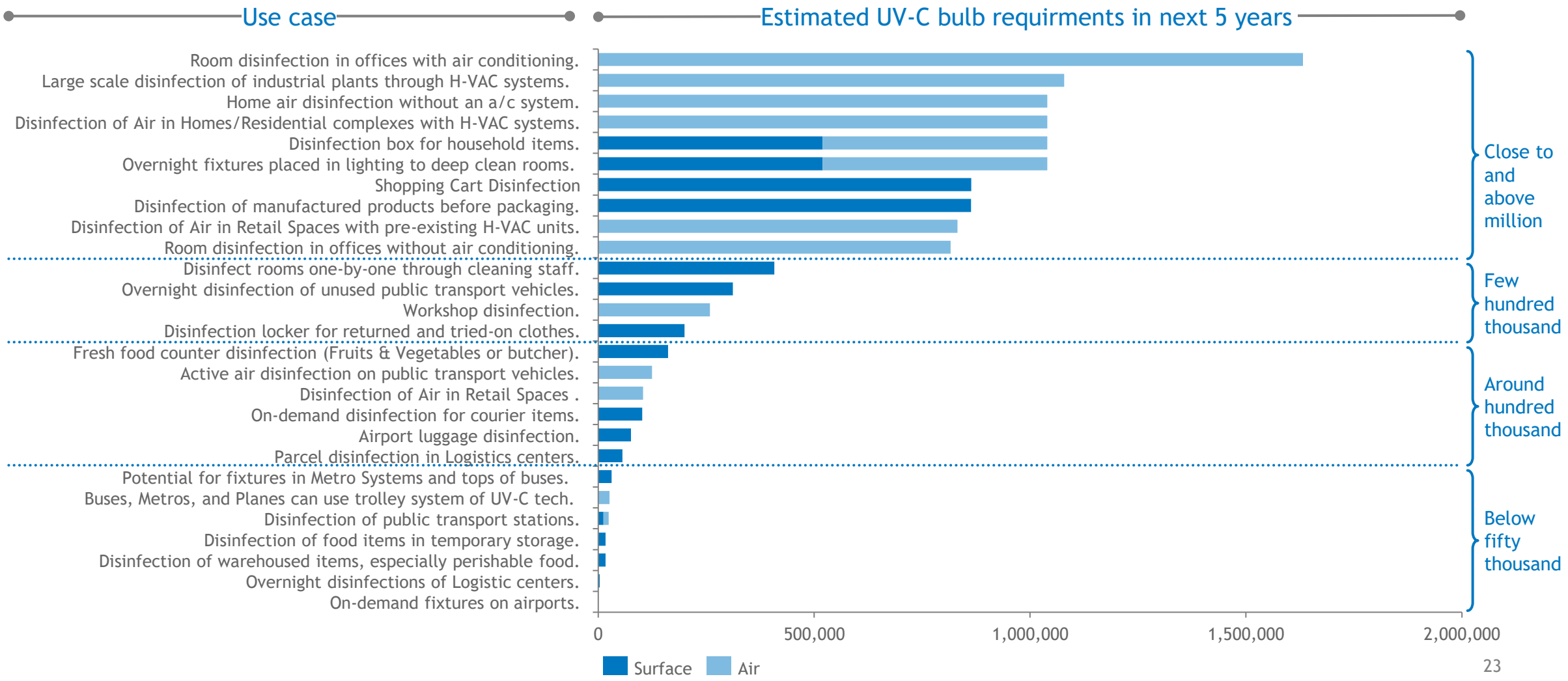
"Support OEMs to go to market"

- Disinfect rooms one-by-one through cleaning staff.
- Workshop disinfection.
- Disinfection locker for returned and tried-on clothes.
- Room disinfection in offices without air conditioning.
- Overnight disinfection of unused public transport vehicles.
- Home air disinfection without an a/c system.
- Disinfection box for household items.
- Overnight fixtures placed in lighting to deep clean rooms.

"Deprioritize"

- Disinfection of Air in Retail Spaces.
- Disinfection of food items in temporary storage.
- Overnight disinfections of Logistic centers.
- Active air disinfection on public transport vehicles.
- Disinfection of public transport stations.
- On-demand fixtures on airports.
- On-demand disinfection for courier items.
- Potential for fixtures in metro systems and tops of buses.
- Buses, metros, and planes can use trolley system of UV-C tech.

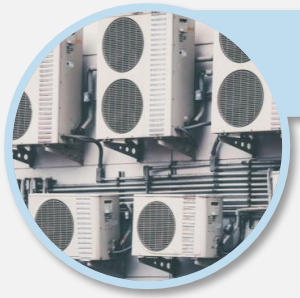
Market potential: Large scale air disinfection expected to drive the volume growth in UV-C in the next 5 years



Right to win: Mix of air and surface opportunities for manufacturers to test the application market

Application	Buyer Concentration	Need for Customization	New to the Market	Right to Win for Light Sources?	Type	
Large scale disinfection of industrial plants through H-VAC systems.	4	4	5	13	Air	Very high right to win
Disinfection of Air in Homes/Residential complexes with H-VAC systems.	3	4	5	12	Air	
Disinfection of manufactured products before packaging.	4	4	4	12	Surface	
Disinfection of Air in Retail Spaces with pre-existing H-VAC units.	4	4	4	12	Air	
Fresh food counter disinfection (Fruits & Vegetables or butcher).	3	4	5	12	Surface	
Room disinfection in offices with air conditioning.	3	3	5	11	Air	High right to win
Shopping Cart Disinfection	4	3	4	11	Surface	
Airport luggage disinfection.	4	4	3	11	Surface	
Parcel disinfection in Logistics centers.	4	4	3	11	Surface	
Disinfection of warehoused items, especially perishable food.	3	4	4	11	Surface	
Disinfect rooms one-by-one through cleaning staff.	2	3	5	10	Surface	Medium right to win
Workshop disinfection.	3	2	5	10	Air	
Disinfection locker for returned and tried-on clothes.	3	2	5	10	Surface	
Disinfection of Air in Retail Spaces .	4	2	4	10	Air	
Disinfection of food items in temporary storage.	3	4	3	10	Surface	
Overnight disinfections of Logistic centers.	4	3	3	10	Surface	
Room disinfection in offices without air conditioning.	3	2	4	9	Air	
Overnight disinfection of unused public transport vehicles.	2	3	4	9	Surface	
Active air disinfection on public transport vehicles.	1	4	4	9	Air	
Disinfection of public transport stations.	1	4	4	9	50/50	
Home air disinfection without an a/c system.	1	2	5	8	Air	Low right to win
On-demand fixtures on airports.	4	1	3	8	Surface	
Disinfection box for household items.	1	1	5	7	50/50	
Overnight fixtures placed in lighting to deep clean rooms.	1	2	4	7	50/50	
On-demand disinfection for courier items.	2	1	4	7	Surface	
Potential for fixtures in Metro Systems and tops of buses.	2	1	4	7	Surface	
Buses, Metros, and Planes can use trolley system of UV-C tech.	1	2	4	7	Air	

Short list: 4 air and 2 surface applications selected to be the most lucrative opportunities



Residential Air Purification

- Large Market
- Simple Installation System
- New Market

Office Air Purification

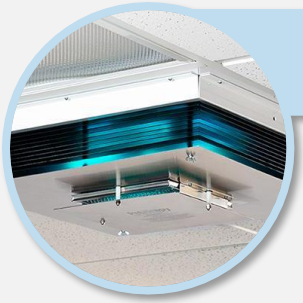
- Largest potential market
- Need for customization to fit into particular A/C systems
- Likely to be standardized for health concerns

Shopping Cart Disinfection

- Large concentration of Buyers in major supermarkets
- Need for health safety in a post-Covid-19 world
- Simple to integrate into retail stores

Industrial Plant Air Purification

- Large Buyer Concentration
- Mass UV production Required
- Need for customization



Retail Store Air Purification

- Likely to become new regulation
- New need for UV Tech to convince customers' safety
- Large concentration of buyers

Product Disinfection

- Highly profitable
- Will be essential in a post-Covid-19 world
- Diverse customer pool

Residential Air Purification: Large market mostly created by Covid

Description

- Residential buildings will be trying to mitigate the risk of spreading illness through air conditioning systems in shared living spaces.
- UV-C will be placed into an air conditioning system/ H-VAC system that the air will run through getting cleaned as it flows by the lamp.

Market potential

- We expect that in 5 years this market will absorb 1,04 Million UV-C Lamps.
- Geographically residential complexes in densely popuplated areas are key targets

Customers

- Main customers are landlords and other complex owners looking to improve the lives of their residents.

Right to win

- **LightSources** can customize their lamps to work with whatever system it is being put into.
- Other companies will not have the patience to work with more difficult cases of air purification

Likely competitors

- There are similar products on the market, however none are regulated/controlling the market.
- The strengths of large companies such as **Phillips** would be their manufacturing speed.

Industrial Air Purification: Established market to be captured through competitive advantage

Description

- System is aimed to control pathogen contamination in industrial settings (Especially in food processing plants)
- UV-C will be placed in standalone systems on the ceilings and H-VAC units for those buildings with and without A/C units.
- Benefits for customers is the prevention of infectious diseases and the prolonged efficiency of existing H-VAC systems

Market potential

- The estimated market size in 5 Years will be over 1 million UV-C Lamps.
- Product will have success in areas with large industrial plants with H-VAC systems.

Customers

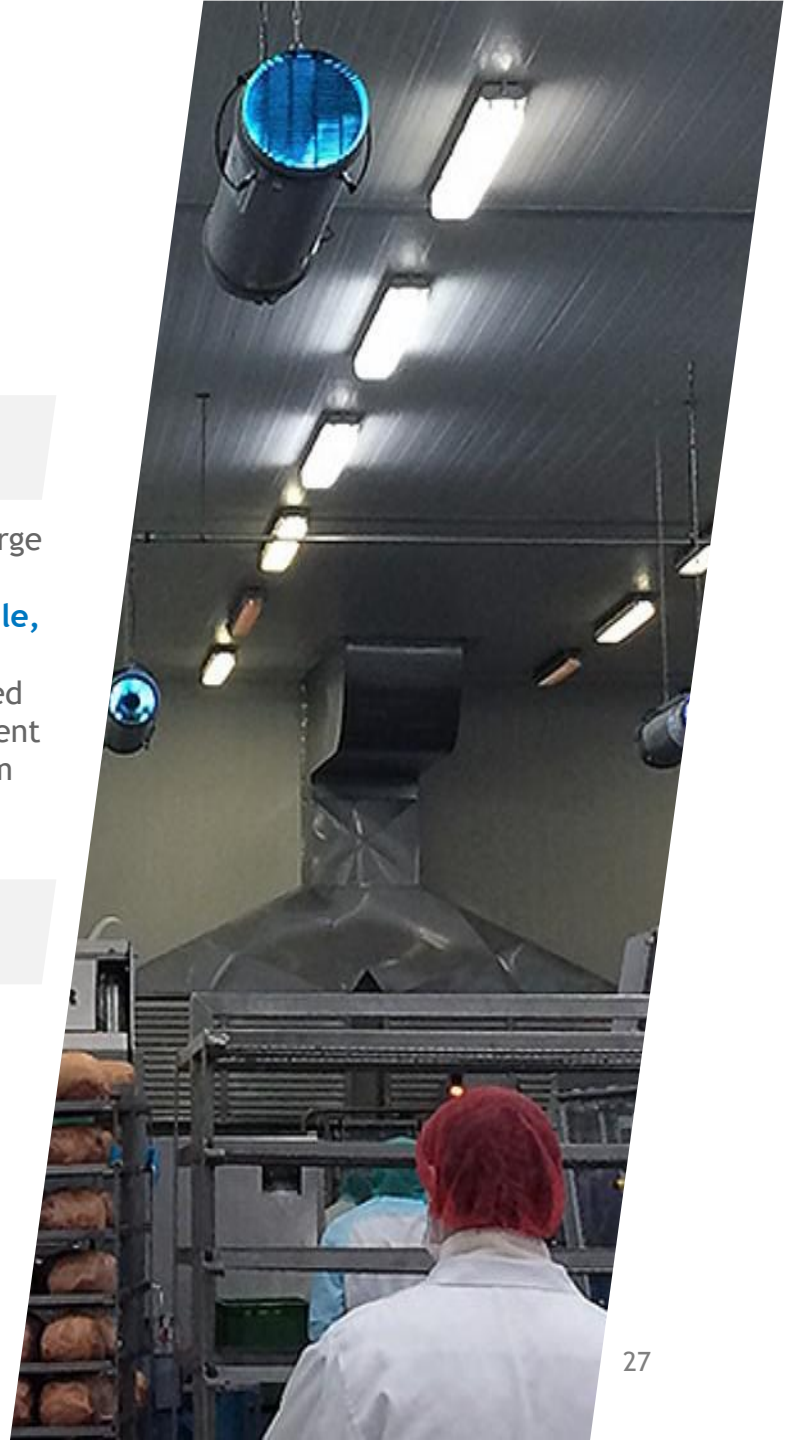
- Main Customers include large manufacturers with H-VAC systems such as **Ford, Apple,** and **Volkswagen.**
- To win the product we need to convince the management this will protect them from potential outbreaks.

Right to win

- The competitive advantage is its ability to customize lamps to applications cutting costs considerably.
- Strong customer support will provide foundation for market leadership

Likely competitors

- There are similar products already on the market, but no market leader so far
- The competitors are likely the smaller specialty application manufacturers who focus solely on their smaller customer pool.



Office Air Purification: A massive market needs modernization

Description

- Device aimed to prevent air contamination and protect H-VAC equipment
- UV-C will be installed into the existing units or alongside new A/C units.
- UV-C systems prolong life-cycle and efficiency of H-VAC systems

Market potential

- 1,632 Million Lamps is the expected market size in 5 years for Office Air Purification.
- Likely large cities with many office buildings with shared H-Vac Systems.

Customers

- Main customers are large scale office buildings, those with a shared H-VAC system specifically.
- To win with the product we need to convince owners that contamination through shared H-VAC systems is possible and likely.

Right to win

- **Light Sources** has superior customization and can make UV-C fit into the pre-existing system of the building. This helps us help them save more money rather than them buy a new H-VAC system.

Likely competitors

- There are similar products on the market, however the customers are all new to market since many of them did not have UV-Tech before the pandemic.
- The only potential challenger of **Light Sources** would be application manufacturers who had been in the market previously.

Retail Air Purification: Retailers need reliable health & safety measures to regain customers' trust

Description

- The Risk being mitigated is the spread of illness in commercial retail stores.
- UV-C will be installed in the current air-flow system and purify the air as it runs through.
- Those customers shopping retail stores will be breathing in clean air. Also retail stores who will be struggling post Covid-19 will be able to claim healthier shopping conditions to attract business.

Market potential

- We estimate that 832 Thousand UV-C lamps will be manufactured for this market in 5 years
- New York City, Los Angeles, London, Tokyo are examples of cities with many retail stores that could use this technology.

Right to win

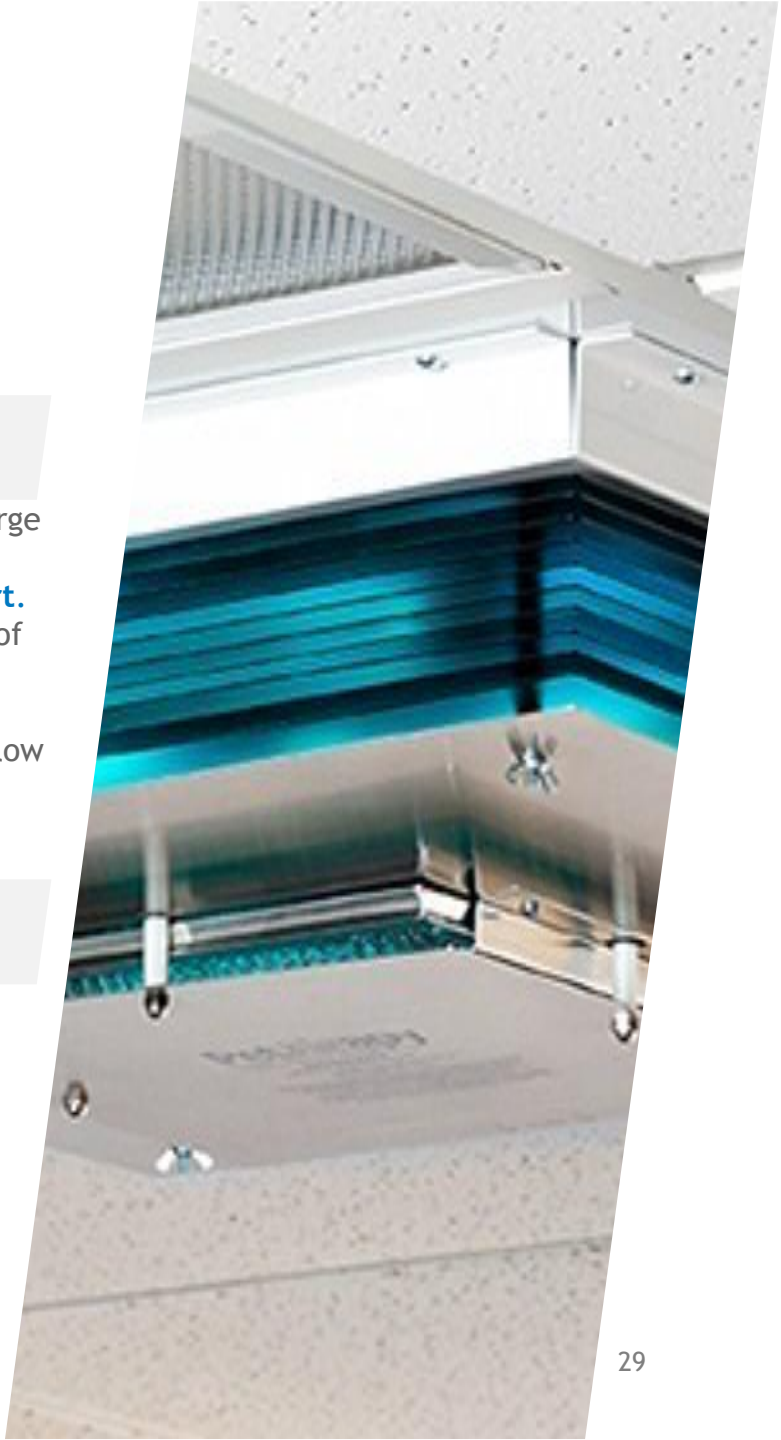
- The advantage of **LightSources** is the customization options it provides to the customers.
- Retrofittable solutions, great value for customers and fitting for LightSources' strengths.

Customers

- Main customers include large scale brand stores such as **Nike, Macy's,** and **Walmart.**
- We need to convince one of these major brands to include LightSources products until the rest follow suit.

Likely competitors

- There are UV-C air purifiers on the market, however due to the pandemic there will be no shortage of buyers.
- Potential competitors include companies such as **SterilAir** that have established surface UV-C tech already.



Shopping Cart Disinfection: Very specialized market leveraging the worldwide abundance of supermarkets

Description

- We are trying to mitigate the risk of spreadig infections through shopping carts.
- UV-C bulbs will be placed into a large box where the shopping carts will run through.
- The benefit to User's and Customers is that the Supermarket is able to claim a cleaner space to buy groceries, and the customers get sanitized shopping carts.

Market potential

- In the next 5 years we can expect to absorb 864 thousand UV-C lamps.
- Market growth will be concentrated in larger cities.

Customers

- Main customers are large scale retailers such as **Target** or **Walmart**.
- To win the product we need to convince upper management that this will be advantageous in a post-Covid world.

Right to win

- New market: Supermarkets will need direct contact with suppliers, this fits well with **Light Sources**' customer service strength.
- Without a steady conversation between buyer and supplier these modernizations will not spread fast

Likely competitors

- Italian manufacturer **Sanycar**, but only local player currently
- Potential newcomers could include other large-scale manufacturers such as **Phillips** who have a fast manufacturing process.

Product Conveyor Belt Disinfection: Lucrative opportunity to capitalize on international trade

Description

- The risk being mitigated is contamination of products being shipped around the world.
- UV-C lamps will be placed periodically at conveyor belts and disinfect all sides of the packages
- Benefits to customers and users is that they can claim they provide a disinfected product to their customers.

Market potential

- In 5 Years we expect the market to absorb 863 thousand UV-C Lamps.
- It will be utilized in industrial manufacturing plants and distribution centers.

Customers

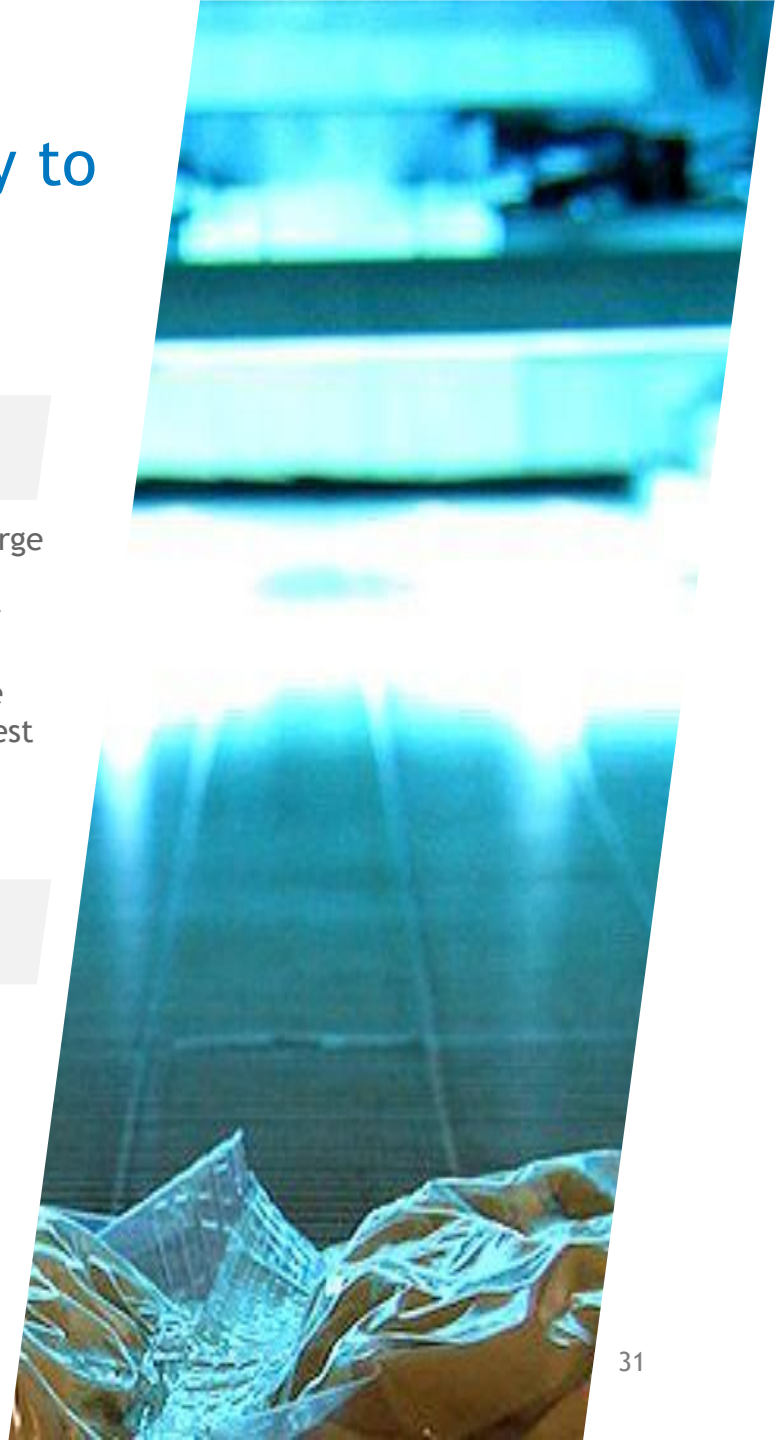
- The main customers are large scale manufacturers and distributors such as **UPS** or **Amazon**.
- We need to convince these large companies and the rest will follow in modernizing.

Right to win

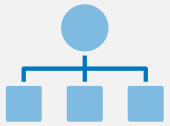
- The competitive advantage **LightSources** has is their ability to customize their lamps to fit the product being disinfected which other companies will not be as wiling to do.

Likely competitors

- There are similar products on the market however none have been picked up by these larger players.
- Potential newcomers could include **Phillips** and those companies with faster manufacturing.

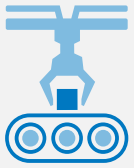


Next steps: Key decisions to be made ahead of entry to the application space



Organization

- Inorganic market entry seems to be the most time effective and would provide access to the manufacturing capacities as well
- When purchasing a subsidiary keep certain things in mind



Manufacturing

- Short term partnering, mid term own manufacturing seems to be the best strategy to expand into new segments
- Private investment of a long-term manufacturing process in house would be the best long-term decision

Branding

- We recommend using the brand of the subsidiary to distance from the parent brand
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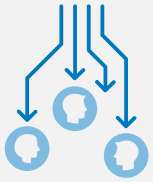


Distribution

- Manufacturer should rely on the subsidiary's distribution in the launch phase
- External Distribution companies seem to be most effective

Organization: Inorganic market entry seems to be the most time effective and would provide access to the manufacturing capacities as well

Organic

This is by the most profitable option going forward. However it has its own downsides. Although you would have full control over the applications and the profits, you would need to spend time developing manufacturing, distributing, and branding. Developing all three of these processes would take a few years, which would mean that manufacturers will miss out on the demand caused by Covid-19.

Partnering

Partnering is a very quick way to get started as well. The burden is shared with one another and there is increased decision-making taking place between partners. However, on the other hand the amount of profit you get immediately takes a hit, and you being to lose full control of what you want to do within the application market.

M&A

Acquiring a company is by far the best option for UV-C manufacturers. It would allow them to isolate the lamp manufacturing from the application manufacturing. This ensures the safety of the original core business and gives them a predetermined distribution and branding system.

Manufacturing: Short-term partnering, mid-term own manufacturing seems to be the best strategy to expand into new segments

Short-term: Leverage external manufacturing capacities

The Market is easier to penetrate right now due to Covid-19. Because of this, spending time on developing a manufacturing process is losing valuable time when the market is essentially wide open. Because of this, partnering with a company in application manufacturing would save valuable time and allow to have quick start on the new market.

Mid-term: Invest in own application manufacturing

While getting a head start is important, in the long-term own manufacturing is more profitable. Partnering with another company while investing in an own manufacturing process would be the most effective strategy for the next few years. However, depending on the nature of the partnership with another company this is liable to change.

Branding: We recommend prospective manufacturers using the brand of the subsidiary to distance from the parent brand

Aim is to have differentiated brand for the different segments

Branding under a new company has one certain advantage, it would reduce the amount of customer displeasure for manufacturer becoming one of their new competitors.

The loss of not being able to market under their current name isn't momentous, since the name itself is only known amongst other application manufacturers.

Examples of successful subsidiary branding…

Distribution: Manufacturers should rely on the subsidiary's distribution in the launch phase

External Distribution companies seem to be most effective

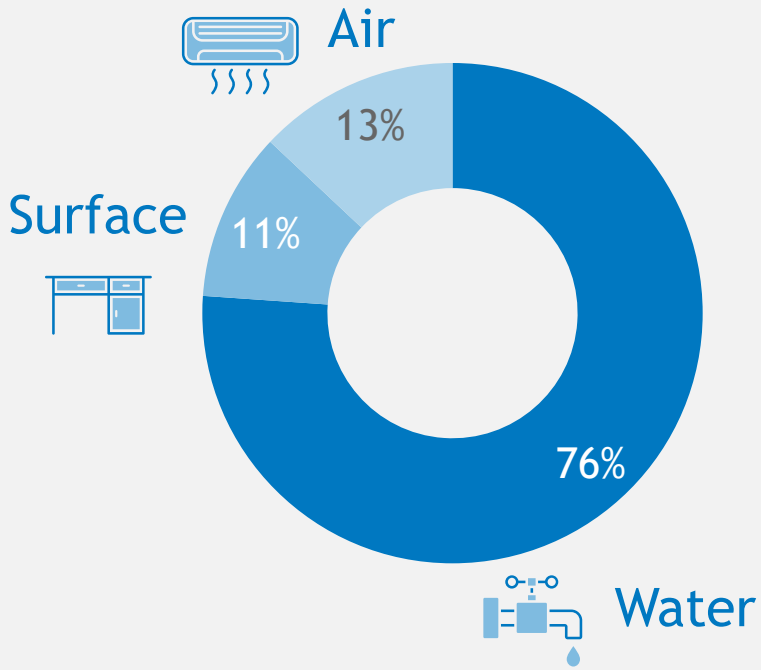
When looking for a subsidiary to invest in, manufacturer should examine closely which one has an established distributor, and manufacturing system.

Taking on the subsidiary's distribution system would be the most cost effective and would allow to get onto the market the fastest.

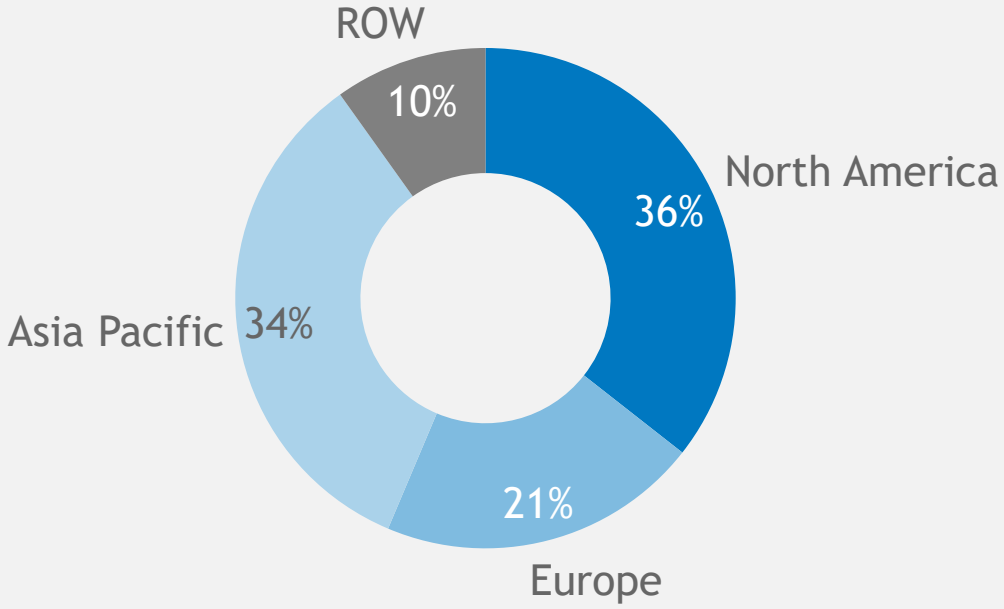
Appendix

The UV-C market is currently dominated by the water segment driven by North America and Asia Pacific

More than 75% of the market is in the water segment today …



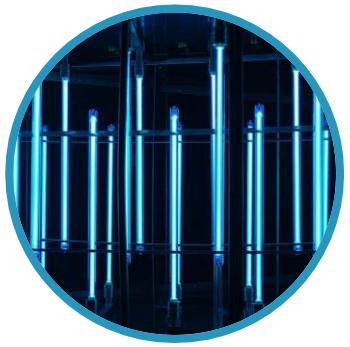
… and North America is the largest market followed by Asia Pacific



Air: Four main types of technological options

Upper air disinfection

- Continuous air disinfection in halls with low air-movement
- Usable in human-occupied rooms
- Standardized units

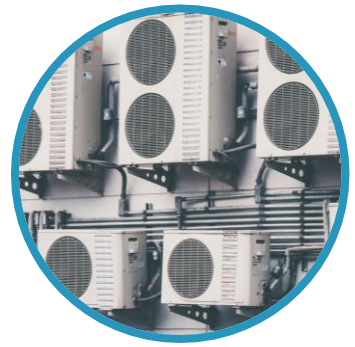


Air duct disinfection

- Continuous air disinfection installed in ducted HVAC systems
- Usable in human-occupied buildings
- Customized for exact system

Portable air disinfection

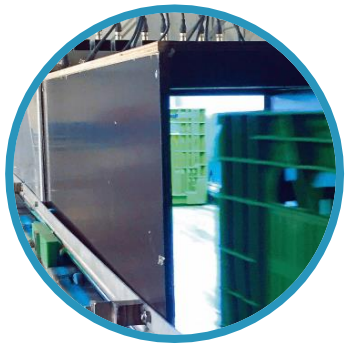
- On-demand air disinfection unit
- Depending on design, may be usable in human-occupied rooms
- Standardized units



Integrated solutions

- Continuous or On-demand air disinfection lamps integrated into consumer A/C units
- Need to be usable in human-occupied rooms
- Highly standardized units

Surface: Four technological options

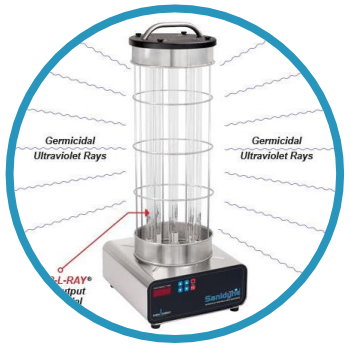


Conveyor belt disinfection

- Items disinfected on a conveyor belt
- Under sufficient concealment humans can occupy the same hall
- Customized equipment

UV-C fixtures for smaller surfaces

- Fixed UV-C installations for smaller surfaces and items
- Humans may occupy the same room wearing protective equipment
- Standardized units



Portable Air + Surface

- On-demand air and surface disinfection
- Humans need to clear the are during operation
- Standardized units

Fixed Air + Surface

- Continuous air and surface disinfection for use in unoccupied halls
- Equipment needs to be turned off during human presence
- Moderate customization needed

Market structure: Three main steps in the UV-C value chain



	Material manufacturing	Lamp manufacturing	Application manufacturing
Core competencies	• Manufacturing of key components such as glass, filaments, etc.	• Customization of product for customers' needs • Calibration and testing of products • Assembly of light bulbs	• Design and engineering of UV-C applications • Product Manufacturing • Marketing and product support
Success factors	• Maintaining longterm contracts	• Adapting to demand conditions and mainitaining reputation	• Cooperating with lamp manufacturers to create efficient designs
Players	• Small local players	signify PHILIPS, LightTech LightSources, OSRAM, SANKYO DENKI	• Multiple small players with different scopes over water air and surface

Long list: Widespread use cases for Surface technologies

Logistics & Retail

Travel & Public Transport

Homes

Office

Industrial & Manufacturing

	Logistics & Retail	Travel & Public Transport	Homes	Office	Industrial & Manufacturing
Conveyor Belt	• Parcel disinfection in Logistics centers • Disinfection at checkout aisle	• Airport luggage disinfection			• Disinfection of manufactured products before packaging
Fixtures	• Fresh food counter disinfection (Fruits&Vegetable and Meat Dept)	• Potential for fixtures in metro systems and tops of buses. • On-demand fixtures on airports	• Disinfection box for household items	• On-demand disinfection for courier items	• Disinfection of food items in temporary storage
Portable Air+Surface		• Overnight disinfection of unused public transport vehicles		• Disinfect rooms one-by-one through cleaning staff	
Stationary Air+Surface	• Disinfection locker for returned and tried-on clothes • Overnight disinfections of Logistic centers		• Overnight fixtures placed in lighting to deep clean rooms.		• Disinfection of warehoused items, especially perishable food

Long list: Air disinfection technologies can be used anywhere

Logistics & Retail

Travel & Public Transport

Homes

Office

Industrial & Manufacturing

	Logistics & Retail	Travel & Public Transport	Homes	Office	Industrial & Manufacturing
Upper Air Disinfection	• Disinfection of air in retail spaces	• Active air disinfection on public transport vehicles	• Home air disinfection without an a/c system	• Room disinfection in offices without air conditioning	• Workshop disinfection
Air duct Disinfection	• Disinfection of air in retail spaces with pre-existing H-VAC units.	• Disinfection of public transport stations	• Disinfection of air in homes and residential complexes with H-VAC systems	• Room disinfection in offices with air conditioning	• Large scale disinfection of industrial plants through H-VAC systems.
Portable Air Disinfection		• Buses, metros, and planes can use trolley system of UV-C tech to disinfect with minimal crew.			

We evaluate the long list items along two dimensions

Evaluation criteria

Market Potential

- **Number of customers:** The number of customers is hugely important for a company attempting to penetrate the market. The number of customers determines weather there is enough demand for a product in a market.
- **Product volume:** This is asking how many lamps this market will likely require. This is where we determine the potential profits from a certain market.
- **Expected penetration in 5 years:** Essentially, we are asking how easy it will be to penetrate the market and if the pre-existing market is saturated or not.

Right to Win

- **Level of Customization:** Firstly, the markets we are looking for should require a certain amount of customization so it can prevent them from going to a larger distributor.
- **Concentration of Buyers:** There being a high concentration of buyers within a market ensures that the players are legitimate and will order a substantial amount of product.
- **New Customers:** Finally, the consumers should preferably be newer to the market, meaning they have no pre-existing supplier.

Right to win: Scoring have developed to rank the potential options

	1	2	3	4	5
Level of Customization	Requires no customization for user needs	Requires a minor amount of customization	Needs a moderate amount of customization to fit into system	Needs to be custom ordered to work efficiently	Custom order is a necessity and will not work without specific metrics
New Customers	Market is involved with the UV-C Market and has previously ordered many UV Lamps	Market has been involved with UV and has fully integrated it into most of their system.	Market has small amount of UV-Tech integrated in their systems	Market wants to introduce UV-Tech and has knowledge on the market.	Market has no previous history with UV-Lamp technology.
Concentration of Buyers	Small amount of buyers not associated with each other	Few buyers in the market are involved with one another but rest of market is individualized	Market has small groups of buyers	Market is made up of large corporations likely all buying from same distributors	Market is made up of corporations that want to stay with the times and make the same purchases others would.

Do later: If capacity permits, more opportunities to capture

Fresh food counter disinfection

- Moderately sized market
- So far untapped opportunity
- Raises health and safety standards

Airpot Luggage belt disinfeciton

- Market size constrained by number of airports
- Covid likely to bring regulation
- Customization necessary

Warehoused item disinfection

- Decent sized market, but segmented
- High amount of lamps per system
- Minor customiztaion option

Logistic center parcel disinfection

- Limited to major distribution centers
- High buyer concentration
- Highly customized systems

Thank you!

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