

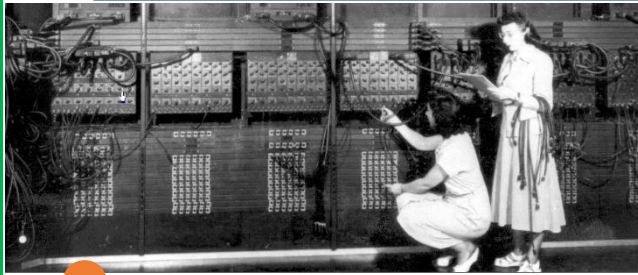
The Smartphones of Water Disinfection – How Micro UV-C LED Systems Can Increase Accessibility to Public Health Protection

Jennifer Pagan, Oliver Lawal
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We Can Learn From The Past

- How have other technologies increased accessibility?
- Will UV follow the same trajectory as other technologies?
- How can micro UV systems increase access to health protections?

Computer Evolution



1941 Z3-Konrad Zuse, German
1944 Colossus Mark 1, British
1946 ENIAC, US Army



1965 DEC PDP-8



1982 Commodore 64
1984 Apple Macintosh



2007, Amazon Kindle, Apple iPhone
2008, MacBook Air-solid state drive

1940

1950

1960

1970

1980

1990

2000

2010

2020

1951-Univac



1975 MITS Altair 8800
1977-1993 Apple II



1991-96 Apple Powerbook,
IBM Thinkpad 701, Sony Vaio



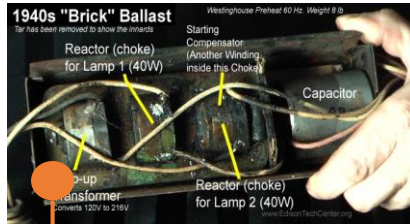
2010-Apple iPad
2013 Google Glass
2015 Apple Watch



aquisense
technologies

UVGI Evolution

1910, UV water treatment
Marseilles, France



Lamp Technology Improvements

1960-Beukers and Berends thymine dimers with UV-C



1980's-Rise of residential



2005 UV for cooling coil



Micro-UV systems

1900

1940

1950

1960

1970

1980

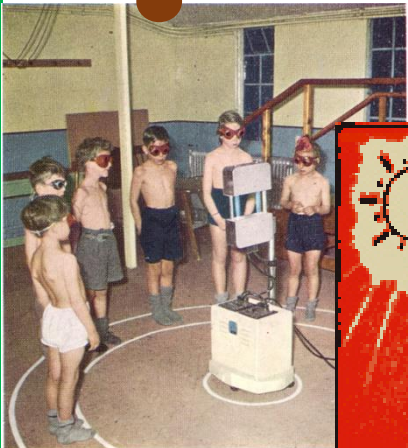
1990

2000

2010

2020

1924-Hanovia founded
1936 use of UVGI at
Duke University



1955, LP UV water treatment
plants in Austria, Switzerland



US EPA funds several full
scale wastewater systems

Municipal Growth

2012-Steripen
Philips Sonicare



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LED Technology like the Transistor

Vacuum Tubes Hg Lamps

- Glass Envelope
- Large footprint
- Physical Electrodes
- Fixturing required

Transistors LEDs

- Solid State
- Small Footprint
- Direct Charge Injection
- Board mountable



Small is problematic for Hg

Smallest Hg lamp is double the size of a LED lamp which includes drive and monitoring circuitry



- WPE is low
- Lifetimes are poor
- Lower reliability

Brand	Ushio	Philips	Philips2	Ushio3	AquiSense
MPN (Part No.)	3000022	PL-S5W/TUV	325126	3000304	PAQC-1
Bulb Shape	T7	Twin-Tube	Twin-Tube	Twin-Tube	PCB
Life Hours (Hours)	3,000	8,000	8,000	8,000	10,000
Wattage (Watts)	3 Watt	5.5 Watt	9 Watt	9 Watt	8 Watt
Voltage	10.5	34	60	59	12
Current (Amps)	0.3	0.18	0.17	0.18	0.35
Base Type	E17	G23	G23	G23	PCB
Ultraviolet Output (Watts)	0.16	1.1	2.3	2.4	0.18
Wavelength	253.7 nm	253.7 nm	253.7 nm	253.7 nm	275-285 nm
Length (mm)	63	85	145	145	20 X30
Diameter (Inches)	20	25,4	28	28	2.6 (height)
WPE	5%	20%	26%	27%	2%

This is a sample of the presentation material.
To request a full copy, please contact:

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