Executive Summary
REPORT OBJECTIVES

Provide a clear understanding of applications and related technologies.

Company ecosystem identification and analysis:
- Major actors on a global basis
- Technical market segmentation
- Economic requirements by segment
- Key players by market and analysis
- Market size and market forecast in $M and M units

Use case analysis and market and technology trends involved:
- Determine applications range
- Detailed applications per market segment
- Technology identification for different products and processes
- Competing technologies
- Main technical challenges
Yole’s market forecast model is based on matching several sources:

**Comparison with existing data**
- Monitoring of corporate communication
- Comparison with existing research data
- Yole screening

**Comparison with prior Yole reports**
- Recursive improvement of dataset
- Customer feedback

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**Top to Bottom approach**
- Aggregate of market forecasts
  - @ System Level

**Bottom-up approach**
- Ecosystem analysis
- Aggregate of main player revenues
  - @ System level

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**Top to Bottom approach**
- Aggregate of market forecast
  - @ Semiconductor device level

**Bottom-up approach**
- Ecosystem analysis
- Aggregate of key player revenues
  - @ Semiconductor device level

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**Market Segmentation**
- Volume (in Munits)
- ASP (in $)
- Revenues (in $M)

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**Semiconductor foundry activity**
- Capacity investments and equipment needs

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**Primary data**
- Reverse costing
- Patent analysis
- Annual reports
- Direct interviews

**Secondary data**
- Press releases
- Industry organization reports
- Conferences

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**Preexisting information**
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COMPANIES CITED IN THIS REPORT

Pierre Cambou

Pierre Cambou has been part of the imaging industry since 1999. He took several positions at Thomson TCS which became Atmel Grenoble in 2001 and e2v Semiconductors in 2006. In 2012 Pierre founded Vence Innovation later renamed as Irlynx in order to bring to market a new infrared sensor technology. He has an Engineering degree from Université de Technologie de Compiègne and a master’s of Science from Virginia Tech. More recently, Pierre graduated with an MBA from Grenoble Ecole de Management. In 2014 he joined Yole Développement as Imaging Activity Leader.

Contact: cambou@yole.fr

Jean-Luc Jaffard

Since 1966 Jean-Luc Jaffard has made invaluable contributions to imaging activity at STMicroelectronics, working at the forefront of this business’s emergence and impressive growth. At STMicroelectronics’ Imaging Division, Jean-Luc was appointed Research Development and Innovation Director, managing a large multidisciplinary/multicultural team. Soon after, he was promoted to Deputy General Manager and Advanced Technology Director, in charge of identifying and developing breakthrough imaging technologies and transforming them into innovative, profitable products. In 2010 he was appointed STMicroelectronics’ Intellectual Property Business Unit Director, and in January 2014 he created Red Belt Conseil’s Technology and Innovation branch.
WHAT WE GOT RIGHT, WHAT WE GOT WRONG

Technology and market forecast challenge

**What we got right**
- CIS’ steady growth
- Dual-camera introduction and impact
- 3D imaging & sensing introduction in mobile
- Automotive’s emergence as a key CIS market
- Security camera dynamics

**What we got wrong**
- Dual-camera sensors resolutions
- Impact of Mobileye and Tesla issue for automotive CIS
- Lower-than-expected computing market
- Higher-than-expected security market
WHAT DOES THIS ANALYSIS ACCOUNT FOR?

From wafer to the first packaged sensor

Market report focus

- CIS wafer
- CIS die
- Image sensors

Market analysis only

- Camera Modules
- Systems

Analysis at the component level

CIS wafer: Courtesy of Sony
CIS die: Courtesy of Omnivision
Image sensors: Courtesy of Sony
Camera Modules: Courtesy of Xiaomi
System: Courtesy of Apple

System: Courtesy of Tesla

Status of the CMOS Image Sensor Industry | Sample | www.yole.fr | ©2018
WHAT WE GOT RIGHT, WHAT WE GOT WRONG

CIS forecast over the years

Yole is again raising its forecast for CMOS image sensors

Mostly driven by dual-camera approaches and the introduction of new sensors in smartphones, our 2017 CIS forecast exceeds previous estimations

Our goal is a +/-10% market prediction in five years’ time
2017 has been an excellent year for CIS as almost all segments but computing have been growing. Driven by new applications the future of the industry remains on very strong footings.

In 2017 the CMOS image sensor market reached $13.9B. Yole forecasts a 9.4% CAGR from 2017 to 2023, mainly driven by smartphones integrating additional cameras that support functionalities like optical zoom, biometry, and 3D interactions.

Concerning the CIS ecosystem, it is now heavily dominated by three Asian heavyweights: Sony, Samsung, and Omnivision. Europe made a noticeable come back with STMicroelectronics and ams both serving sensing for mobile and the industry. The US has maintained a presence in the high-end sector, with On Semi for automotive and industrial markets as well as Teledyne for industrial and medical.

Market-wise, mobile rules revenue and technology development. New approaches such as hybrid stack and triple stack are driving new features like super-slow motion and 3D sensing. Automotive and Security are additional growth engine to CIS. Consumer IoT is finally making a significant entry with home devices carrying micro cameras.

CIS technology is becoming increasingly innovative, being at the forefront of 3D semiconductor technologies, quantum energy detection, artificial intelligence, and more. It will be part of several megatrends, including autonomous vehicles and the robotic revolution at large.
Sony maintains its market leadership, leveraging technology rooted in digital photography and applied to mobile.

Second tier players become more homogenous as On Semi, Panasonic and STMicro maintain growth in respect to Omnivision and Samsung.
### 2017 CIS Revenue Breakdown

By market (in $M)

<table>
<thead>
<tr>
<th>Market</th>
<th>2016</th>
<th>2017</th>
<th>YoY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile</td>
<td>8,068</td>
<td>9,437</td>
<td>17%</td>
</tr>
<tr>
<td>Consumer</td>
<td>1,120</td>
<td>1,127</td>
<td>1%</td>
</tr>
<tr>
<td>Computing</td>
<td>1,394</td>
<td>1,298</td>
<td>-7%</td>
</tr>
<tr>
<td>Automotive</td>
<td>536</td>
<td>658</td>
<td>23%</td>
</tr>
<tr>
<td>Medical</td>
<td>60</td>
<td>69</td>
<td>15%</td>
</tr>
<tr>
<td>Security</td>
<td>624</td>
<td>786</td>
<td>26%</td>
</tr>
<tr>
<td>Industrial/Space/Defense</td>
<td>462</td>
<td>555</td>
<td>20%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>11,598</strong></td>
<td><strong>13,906</strong></td>
<td><strong>19.9%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue (in $M)</th>
<th>YoY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>11,598</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>13,906</td>
<td></td>
</tr>
</tbody>
</table>
2017 CIS REVENUE RANKINGS

By player

2016-2017 CIS revenue market share by player (in $B)
(Source: Status of the CMOS Image Sensor industry 2018, Yole Développement, September 2018)

2016 $11.6B
2017 $13.9B

Sony 42%
Samsung 20%
Omnivision 11%
ON Semiconductor 5%
STMicroelectronics 5%
Panasonic 3%
Canon 3%
SK Hynix 2%
Galaxycore 2%
Hamamatsu 1%
Smartsens 1%
Pixelpus 1%
Others 4%
2017 CIS PRODUCTION RANKINGS

By foundry (in kWPY 12” eq.)

2017 CIS production breakdown by foundry

- Sony: 38%
- Samsung: 20%
- TSMC: 16%
- HLMC: 5%
- SMIC: 8%
- TSMC: 3%
- ST Micro: 3%
- TPS Co: 4%
- SMIC: 0%
- DB Hitek: 1%
- Other: 2%

2016 2,367kW
2017 2,422kW

Value of the CMOS Image Sensor Industry | Sample | www.yole.fr | ©2018
CIS WAFER PRODUCTION FORECAST 2011 - 2023

By technology (in kW 12” eq.)

Since 2010, BSI technology increased its market share

Since 2014, the stacked BSI approach has been dominant

The hybrid stack technique will be predominantly used for specific sensors such as 3D imagers

CIS is predominantly produced using 3D stacked technology
MOBILE MARKET TREND

3D brings the fourth camera embedded in smartphones!

Most of the business is for 10x10x5mm³ camera modules

Module size & cost

<table>
<thead>
<tr>
<th>Size</th>
<th>20x10mm²</th>
<th>10x10mm²</th>
<th>5x5mm²</th>
<th>1x1mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$20</td>
<td>$10</td>
<td>$5</td>
<td>$1</td>
</tr>
</tbody>
</table>

Smartphones: the size of main camera stops shrinking and a front facing camera is added

Camera phones: Innovation from Sharp in June 2000

Dual rear: improved photography thanks to dual approach

The selfies trend: the size of front facing camera is increasing

3D sensing module: the front camera becomes a user interface

Market size

<table>
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<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Market size</td>
<td>$20B</td>
<td>$10B</td>
<td>$5B</td>
<td>$1B</td>
<td>$20B</td>
<td>$10B</td>
<td>$5B</td>
</tr>
</tbody>
</table>

Status of the CMOS Image Sensor Industry | Sample | www.yole.fr | ©2018
MOBILE MARKET TREND
More cameras - Most probably of different kinds

Top smartphone flagship camera configuration scenario
(Source: Status of the CMOS Image Sensor industry 2018, Yole Développement, September 2018)

If the trend maintains we are heading toward 10 cameras per smartphone
MOBILE MARKET TREND

Number of cameras per smartphone (in units)

Originally, front cameras differentiated smartphones from feature phones.

The introduction of dual-front and back cameras is increasing the number of cameras per smartphone.

3 cameras per phone in average by 2022.
MOBILE TECHNOLOGY TREND

From FSI, to BSI, to Multi-stacked BSI - pixel level

BSI opened the way to 3D semiconductor

Front-side illuminated (FSI)

Backside illuminated (BSI)

Stacked BSI

Multi-stacked BSI
Healthy growth still ahead

2018 conclusions

• The CMOS image sensor industry will maintain its healthy growth pattern at a 9.4% CAGR from 2017 - 2023

• Sony is the undisputed leader due to its role in mobile, but competition is still open in many other dynamic markets, i.e. security and automotive

• Photography applications are still powering the mobile growth engine, mostly thanks to dual-camera approaches. The industry is on the verge of a massive transformation fuelled by augmented reality applications involving 3D sensing.

• Technological innovation is ongoing. After a period of stacked BSI introduction (which is now the new normal), fresh techniques like multi-stack and hybrid-stack enable new features like super-slow motion and full PDAF.

• The key trend of using computing power to manipulate, enhance, and extract metrics from an image led to Intel’s $15B mega-purchase of Mobileye. The stakes are indeed very high for downstream image usage.
IMAGE SENSOR APPLICATIONS - WHAT’S NEXT?
A roadmap for the next 10 years

The technology shift of 2020 will be AI-related

Status of the CMOS Image Sensor Industry | Sample | www.yole.fr | ©2018
IMAGE SENSOR APPLICATIONS - WHAT’S NEXT?
A roadmap for the next 20 years

From “vision for imaging” to “vision for sensing”

Era of Photography
- 1900 to 1980
- 1980 to 2020
- 2020 to 2040
- 2040 to 2045

Era of Machine Sensing
- 1900 to 1980
- 1980 to 2020
- 2020 to 2040
- 2040 to 2045

Main Players could change
- Proximity sensor
- Autofocus
- Single-photon imagers
- Event-based imagers
- 3D time of flight
- Multi-wavelength imagers
- Holographic imagers

By 2030, new technologies serving machine-sensing could become dominant

Next Era
- Human vision enhancement?

Technology x Market Penetration

Acceleration: the speed of technology change doubles with every technological shift
Yole Développement
Yole Développement

*From Technologies to Market*
YOLE DEVELOPPEMENT – 4 DIVISIONS

Life Sciences & Healthcare
- Microfluidic
- BioMEMS
- Inkjet Printing
- Solid-State Medical Imaging & BioPhotonics
- Bio Technologies

Power & Wireless
- RF Devices & Technology
- Compound Semiconductors & Emerging Materials
- Power Electronics
- Batteries & Energy Management

Semiconductor & Software
- Package & Assembly & Substrates
- Semiconductor Manufacturing
- Memory
- Software & Computing

Photonics, Sensing & Display
- Solid-State Lighting & Display
- MEMS, Sensors & Actuators
- Imaging
- Photonics & Optoelectronics
4 BUSINESS MODELS

- **Consulting and Analysis**
  - Market data & research, marketing analysis
  - Technology analysis
  - Strategy consulting
  - Reverse engineering & costing
  - Patent analysis
  - Design and characterization of innovative optical systems
  - Financial services (due diligence, M&A with our partner)

- ** Syndicated reports**
  - Market & technology reports
  - Patent investigation and patent infringement risk analysis
  - Teardowns & reverse costing analysis
  - Cost simulation tool
  - www.i-Micronews.com/reports

- **Monitors**
  - Monthly and/or Quarterly update
  - Excel database covering supply, demand, and technology
  - Price, market, demand and production forecasts
  - Supplier market shares
  - www.i-Micronews.com/reports

- **Media**
  - i-Micronews.com website
  - @Micronews e-newsletter
  - Communication & webcast services
  - Events: TechDays, forums, …
  - www.i-Micronews.com
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Yole Group of Companies

- **Yole Développement**
  - Market, technology and strategy consulting
  - [www.yole.fr](http://www.yole.fr)

- **SystemPlus Consulting**
  - Manufacturing costs analysis
  - Teardown and reverse engineering
  - Cost simulation tools
  - [www.systemplus.fr](http://www.systemplus.fr)

- **KnowMade**
  - IP analysis
  - Patent assessment
  - [www.knowmade.fr](http://www.knowmade.fr)

- **Piseo**
  - Design and characterization of innovative optical systems
  - [www.piseo.fr](http://www.piseo.fr)

- **Blumorpho**
  - Innovation and business maker
  - [www.blumorpho.com](http://www.blumorpho.com)

- **Yole Finance**
  - Due diligence
  - [www.yole.fr](http://www.yole.fr)
OUR GLOBAL ACTIVITY

40% of our business

Europe office

Greater China office

30% of our business

30% of our business

HQ in Lyon

Yole Korea
Seoul

Yole Japan
Tokyo

Greater China office
Hsinchu

Yole Inc.
Phoenix

Yole Korea
Seoul

Yole Inc.
Phoenix

Palo Alto
ANALYSIS SERVICES - CONTENT COMPARISON

- Technology and Market Report
- Leadership Meeting
- Q&A Service
- Meet the Analyst
- Custom Analysis

Depth of the analysis vs. Breadth of the analysis graph.
SERVING THE ENTIRE SUPPLY CHAIN

Integrators, end-users and software developers

Device manufacturers

Suppliers: material, equipment, OSAT, foundries...

Financial investors, R&D centers

Our analysts provide market analysis, technology evaluation, and business plans along the entire supply chain.
SERVING MULTIPLE INDUSTRIAL FIELDS

We work across multiple industries to understand the impact of More-than-Moore technologies from device to system.
Yole Développement, System Plus Consulting, KnowMade and PISEO, all part of Yole Group of Companies, keep on increasing their collaboration to offer, in 2018, a collection of 150+ reports. Combining respective expertise and methodologies from the 4 companies, the reports aim to provide market & technology analysis, patent investigation and patent infringement risk analysis, teardowns & reverse costing analysis. They cover:

- MEMS & Sensors
- RF devices & technologies
- Imaging
- Medical technologies (MedTech)
- Photonics
- Advanced packaging
- Manufacturing
- Advanced substrates
- Power electronics
- Batteries and energy management
- Compound semiconductors
- Solid state lighting
- Displays
- Software
- Memory

You are looking for:

- An analysis of your product market
- A review of your competitors evolution
- An understanding of your manufacturing and production costs
- An understanding of your industry technology roadmap and related IPs
- A clear view on the evolution of the supply chain…

Our reports are for you!

The combined team of 60+ experts (PhDs, MBAs, industry veterans…) from Yole Développement, System Plus Consulting, KnowMade and PISEO, collect information, identify the trends, the challenges, the emerging markets, the competitive environments and turn it into results to give you a complete picture of your industry landscape.

In the past 20 years, we worked on more than 1700 projects, interacting with technology professionals and high level opinion makers from the main players of the industry.

In 2018, Yole Group of Companies plan to publish +150 reports. Gain full benefit from our Bundled Offer and receive at least a 36% discount.
MEMS & SENSORS

- **MARKET AND TECHNOLOGY REPORT** – by Yole Développement
  - Status of the MEMS Industry 2018 – Update
  - Silicon Photonics 2018 – Update
  - Consumer Biometrics: Hardware & Software 2018 – Update
  - Inkjet Functional and Additive Manufacturing for Electronics 2018
  - Fingerprnt Sensor Applications and Technologies – Consumer Market Focus 2017
  - Sensors and Sensing Modules for Smart Homes and Buildings 2017
  - Acoustic MEMS and Audio Solutions 2017
  - MEMS & Sensors for Automotive Market & Technology Trends 2017
  - High End Inertial Sensors 2017
  - Magnetic Sensor 2017

- **REVERSE COSTING® – STRUCTURE, PROCESS & COST REPORT** – by System Plus Consulting
  - Piezo MEMS 2018 *

- **PATENT ANALYSES** – by KnowMade
  - MEMS Microphone – Patent Landscape Analysis
  - Knowles MEMS Microphones in Apple iPhone 7 Plus – Patent-to-Product Mapping 2017

- **LINKED REPORTS** – by Yole Développement, System Plus Consulting and KnowMade
  - MEMS Pressure Sensor 2018 – Market & Technology Report
  - Gas & Particles 2018 – Market & Technology Report
  - LiDARs for Automotive and Industrial Applications 2018 – Market & Technology Report
  - LiDAR for Automotive 2018 – Patent Landscape Analysis
  - MEMS Packaging 2017 – Market & Technology Report

RF DEVICES AND TECHNOLOGIES

- **MARKET AND TECHNOLOGY REPORT** – by Yole Développement
  - Wireless technologies (Radar, V2X) for Automotive 2018
  - RF Standards and Technologies for Connected Objects 2018
  - RF & Photonic Components & Technologies for 5G Infrastructure 2018

- **REVERSE COSTING® – STRUCTURE, PROCESS & COST REPORT** – by System Plus Consulting
  - Automotive Radar Comparison 2018

- **PATENT ANALYSES** – by KnowMade
  - RF Acoustic Wave Filters 2017 – Patent Landscape Analysis

- **LINKED REPORTS** – by Yole Développement, System Plus Consulting and KnowMade
  - 5G impact on RF Front End Modules and Connectivity for Cellphones 2018 – Market & Technology Report – Update
  - RF Front End Modules for Cellphones 2018 – Patent Landscape Analysis
  - Advanced RF System-in-Package for Cellphones 2018 – Market & Technology Report – Update*
  - RF GaN 2018 – Patent Landscape Analysis

SOFTWARE

- **MARKET AND TECHNOLOGY REPORT** – by Yole Développement
  - Consumer Biometrics: Sensors & Software 2018 – Update
  - Processing Hardware and Software for AI 2018 - Vol. I & 2
  - From Image Processing to Deep Learning, Introduction to Hardware and Software
OUR 2018 REPORTS COLLECTION (2/4)

IMAGING & OPTOELECTRONICS

- **MARKET AND TECHNOLOGY REPORT** – by Yole Développement
  - Status of the Compact Camera Module and Wafer Level Optics
  - Industry 2018 – Update
  - 3D Imaging and Sensing 2018 – Update
  - Sensors for Robotic Vehicles 2018
  - Machine Vision for Industry and Automation 2018
  - Imagers and Detectors for Security and Smart Buildings 2018
  - Uncooled Infrared Imagers 2017

- **PATENT ANALYSES** – by KnowMade
  - iPhone X Dot Projector – Patent-to-Product Mapping

- **LINKED REPORTS** – by Yole Développement, System Plus Consulting and KnowMade
  - Status of the CMOS Image Sensor Industry 2018 – Market & Technology Report - Update
  - CMOS Image Sensors Monitor 2018* – Quarterly Update**
  - Camera Module 2017 – Market & Technology Report
  - LiDARs for Automotive and Industrial Applications 2018 – Market & Technology Report
  - LiDAR for Automotive 2018 – Patent Landscape Analysis

ADVANCED PACKAGING

- **MARKET AND TECHNOLOGY REPORT** – by Yole Développement
  - Status of Advanced Packaging Industry 2018 – Update
  - Status of Advanced Substrates 2018: Embedded Die and Interconnects, Substrate Like PCB Trends
  - 3D TSV and Monolithic Business Update 2018 – Update
  - Power Modules Packaging 2018 – Update
  - Discrete Power Packaging 2018 – Update*}

- Status of Panel Level Packaging 2018
- Trends in Automotive Packaging 2018
- Hardware and Software for AI 2018 - Vol. I & 2
- Thin-Film Integrated Passive Devices 2018
- Memory Packaging Market and Technology Report 2018 – Update*

- **PATENT ANALYSES** – by KnowMade
  - Hybrid Bonding for 3D Stack – Patent Landscape Analysis

- **LINKED REPORTS** – by Yole Développement and System Plus Consulting
  - Advanced RF System-in-Package for Cellphones 2018 – Market & Technology Report - Update*
  - Fan-Out Packaging 2018 – Market & Technology Report – Update*

MANUFACTURING

- **MARKET AND TECHNOLOGY REPORT** – by Yole Développement
  - Wafer Starts for More Than Moore Applications 2018
  - Equipment for More than Moore: Technology & Market Trends for Lithography & Bonding/Debonding 2018
  - Polymeric Materials for wafer-level Advanced Packaging 2018
  - Laser Technologies for Semiconductor Manufacturing 2017
  - Glass Substrate Manufacturing in the Semiconductor Field 2017
  - Equipment and Materials for Fan-Out Packaging 2017
  - Equipment and Materials for 3D TSV Applications 2017

- **LINKED REPORTS** – by Yole Développement and System Plus Consulting

Update : 2017 version still available / *To be confirmed

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OUR 2018 REPORTS COLLECTION (3/4)

MEMORY
- MARKET AND TECHNOLOGY REPORT – by Yole Développement
  - Emerging Non Volatile Memory 2018 – Update
  - Memory Packaging Market and Technology Report 2018 – Update*
- QUARTERLY UPDATE – by Yole Développement**
  - Memory Market Monitor 2018 (NAND & DRAM)
- MONTHLY UPDATE – by Yole Développement**
  - Memory Pricing Monitor 2018 (NAND & DRAM)
- REVERSE ENGINEERING & COSTING REVIEW – by System Plus Consulting
  - DRAM Technology & Cost Review 2018
  - NAND Memory Technology & Cost Review 2018
- PATENT ANALYSES – by KnowMade
  - 3D Non-Volatile Memories – Patent Landscape

COMPOUND SEMICONDUCTORS
- MARKET AND TECHNOLOGY REPORT – by Yole Développement
  - Status of Compound Semiconductor Industry 2018*
  - GaAs Materials, Devices and Applications 2018
  - InP Materials, Devices and Applications 2018
  - Bulk GaN Substrate Market 2017
- LINKED REPORTS – by Yole Développement, System Plus Consulting and KnowMade
  - SiC Transistor Comparison 2018 – Structure, Process & Cost Report
  - Power SiC 2018 – Patent Landscape Analysis
  - GaN-on-Silicon Transistor Comparison 2018 – Structure, Process & Cost Report
  - RF GaN – Patent Landscape Analysis

POWER ELECTRONICS
- MARKET AND TECHNOLOGY REPORT – by Yole Développement
  - Status of Power Electronics Industry 2018 – Update
  - Discrete Power Packaging 2018 – Update*
  - Power Electronics for Electric Vehicles 2018 – Update
  - Integrated Passive Devices (IPD) 2018
  - Wireless Charging Market Expectations and Technology Trends 2018
  - Thermal Management Technology and Market Perspectives in Power
    - Electronics and LEDs 2017
    - Gate Driver 2017
    - Power MOSFET 2017
    - IGBT 2017
  - Market Opportunities for Thermal Management Components in Smartphones 2017
- LINKED REPORTS – by Yole Développement, System Plus Consulting and KnowMade
  - Power Modules Packaging 2018 – Market & Technology Report – Update
  - Power ICs Market Monitor 2018 – Quaterly Update**

BATTERY AND ENERGY MANAGEMENT
- MARKET AND TECHNOLOGY REPORT – by Yole Développement
  - Li-ion Battery Packs for Automotive and Stationary Storage Applications 2018 – Update
- PATENT ANALYSES – by KnowMade
- LINKED REPORTS – by Yole Développement and KnowMade
  - Solid State Electrolyte Battery 2018 – Market & Technology Report
  - Solid-State Batteries 2018 – Patent Landscape Analysis

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  - OCT Medical Imaging – Patent Landscape
  - Pumps for Microfluidic Devices – Patent Landscape 2017
  - Microfluidic Technologies for Diagnostic Applications – Patent Landscape 2017
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