REPORT ON THE 2019 REVIEW OF THE GAME CONSOLE SELF-REGULATORY INITIATIVE

Final report date:

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EXECUTIVE SUMMARY

This report is the second undertaken by the Signatories of the Game Console Self-Regulatory Initiative (SRI). It explains in detail the process and rationale leading to the proposed SRI revisions and updates after 2017. The revision process includes analysing the essential elements of the SRI to determine whether revisions are necessary, taking into consideration the latest technological and regulatory developments.

The industry 2019 Review of the SRI was carried out in parallel with the independent "Videogame Consoles Review Study" commissioned by the European Commission. The objective of the Review Study was to "provide an independent review of the targets contained in the current version of the Game Console SRI (Version 2.6 of 5 June 2018), make proposals for changes and inform the revision of the voluntary agreement planned for 2019".

As a result of the industry review, as well as the independent Study, various updates to the SRI are proposed.

The main conclusion is that the SRI remains the preferred choice for addressing energy and material efficiency of games consoles, due to a higher transparency process and the speed of technology development within the sector.

Updates on Industry Compliance with the SRI

Under the SRI, each Signatory is required to submit an annual Product Compliance Report (PCR) to the Independent Inspector for each of its game console models in scope.

Since formal endorsement of the SRI in April 2015, the Signatories have undergone four reporting cycles in total (covering consoles placed on the market in 2015, 2016, 2017 and 2018, respectively). In each case, the Independent Inspector determined that all Signatories were compliant with their SRI commitments for all reporting periods to date.

In 2018, on account of technological developments in the market and in an effort to set staged and quantified objectives in accordance with Annex VIII of the ErP Directive, the Signatories took steps to revise the SRI to include new commitments, added new responsibilities for the Independent Inspector, and implemented new timescales to align existing SRI provisions with the European Commission's published guidelines for industry self-regulation measures.

Regarding governance of the SRI, Tim Calland (Microsoft), who served as the Steering Committee Chairman since December 2015, has stepped down from that post on account of his retirement in July 2019. Election of the new Chairperson, Kieren Mayers (Sony), took place at the meeting of the Steering Committee on 14th November 2018.

Review of Technology

The next shift in gaming could be considerable and may be the biggest the consoles industry have seen in 40 years when home console gaming took over from gaming at centralized video arcades.. Users no longer consumed energy in transportation to and from the arcades. There were shifts in the lifecycle energy consumption of home games consoles relative to arcade cabinets as well as in the manufacture and distribution of games. Finally, the higher sales of home gaming products spurred innovation that has led to the increased performance and reduced overall energy consumption of consoles over time.

The move from console-based to streaming gaming will likely be slower as it will depend on ubiquitous high-speed connections, but it will still have as many variables to consider when calculating the effect on aggregate energy consumption. Despite the continual increase in computational power and display resolution, the overall energy consumption in consoles has not increased significantly and for some aspects it has even dropped.

Videogame Consoles Review Study

In December 2018, the European Commission undertook steps to select a team of independent consultants to perform the Videogames Consoles Review Study, and a final report was completed in September 2019. This Study ran contemporaneously and in parallel with the Signatories' own review of the SRI. Consideration has been given to each of the potential improvement measures proposed by the independent consultants. A summary of the adopted measures has been described in the relevant section.

Energy Efficiency Proposal

This section describes the energy savings attributable to the SRI as well as the latest proposed updates to the SRI energy commitments. The Game Console SRI has driven an estimated energy saving 17 TWh (up until June 2019). The games consoles industry estimates that in 2020 there will be an energy savings of 6.8 TWh for UHD media-capable games consoles. These energy savings are largely due to manufacturers adopting a large variety of energy efficient technologies and implementing reductions in power consumption of consoles more rapidly than expected. In addition, further energy savings updates are proposed:

- Remove the 20W natural user interface allowance
- Navigation power reduction

Material Efficiency Proposal

This section provides a recap of the commitments derived from the previous Review (2017) as well as covers each proposal for modification of the SRI material efficiency commitments for this Review. Proposed SRI revisions include:

- Plastic parts removability and BFR (bromate fire retardants) marking
- Use of standard repairability statements
- Adding home consoles consuming <20 W to the scope of material efficiency

Summary of all proposed changes to the SRI

This section lays out clearly and succinctly all the proposed updates and changes to the SRI, stemming from both Signatories' own review as well as the Consultants' Review Study.

INTRODUCTION

Background on the SRI

The development of the Game Console Self-Regulatory Initiative ("SRI") under the Ecodesign Directive (2009/125/EC) started in 2010 and was formally endorsed in April 2015.

The Signatories of the SRI are the three major game consoles manufacturers: Microsoft, Nintendo and Sony.

The aim of the SRI continues to be reducing the environmental impact of games consoles over their life-cycle and to achieve energy and material savings through better design. Under the Game Console SRI, manufacturers commit to make ambitious improvements to the energy and material efficiency of their consoles. The SRI remains the most effective approach for setting Ecodesign requirements for games consoles; it achieves policy objectives more quickly and at lesser expense than mandatory requirements:

- There are only three manufacturers: easier to reach agreement
- The rate of technology improvement outpaces regulatory processes
- Substantial differences between platforms render standardisation difficult

The SRI specifies commitments regarding maximum power limits, auto-power down, market coverage, resource-efficiency/end-of-life design, and user information requirements for games consoles "placed on the market" in the EU.

When determining possible new commitments, the Signatories consider ways to improve game console energy and material efficiency without compromising console function and performance and therefore consumer experience.

The Game Console SRI is a world-leading approach. As each producer develops and distributes their models globally, the SRI provides a *de facto* global standard.

Objective of the Report

As part of their obligations under the SRI, the Signatories are required to review the SRI's essential elements every two years to examine if existing provisions need to be updated and whether new commitments should be included. The objective of this report is to provide a detailed description of the Signatories' research and review process underlying the latest proposed amendments to the SRI.

Transparency of the process

The process of updating the SRI continues to be an open and transparent one, whereby the opinion of all stakeholders is considered.

Review Process Timescales

This review process started in January 2019. Informal feedback from the Commission and stakeholders, as well as formal input from the Consultants' Review Study on Games Consoles, were considered in this industry review report and the updated SRI document throughout the process.

The overall timelines being followed by the SRI Signatories for the 2019 SRI Review process are shown in the figure below. The completion of the industry SRI Review was achieved at a later stage than the previous (2017) Review, as this time it had to address the points raised by the independent Consultants' Study. .

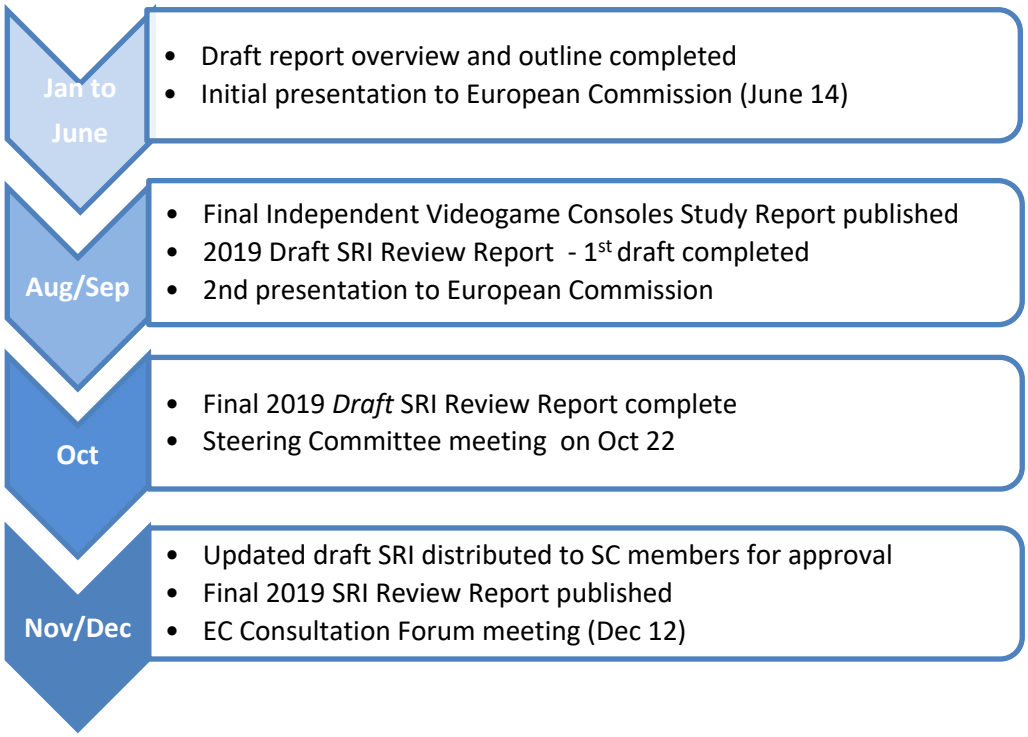

Figure 1: Timelines followed by the SRI Review process

The new version of the SRI is expected to be implemented from 2020.

COMPLIANCE UPDATE

The last industry review of the SRI was in July 2017. Since then, there have been two additional reporting cycles (4 in total since the SRI's endorsement in 2015) involving the annual submission of Signatory data to the Independent Inspector for verification of their compliance with SRI requirements covering games consoles sold in the years 2017 and 2018. The Microsoft Xbox One X console was launched in November 2017. No new models were introduced on the market by the Signatories in 2018.

As confirmed by the Independent Inspector (Intertek) in its Annual Compliance Reports covering both respective years, the Signatories were able to demonstrate their continued compliance with the SRI for all console models they placed on the market.

SRI Revisions in 2018

On account of technological developments in the market and in an effort to set staged and quantified objectives in accordance with Annex VIII of the ErP Directive, the Signatories took steps to revise the SRI to include new commitments in 2018. The new commitments consist of:

- New categories for UHD consoles
- New Tier 4 (2019) requirements
- New removability requirements
- New recyclability / durability rules

The Signatories also wrote into the SRI several new responsibilities for the Independent Inspector and implemented new timescales to align existing SRI provisions with the European Commission's published guidelines for industry self-regulation measures. The role of the Independent Inspector has been significantly broadened regarding its auditing and testing of consoles to verify their conformity with SRI requirements. These changes to the SRI consequently necessitated the Signatories having to renegotiate the terms in their service contract with the Independent Inspector.

In consultation with the Independent Inspector and the European Commission, various additional amendments were made to the SRI with the aim to improve both text clarity and test procedures. Signatory data submitted for the 2018 reporting cycle was reviewed against the latest version of the SRI (version 2.6.3), which includes the aforementioned revisions.

Product Compliance Reporting Template

The Signatories submit Product Compliance Reports to report and describe how each of their product models comply with the commitments set out in the SRI. They make use of a product compliance reporting template, which was designed with input and feedback from the Independent Inspector, to ease the use and review of their data submissions. Use of the

template is intended to standardize and streamline the reporting process and eliminate cut & paste errors. The product compliance reporting template was revised in 2018. (Details about the revision can be found in the Signatories' *Explanatory notes to SRI version 2.6.3*, published on the SRI website.)

Election of New Chairperson

Governance of the SRI is effectuated by a Steering Committee comprising of the Signatories, a representative of the European Commission and a Chairperson. The Steering Committee is responsible for the overall direction and management of the SRI. Tim Calland (Microsoft), who served as the Steering Committee Chairman since December 2015, has stepped down from that post on account of his retirement in July 2019. Election of the new Chairperson, Kieren Mayers (Sony), took place at at the meeting of the Steering Committee on 14th November 2018.

REVIEW OF TECHNOLOGY

As the video experience evolved from small-screen black-and-white Cathode Ray Tubes (CRTs) to high-frame rate, high-dynamic response (HDR) and Ultra-High Definition (UHD), the display technology computational requirements increased (and continue to increase) in a non-linear fashion.

There has been a rapid adoption of 4K displays and televisions with some models selling for under USD $300. In addition, many media streaming providers, including YouTube, Netflix and Hulu have a significant amount of available 4K content. 4K display technology has four times the resolution of 1080p video, requiring increased computation and four times the display memory bandwidth for rendering any images, including games.

The introduction of High Dynamic Range (HDR) and wider colour gamut requires further complexity. The next step in resolution, 8K, is at the cusp of a transition from high-end technology to mass market. While 8K televisions are currently an order of magnitude more expensive than 4K televisions, the prices are dropping, and they will become common within the next few years. The Signatories anticipate that future consoles will be challenged to handle 8K resolution requiring yet another increase in computation and a further four-fold increase in display memory bandwidth for image rendering to handle the approximately 33 million pixels per frame. Videogame consoles will be able to provide new and immersive experiences in these higher resolutions that will not be possible for streaming gaming or gaming on other devices.

The increase in video resolution has spurred improvements in video compression technology. Video compression has progressed from H.262 (MPEG-2) to H.264 (MPEG-4) to H.265 (High Efficiency Video Coding/HEVC). Each improvement reduces the amount of data that needs to be transmitted, but it increases the computation required to decode the video. H.266, also known as Versatile Video Coding (VVC) is expected to be released by the end of 2020 and it will require even more computational power to decode today's higher resolution video streams.

Virtual reality, another area of increased interest, is the computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment. The user experience is under continuous improvement with a considerable amount of research and development being done in this area. However, it is worth noting that some of the present limitations, such as wearing a helmet tethered to a large processing unit, have significantly limited the mass-market adoption of VR technology. These are the kinds of problems that, when solved, will enhance user experience – perhaps reminiscent of the Holodeck of Star Trek fame.

Despite the continual increase in computational power and display resolution, the overall energy consumption in consoles has not increased significantly and for some aspects it has even dropped. The SRI Signatories expect that a number of technological improvements will allow increases in game resolution without always requiring an increase in overall power consumption. This is primarily due to Moore's Law - the observation that the number of transistors in a dense integrated circuit doubles approximately every two years, by shrinking the transistors geometry and therefore increasing the number of transistors that can be fitted on a chip. As a result of this process, the amount of electricity required for a given unit of computing has gone down in step functions over the last 40 years. However, the physical limits of silicon processing and physics have begun to put the brakes on this phenomenon, and the industry expect to see an added energy cost in the future for a commensurate increase in gaming power. The current level of technology can produce minimum transistor sizes of 14 nm commonly, with 10 nm and even some 7 nm products starting to hit the market. However, at 7 nm, a transistor is only about 60 silicon atoms across, close to the limit of what is possible before the effects of quantum physics override the basic electrical properties used for computing. The Signatories expect to see an overall slowing of the rate of the energy reduction from this process as it nears its physical limits.

Cloud computing and streaming gaming is just starting to be introduced into the market. The Signatories are starting to offer streaming games to consoles and sometimes to devices other than consoles. It is more challenging to foresee the effect on energy consumption as the computing power for gaming is shifted from the console to the data centre. There could be a short-term increase in energy consumption as the data centre infrastructure for gaming is implemented. However, this could eventually lead to a long-term decrease in energy consumption. A CPU in a data centre can be dynamically reallocated to new computing loads. When one user stops playing games, a CPU can then be allocated to computing tasks for a new user. Gamers will be able to play on devices they already have, whether a computer, smart phone or other device without having to purchase new hardware each time gaming performance improves. The computing power for gaming in the data centre can be maintained and upgraded in a centralized method reducing lifecycle energy costs related to shipping and distribution. Data centre equipment typically gives minimal concessions to aesthetics, reducing the amount of plastics used and thereby reducing the amount of flame retardants.

Predicting energy variations for streaming gaming is difficult. The next shift in gaming may be the biggest seen in 40 years. In the early 1980s, video arcades were the standard for computer gaming, with hundreds of giant gaming cabinets in centralized locations. Within 10 years, home gaming was taking over, thereby disrupting the energy calculations for the game arcade. Users no longer consumed energy in transportation to and from the arcade.

There were shifts in the lifecycle energy consumption of home games consoles relative to arcade cabinets. There were energy shifts in the manufacture and distribution of games. Finally, the higher sales of home gaming products spurred innovation that has led to the increased performance and reduced overall energy consumption of consoles over time. The shift to streaming gaming will likely be slower as it will depend on ubiquitous high-speed connections, but it will still have as many variables when calculating the effect on aggregate energy consumption.

INPUT FROM THE VIDEOGAME CONSOLES REVIEW STUDY

The European Commission undertook steps to select a team of independent consultants to perform the Videogames Consoles Review Study that ran from December 2018 to September 2019. This Study ran contemporaneously and in parallel with the Signatories' own review of the SRI. The aim of the Consultants' Review Study was to provide an independent review of the targets in the current SRI (version 2.6.3) and make proposals for possible changes.

The Signatories participated in an initial kick-off meeting with the consultants in Hamburg, Germany, and in two subsequent Stakeholder Meetings held by the Commission in Brussels, in March and in July respectively. The Signatories engaged cooperatively with the consultants to address their questions, providing extensive data and other sources of information to support the Consultants' Study. The Consultants provided the Signatories with their Final Report in September 2019. Their conclusions and recommendations stemming from the Consultants' Review Study fed into the Signatories' present 2019 SRI Review Report and influenced the development of the latest SRI revision proposals. Consideration has been given to each of the potential improvement measures proposed by the Consultants.

Consultants' Review Study Recommendations

Revision of the SRI Scope

The consultants proposed revising the scope definition of the SRI to omit the exclusion of consoles that consume less than 20W in active gaming mode and to include handheld gaming devices. The table below shows the difference between the scope definition of the Consultants' Study and the current SRI (version 2.6.3).

Study Scope Definition	SRI version 2.6.3 Scope Definition
'Games console' means a device which is designed to provide video game playing as its primary function. Games consoles either use an external or an internal display as the game-play display or both. Games consoles typically include a CPU, system memory and a graphics processing unit(s)(GPU), and may contain hard drives or other internal storage options, and optical drives. Games consoles typically utilise handheld controllers or other interactive controllers as their primary input device rather than an external keyboard or mouse. Games consoles do not typically include conventional personal computing operating systems but instead utilise console-specific operating systems. Handheld gaming devices, with an integrated display as the	A Games Console is a computing device whose primary function is to play video games. Games Consoles share many of the hardware architecture features and components found in general personal computers (e.g. central processing unit(s), system memory, video architecture, optical drives and/or hard drives or other forms of internal memory). Games Consoles covered by this SRI are those that: • Utilise either dedicated handheld or other interactive controllers designed to enable game playing (rather than the mouse and keyboard used by personal computers); and • Are equipped with audio-visual outputs for use with external televisions as the primary display; and

primary game-play display, and which primarily operate on an integrated battery or other portable power source rather than via a direct connection to an AC power source, are considered to be a type of game console.	• Use dedicated Console operating systems (rather than using a conventional PC operating system); and • May include other secondary features such as optical disc player, digital video and picture viewing, digital music playback, etc.; and • Are mains powered devices that use more than 20 watts in Active Game mode with either internal or dedicated external power supply units.

Table 1: Comparisson between the scope definition suggested by the Study and the definition and scope specified in the current SRI (version 2.6.3)

The Signatories acknowledge that games consoles are commonly understood to include both stationary gaming devices and handheld gaming devices and that this is not adequately reflected in section 2.1 Definition of a "Games Console." The original intention of the European Commission was to have the SRI applied only to stationary games consoles and not to portable handheld devices, which as noted by the Consultants' Review Study in section 2.1.3 (p.13), inherently have a low energy use. To address this, the Signatories consider it is important to keep the definition of "Games Console" separate from the SRI scope.

With respect to changes to the SRI scope, the independent consultants proposed removal of the 20W exemption and inclusion of games consoles "with a capability for both stationary and handheld gaming" in order "to account for the growing importance of material efficiency under the Ecodesign Directive […] and to avoid the exclusion of relevant market players from the VA." The Consultants proposed in section 7.2 (p.135) a revised scope definition (see above) that would include "Handheld gaming devices"; however no analysis or justification was provided for this as required by the MEErP methodology, and it is unclear how broadly or narrowly one ought to interpret this term. It appears that the intention underlying these proposals was to extend the scope of the SRI to cover only consoles like the Nintendo Switch and arcade-style consoles. The Signatories note that inclusion of "Handheld gaming devices" would conceivably cover a vast variety of products that go far beyond what is understood by the Consultants as games consoles, e.g. educational computer toys for kids, Tamagotchi, electronic pocket games, etc. The Consultants' study lacked any evaluation of the energy and material efficiency aspects of these kinds of products. Also having such a broad scope definition would necessitate consideration of an unforeseeably large number of potential participants to the SRI, thus making the SRI unmanageable. Since it is unclear what kind of products the report refers to as "Handheld gaming devices", and given that no analysis of those products pursuant to MEErP principles was provided for, the Signatories have for purposes of this present review set aside consideration of including "Handheld gaming devices" in the SRI scope.

The Signatories are willing to remove the 20 W exemption and to include a commitment to bring games consoles consuming less than 20 W in Active Gaming mode into the scope with only the material efficiency requirements of the SRI applicable to such consoles starting from January 2021. As noted also by the Consultants in their Review Study, the energy consumption of Nintendo Switch is significantly below the power caps required in the SRI for HD consoles so it already a highly energy efficient games console. Since the Nintendo Switch was designed from the outset to be very low power consuming, its potential for further energy savings is extremely limited, and if any further energy savings could be reached, it is likely to be little and not cost effective to implement. As shown also in the Review Study by the Consultants (section 7.3.1.4 and Figure 58) the cumulative electricity consumption over the lifetime of the Nintendo Switch is so low that any further savings would not have any drastic effect on the home games consoles power consumption total. Therefore, Nintendo believes, as also pointed out by the Consultants in their scope section for the Review Study (section 2.1.3, p.13) that the main consideration for home consoles consuming less than 20 W in gaming mode should be the material efficiency aspects.

Even if theoretically games consoles with less than 20W energy consumption could be further improved in regards of energy efficiency, opportunities for improved energy efficiency for these consoles remain very limited. The Signatories disagree with the Consultants' proposal to include arcade-style gaming devices into the SRI scope because arcade-style gaming devices are not 're-engineered consoles', nor do they have console-dedicated operating systems.

It would be possible for the Signatories to revise section 2.1 of the SRI as shown in the next table (revised text shown in blue), below:

Study Scope Definition	**Revised SRI Scope Definition (v2.7)**
'Games console' means a device which is designed to provide video game playing as its primary function. Games consoles either use an external or an internal display as the game-play display or both. Games consoles typically include a CPU, system memory and a graphics processing unit(s)(GPU), and may contain hard drives or other internal storage options, and optical drives. Games consoles typically utilise handheld controllers or other interactive controllers as their primary input device rather than an external keyboard or mouse. Games consoles do not typically include conventional personal computing operating systems but instead utilise console-specific operating systems. Handheld gaming devices, with an integrated display as the primary game-play display, and which primarily operate on an integrated battery or other	A Games Console is a computing device whose primary function is to play video games. Games Consoles share many of the hardware architecture features and components found in general personal computers (e.g. central processing unit(s), system memory, video architecture, optical drives and/or hard drives or other forms of internal memory) **and may include other secondary features such as optical disc player, digital video and picture viewing, digital music playback, etc**. Games Consoles covered by this SRI are those that: • Utilise either dedicated handheld or other interactive controllers designed to enable game playing (rather than the mouse and keyboard used by personal computers); and • Are equipped with audio-visual outputs for use with external televisions as the primary display; and

portable power source rather than via a direct connection to an AC power source, are considered to be a type of game console.	• Use dedicated Console operating systems (rather than using a conventional PC operating system); and • **Use either internal or dedicated external power supply units.**

Table 2: Comparisson between the scope definition suggested by the Study and the modified definition and scope suggested by the Signatories for the next SRI version.

Response to Energy Efficiency Recommendations

In addition to their scope modification proposals, the Consultants made numerous suggestions for the Signatories to consider relating to changing the energy efficiency requirements of the SRI. The Signatories assessed the feasibility of adopting each proposed measure, detailing their considerations and whether changes to the SRI would be necessary (see table in Annex 2 of this Report). The key conclusions discussed and agreed at the SRI Steering Committee meeting on 22 October 2019 are summarised below. Many of these recommendations are already addressed, or form part of the revised SRI proposal. A list of recommendations not included in the new SRI proposal is provided below, along with an explanation.

New energy efficiency proposals based on Consultants' recommendations

- Introduce new separate caps for next generation consoles
  A new category of consoles will be defined for next generation and, once complete specifications are announced, a new SRI review will be carried out to evaluate and determine new power caps and other requirements during 2020.
- Clarify basis of navigation power caps
  How navigation mode operates differs for each type of console on the market. Signatories are considering the addition of alternative measurement methods for the navigation mode to take this into account.
- Introduce 65 W cap for 2K navigation and 70 W cap for 4K navigation for 4K capable gaming consoles in 2020
  Power caps for navigation will be reduced to reflect performance related power reductions achieved for inactive navigation mode in practice under conditions of normal use.
- Consider definition and power cap for rest modes of next generation consoles in the next SRI review
  Although the features of next generation consoles are not yet publicly known, the scope of functions included in rest mode and a corresponding power cap will be considered for next generation consoles during the next SRI review. Note that rest

mode is an optional feature for consumers; consoles do not need to include a rest mode.

- Include a method to check stability of measurements and where necessary extend test time on a case by case basis
  A longer testing period can improve stability of measurements, although the recommended 30 minutes may not be necessary in every case. A new method to check stability of measurements and where necessary extend test time on a case by case basis will be included in the SRI.
- Consider reporting power consumption of any separately enabled ray tracing for next generation consoles in the next SRI review
  Although next generation features are not fully pubic yet, reporting separate power measurements for ray tracing will be considered where appropriate and applicable during the next SRI review.

Consultants' energy efficiency recommendations already addressed

- Compliance with lot 26
  Signatories' consoles currently on the market already comply with the amended EC Commission Regulation 1275/2008 to the extent that the 0.5W limit for non-network standby and the new 2W limit for network standby are applicable.
- Provide easily accessible information on console power use
  Access to the information is already featured in user instructions provided with the product.

Consultants' energy efficiency recommendations not included in SRI review proposal

- Adaptative power management
  Adaptive APD is typically used for home heating to sense the presence of residents within or in proximity to the home, and through which it learns their preferences over time. Residents do not have direct interaction with their home heating systems on a daily basis unless it is to set timers or temperatures. In the case of the games console, the system can automatically sense the presence of the players by their interactions with the controller, and power management is automatically enabled by default. Statistics already indicate that consoles are off or in low power mode for 21 hrs per day on average. Adaptive APD cannot improve on the APD system already used within consoles. Its use is highly likely to frustrate users, who have direct interaction with consoles at specific times, as the system wakes up and powers down according to its own judgment.

- Use current generation console power as a baseline for next
  Next generation consoles will be higher performing and have new functions, and they may not meet current UHD console power caps at first. Under MEERP methodology, as new consoles generation consoles provide new functions and higher performance, they have a different functional unit and a new base case will be used to evaluate energy savings.
- One step approach for powering consoles off
  Consoles have sophisticated low power functions designed for energy saving. The consultant's report did not include evidence that including such a feature would lead to energy saving over and above rest mode features. SRI signatory customers do not generally complain that consoles are difficult to power off, and power-down settings are already easily changed.
- Consider 90 W cap for 4K media play on UHD gaming capable consoles
  As the consultant correctly notes, there can be high variability in the power consumption of different components. An explanatory rationale for this cap will be included within the SRI.
- Schedule downloads for times of peak renewable generation
  Software updates account for only a fraction of console energy use, and the necessary smart grids infrastructure to implement this does not exist.

Response to Material Efficiency Recommendations

The Consultants also made various suggestions for the Signatories to consider relating to improving the material efficiency requirements of the SRI. As above, the Signatories have considered each in detail (see table in Annex 2 of this Report). The key conclusions discussed at the SRI Steering Committee meeting on 22 October 2019 are summarised below. Many of these recommendations are already addressed or form part of the revised SRI proposal. A list of recommendations not included in the new SRI proposal is provided below, along with an explanation.

New material efficiency proposals based on Consultants' recommendations

- Plastic enclosure parts >100g removable using tools commercially available to recyclers
  As set-out in the last SRI review, Signatories undertook to consider removability of plastic enclosure parts for recycling, and a new commitment will be included in the SRI on this.
- Draft statements describing the reparability of consoles
  A new requirement to include standard statements on the repairability of consoles in

product instructions (whether with the product, online, etc.) will be included in the SRI, using criteria derived from relevant EC standards.

Consultants' material efficiency recommendations already addressed

- Ensure batteries are easy to replace
  This is already a requirement of the Battery Directive except where needed for data integrity and safety reasons, which is the case for our consoles and peripherals. At the EOL of the product the Signatories ensure, as required by the Battery Directive, that the batteries are readily removable by qualified professionals.
- Disassembly using common tools
  The SRI already requires the use of commercially available tools
- Use common external power supplies
  This matter is being addressed by the Radio Equipment Directive's Common Charger initiative and therefore will not be added to the SRI.
- Phase out hazardous substances
  Hazardous substance restrictions are not in the scope of the ErP Directive, but are covered under REACH, RoHS Directive, etc.
- Guarantee free system updates
  The Signatories already provide all system updates free of charge, available all the time. This is not relevant for the VA since it is entirely necessary and commonplace for consoles. In addition, determining the price of software licensing is not a matter for ErP, but commercial matter.
- Provide separate take-back of consoles
  This is a matter covered already by the WEEE Directive and not ErP. It is not cost or environmentally beneficial to collect consoles individually for recycling. Improving recycling processes is a matter for EPR and recycling standards.
- Provide information on flame retardant contents
  The SRI already includes a requirement to provide information on brominated flame retardants.

Consultants' energy efficiency recommendations not included in SRI Review proposal

- Keep battery capacity at 90% after 500 charges
  The consultants' Final Report includes no evidence to suggest that there is a shortfall in console battery performance requiring such a measure. Available studies provide evidence that consoles remain in use for many years.
- Use >10% post-consumer plastic, and report to consumers
  In the industry's experience, the polymers currently available do not meet the

necessary quality and volume of supply requirements for our production. Presently, the Signatories are not aware of any recycled PC+ABS that can comply with flame retardant grade V0 (1.5mm) required by IEC62368. Signatories will continue to monitor the development of polymers and consider revisions to the SRI as new post-consumer recycled resins become available.

- Provide spare parts to all repairers for 7 years
  Recognising the strong push for a consumer's 'right to repair' the Signatories have included a commitment in the SRI to provide refurbishment or out-of-warranty repair services enabling the possibility for consumers to repair their devices easily. However, because most parts of our consoles are proprietary and form part of an encrypted system to protect the consoles against hacking and games piracy, the Signatories cannot directly provide spare parts to independent repair companies without compromising consoles systems and technology. All repair operators must therefore be authorised to ensure proper, safe, and secure console operation. The Waste Framework Directive already requires that Member States take sufficient steps to protect intellectual property from being made freely available.
- Commit to free repair as the first option under guarantee
  Depending on the level of repair/nature of the damage (e.g. water damage) there could be cases where the console cannot be repaired and must be "substituted" to assure consumer and product safety.
- Provide information on durability of consoles
  Progress in this area will be reviewed at the necessary CENELEC standards are published. Presently, Signatories are not aware of any known reliable method or standard to measure or report the expected lifetime of an electronic circuit or product at the time before it is sold. Information regarding repair returns or current usage is only obtained after a period of use, and also reflects the period over which consoles are used, not their technical lifetime. In any case, existing studies, including the consultant's study, provide evidence demonstrating that games consoles are reliable products and typically long-lasting. This is generally known by consumers and very positive for material efficiency; providing more specific information on console lifetime is not specifically necessary and will not, therefore, improve this positive outcome further.

In addition to the various consultant's recommendations that will be included within the new SRI, Signatories have also put forward their own additional improvement proposals detailed in the following two sections. The total list of improvement proposals, combining those

suggested within the EC consultant's report and those put forward by Signatories, is included in the "Conclusions" section.

Estimated Energy Savings

This section quantifies the energy savings made by ultra-high definition capable games consoles sold in Europe, driven by the adoption and implementation of the SRI. To date, the Game Console SRI has driven an estimated energy saving 14.2 TWh (up to June 2019). Furthermore, the Signatories estimate that in 2020 there will be an energy saving of 6.7 TWh for UHD media-capable and UHD gaming capable games consoles (no sales data are publically available for PS4 Pro and Xbox One X, this estimate is based on assumption that between 1/4 and 1/5 of UHD games consoles sold are UHD-gaming capable). This is significantly higher than the 1.1 TWh savings estimated by 2020 in the original version of the SRI. These energy savings are largely due to manufacturers adopting a large variety of energy efficient technologies and implementing reductions in power consumption of consoles more rapidly than expected. Over the lifetime of current generation games consoles in scope of the SRI (PlayStation 4, PlayStation 4 Pro, Xbox One and Xbox One X), energy savings are expected to be in the order of 48.2 TWh – which is equivalent to the annual energy production of Portugal. Energy savings of current generation consoles have exceeded initial expectations, showing that the SRI continues to be an effective driver of energy efficiency.

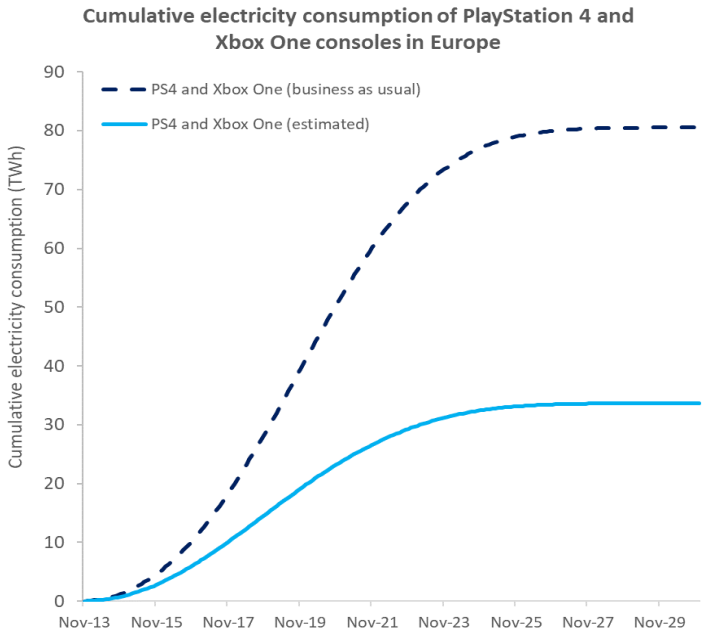

Figure 2: Cumulative electricity consumption of PlayStation 4 and Xbox One consoles in Europe compared to the estimated business as usual energy use. Estimated avoided energy use is the difference between the two curves.

Existing Energy Efficiency Commitments

As part of the energy efficiency commitments enshrined in the current SRI, maximum power caps have been set. The table below shows the power caps set for all HD and UHD past and present operational modes, including Natural User Interface (NUI):

<table>
<tr><th></th><th colspan="3">Navigation (W)</th><th colspan="3">Media Playback (W)</th><th colspan="2">Additional (NUI) (W)</th></tr>
<tr><th></th><th>HD</th><th colspan="2">UHD</th><th>HD</th><th colspan="2">UHD</th><th>UH</th><th>UHD</th></tr>
<tr><td>Tier 1
(from Jan 1 2014)</td><td>90[1]</td><td colspan="2">90[2]</td><td>90[1]</td><td colspan="2">-</td><td>20</td><td></td></tr>
<tr><td>Tier 2
(from Jan 2016)</td><td>-</td><td colspan="2">-</td><td>-</td><td colspan="2">90[2]</td><td></td><td>20</td></tr>
<tr><td>Tier 3
(from Jan 2017)</td><td>70[1]</td><td colspan="2">70[2]</td><td>70[1]</td><td colspan="2">-</td><td>15</td><td></td></tr>
<tr><td rowspan="3">Tier 4
(from Jan 1 2019)</td><td rowspan="3">50[1]</td><td>Media Capable</td><td>50[2]</td><td rowspan="3">60[1]</td><td>Media Capable</td><td>60[2]</td><td rowspan="3"></td><td rowspan="3">15</td></tr>
<tr><td rowspan="2">Gaming Capable</td><td rowspan="2">70[2]</td><td rowspan="2">Gaming Capable</td><td>70[1]</td></tr>
<tr><td>110[3]</td></tr>
</table>

Table 3: Current SRI Energy Efficiency caps

[1] Measured at 2K (HD) resolutions

[2] Measured at 2K (HD) and 4K (UHD) resolutions

[3] Measured at 4K (UHD) video resolutions

The Auto-Power Down (APD) times are currently as follows:

- within 4 hours for Media playback (disk playing and streaming)
- within 60 minutes for all other modes.

Proposed Energy Efficiency Changes

In order to further improve the energy efficiency of the game consoles as well increase clarity of the SRI text and processes, the Signatories propose the following updates to the SRI document:

Remove +20 W allowance for NUI

The first proposal is to remove the 20 W allowance for Natural User Interface (NUI). The 20 W allowance for NUI was originally included in the SRI to allow for the use of sensing camera peripherals with consoles. The Xbox Kinectis no longer sold. None of the signatories, therefore, currently produce NUI peripherals and as such the additional power allowances (see table 2 below) for NUI are no longer required in the SRI.

Additional Power Cap allowances for Games Consoles using a Natural User Interface

	High Definition Consoles	Ultra-High Definition Consoles
Tier 1 Effective from 1st January 2014	+20W	-
Tier 2 Effective from 1st January 2016	-	+20W
Tier 3 Effective from 1st January 2017	+15W	-
Tier 4 Effective from 1st January 2019	-	+15W

Table 4:The NUI allowances above are no longer required in the SRI

Clarifying the basis of power caps for navigation mode

Navigation mode now includes a variety of complex features, as there are many functions and applications that can be selected by the user – each of which may preview certain features whilst navigating, for example. Minor clarifications to the definition of navigation mode and the test procedure in the current SRI are required to ensure consistent and representative measurements in future. These clarifications ensure that navigation is measured properly for each status and without disabling other power saving features, such as screen savers. This also ensures that consoles are tested in a manner that is representative of real use.

Introduce 65 W cap for 2K navigation for UHD gaming capable consoles

The SRI defines separate power caps for media modes in 2K (HD) and 4K (UHD) resolution for UHD gaming capable consoles, at 70 W and 110 W respectively. The current power caps for UHD gaming capable consoles for navigation mode is 70 W at both resolutions (see Tier 4 in table below). As noted in the consultant's report, further reductions in power consumption have been achieved in UHD gaming capable consoles for navigation mode. Therefore, the signatories propose to add a new tier of power caps for 2020, to include a 65 W power cap for navigation mode at 2K resolutions for UHD gaming capable consoles (see Tier 5 in table below).

	High Definition Consoles	UHD Media Capable Consoles	UHD Gaming Capable Consoles
Tier 4 Effective from 1st January 2019	50W[1]	50W[2]	70W[2]
	High Definition Consoles	UHD Media Capable Consoles	UHD Gaming Capable Consoles

Tier 5 Effective from 1st January 2020	50W[1]	50W[2]	65W[1]	70W[3]

[1] Measured at 2K (HD) resolutions

[2] Measured at 2K (HD) and 4K (UHD) resolutions

[3] Measured at 4K (UHD) video resolutions.

Table 5: Current and proposed power cap tiers for navigation mode

Explanation of tolerance in power caps for sample variation

The current power caps set in the SRI are higher than the measured average power consumption for consoles currently in scope. For example, the cap for UHD gaming capable consoles is 110 W for media play. The measured average power consumption is lower than this cap, however the cap is set higher to account for variation between samples. This is due the inherent variability exhibited from the component manufacturing stage, which means that some components may have a higher power draw than the expected average (and some lower), see figure 4below. In general, for the manufacturing of components, such as microprocessors, there is a normal distribution for the functional properties (such as speed and power consumption) that each component has. In rare cases there may be consoles that are assembled with several components that consume above the average power. For such cases, the “sum of the parts” will result in total power consumption that is higher than average for the sample. The power caps in the SRI are, therefore, set higher than the measured average power consumption to account for this inherent variation – although on average consoles consume less power.

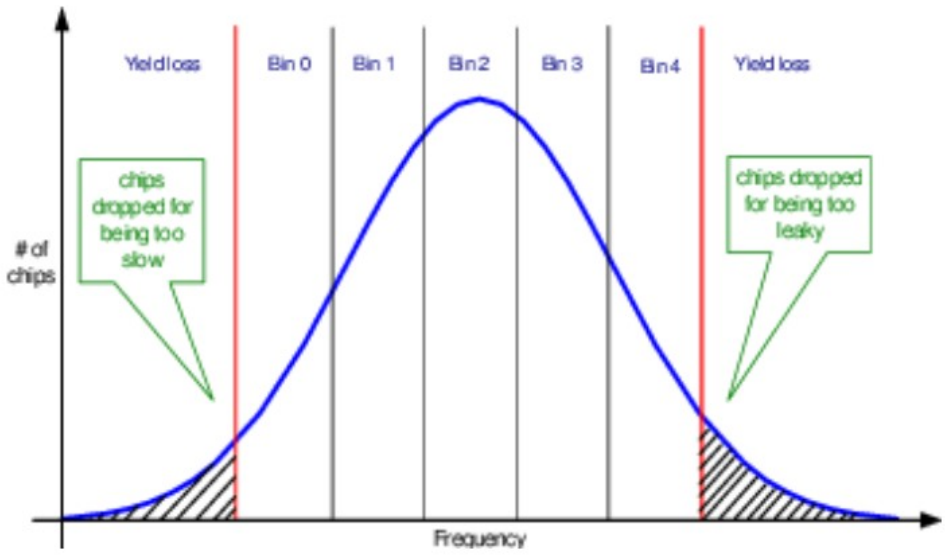

Figure 3: Variability between samples – example of the type of inherent variation in microprocessor properties from manufacturing process showing normal distribution for number of chips vs frequency range

Explanation for omittance of requirements for HDR

There are no additional requirements for High Dynamic Range (HDR) functionality, as the SRI Signatories do not currently provide navigation function or media content in HDR.

Set requirements against circumvention

Finally, an additional commitment is proposed to define and prohibit circumvention. This includes statements committing signatories to ensure games consoles do not alter their performance in test conditions, as well as provisions within the test procedure to ensure that the console is operated in the manner that it is intended to be used.

MATERIAL EFFICIENCY PROPOSAL

The Game Console Self-Regulatory Initiative aims to reduce the environmental impact of games consoles over their life cycle and to achieve energy savings and material efficiency through better design. Thus, benefiting the environment without compromising console performance and gaming experience. It also includes provisions to align with the European Commission's proposed action plan on the Circular Economy[1] (CE).

Introduction

CE is generally recognised as a shift from a linear-type economy, where raw materials are extracted and disposed, to a more circular approach which aims to 'close the loop' by retaining material within the economy. CE aims to enable the more efficient use of raw materials and limiting (or theoretically eliminating) the production of waste.

The transition towards a CE has been spearheaded by the European Union, through the development of current and new legislative pathways. Particularly in the electronics industry, CE thinking is being applied through current policy frameworks such as the Ecodesign Directive. When coupled with NGO and external influences, such as The Ellen MacArthur Foundation, voluntary pledges such as The Circular Plastics Alliance, and the potential business case for CE, it is becoming increasingly important for industry to consider their opportunities for material efficiency.

The European Commission adopted an action plan for the Circular Economy in 2015**,** that lists 54 measures to improve material efficiency of products and retain waste as a resource. It aims to reduce production and consumption, improve waste management and increase the market for secondary raw materials. The action plan identifies five priority sectors and puts a strong emphasis on building foundations for investments and innovation to thrive. It also promotes close cooperation with Member States, regions and municipalities, businesses, research bodies, citizens and all other stakeholders involved in the CE.

It is vital to take a life-cycle approach when assessing CE strategies, to ensure that any changes made avoid unintended consequences and truly decrease the environmental impact of business. For this review report Signatories present their rationale for material efficiency commitments made for the 2019 review of the SRI.

Methodology

In order to further understand what CE-related requirements could be implemented by Signatories to meet political expectations, in line with the exercise detailed in the 2017 Review

[1] Closing the loop – An EU action plan for the Circular Economy. Brussels, 2.12.2015 COM (2015) 614 final.

Report[68], the Signatories (for the 2019 Review) performed a detailed and systemic review of the below listed technical reports, standards and documents, across sectors and geographical location, examining how material efficiency is defined by assessing the scope and criteria covered. A matrix of criteria was created and once it was complete (see Annex 1), Signatories considered the feasibility of implementing each requirement in their consoles for this year's review.

- Self-Regulatory Initiative to further improve the energy efficiency of Games Consoles [Version 2.6.3]
- General method for the assessment of the durability of energy-related products prEN 45552/CEN-CLC TC10Sec136DC SDS/1/11/17_0087 [Draft available through working group - November 2018]
- General method for the assessment of the ability to re-manufacture energy related products prEN 45553 [Draft available through working group - November 2018]
- General methods for the assessment of the ability to repair, reuse and upgrade energy related products prEN 45554 [Draft available through working group - November 2018]
- General methods for assessing the recyclability and recoverability of energy related products prEN 45555 [Draft available through working group - August 2018] General method for assessing the proportion of reused components in energy-related products prEN 45556 [Draft available through working group - January 2019]
- General method for assessing the recycled material content in energy-related products prEN 45557 [Draft available through working group - August 2018]
- General method to declare the use of critical raw materials in energy-related products BS EN 45558:2019
- Industry Voluntary Agreement To Improve The Environmental Performance Of Imaging Equipment Placed On The European Market Draft FY19 v.2
- Voluntary Industry Agreement to improve the energy consumption of Complex Set Top Boxes within the EU, Version 6.0, 2nd April 2018
- [Joint Research Centre] Cordella M, Alfieri A, Sanfelix J, Analysis and development of a scoring system for repair and upgrade of products – Final report, EUR 29711 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-01602-1, doi:10.2760/725068, JRC114337
- [February 2019 Draft] COMMISSION REGULATION (EU) …/… of XXX laying down ecodesign requirements for electronic displays pursuant to Directive 2009/125/EC of the European Parliament and of the Council, amending Commission Regulation (EC) No 1275/2008 and repealing Commission Regulation (EC) 642/2009 (and Annexes)
- COMMISSION REGULATION (EU) 2019/424of 15 March 2019 laying down ecodesign requirements for servers and data storage products pursuant to Directive 2009/125/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 617/2013
- Preparatory study on the Review of Regulation 617/2013 (Lot 3) Computers and Computer Servers Task 7.1 report Presentation of policy measures [2 February 2017]
- Circular Economy roadmap of France: 50 measures for a 100% circular economy (2018)
- Leading the transition [Action plan for circular economy in Portugal: 2017-2020]
- Our Waste, Our Resources: A strategy for England [DEFRA, 2018]

To recap, for clarity and consistency throughout the current SRI, the current material efficiency obligations can be split into the following commitments:

1. Repairability
2. Recyclability
3. Life Extension/ Durability

This recap is expanded and explained further in the subsections below.

Current SRI Repairability Commitments

Within the current SRI, the following material efficiency commitments are included on repair:

- A refurbishment or out-of-warranty repair service for each games console will be made available, and supported by the following requirements:
  - Technical documentation shall be made available to authorised repair centres to enable repair or refurbishment of each games console.
  - Spare parts shall be made available to authorised repair or refurbishment centres for each games console.
  - To improve both recycling and reuse at end-of-life, maintenance and refurbishment of each games console shall be possible by non-destructive disassembly of the following key components: the motherboard, hard disk drive, optical drive, and internal power supply. In addition, Signatories shall ensure that joining or sealing techniques do not prevent the removal of the components, applicable to games consoles, listed in point 1 of Annex VII of Directive 2012/19/EU, when present. Exemptions apply where non-removable joining and sealing techniques may be used to ensure either user safety necessary to comply with safety-related EU legislation or product quality necessary to avoid wear and tear that would otherwise shorten the product's useful life[2].
  - Accessing components shall be enabled by documenting the dismantling operations needed to access the targeted components, including for each of these operations: type of operation, type of fastening technique(s) to be undone, and tool(s) required.
  - Consumers will be informed of end-of-life processing, refurbishment, and out-of-warranty repair options available within the operating instructions of each games console (with instructions either provided with the console itself, onscreen or hardcopy, or online).

More technically advanced products, such as games consoles, require specialist repairs to ensure quality and safety and extend the working life of consoles, whilst protecting intellectual property rights of proprietary components. Therefore, Signatories have committed to provide out-of-warranty repair services. A recent UK Government study[3] suggests that games consoles "never die", which is also supported by surveys of WEEE that have found 34% of consoles are usually more than 5-years-old when disposed of[4]. Consoles are often kept longer, as they become collectors' items, making the offering of out-of-warranty repair even

[2] For batteries, exemptions in the Battery Directive 2006/66/EC amended by Directive 2013/56/EU apply.

[3] Baldé, C.P., Forti V., Gray, V., Kuehr, R., Stegmann, P. (2017): The Global E-waste Monitor – 2017, United Nations University (UNU), International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), Bonn/Geneva/Vienna.

[4] BBC (2017) Retro gaming: Why players are returning to the classics. J, Scott, https://www.bbc.co.uk/news/uk-40427838, 28/06/2017.

more essential. Nevertheless, Signatories considered several potential additional recyclability and repairability aspects for this SRI, as discussed below.

Due to the out-of-warranty repair service commitment, third party repair demand is low. Signatories are rarely asked to provide parts or information to third party repair or non-professional repairers, if at all. However, technical guidance documents reviewed, such as JRC Technical report[5], state that repair instructions and standardised components should be available to third-party repair centres to increase repair activities.

Though standardising components may ease repair, it would drastically limit innovation in the console industry and undermine competition between producers. Therefore, current commitments within this SRI focus on ensuring that Signatories do not use proprietary screws, avoid non-separable connections or joins/fastenings, and ensure key components are removable through non-destructive disassembly of the product. This ensures these components are removable for repair and end-of-life to facilitate longer working lifespans and ensures correct treatment at end-of-life through improving recyclability of the consoles. In the rare case that a Signatory is unable to repair a model, for example due to water damage, consoles will be replaced with a refurbished or new model depending on availability.

One Signatory's reverse logistics process was featured as a case study in the UK Resource and Waste Strategy for England[6]**.** The report outlines the UK's approach to preserving material resources by minimising waste, promoting resource efficiency and the move towards a circular economy in England. As discussed in the case study, Signatory's repair models are optimised for efficiency, and therefore minimise environmental impacts beyond what would be possible via third-party repairers. Furthermore, as Signatories maintain product production and repair data, they can accurately predict the demand for spare parts, minimising overstocking and saving resources.

Various technical documents reviewed (listed in Annex 1) outline the need to provide information to consumers on repairability, reusability, upgradability and product lifespan. One of the Signatories is directly involved in development of a suite of material efficiency CEN-CENELEC standards, that will standardise how assessments of topics such as repairability should be provided. These standards are being created to guide further product group specific

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[5] Analysis and development of a scoring system for repair and upgrade of products – Final report, EUR 29711 EN

[6] DEFRA (2018) HM Government, Our Waste, Our resource: A Strategy for England https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/765914/resources-waste-strategy-dec-2018.pdf

standards, where issues like this can be addressed as relevant to the product group. The applicability of these material efficiency standards, including “ability to reuse, repair and upgrade” will be reviewed following publication in 2020, and considered in the next SRI review.

As outlined above, Signatories also proposed to provide instructions for extending the product life so that consumers can fix minor faults and/or take precautionary steps (i.e. maintenance) to avoid problems, without risking infringing intellectual property rights, the liability of the manufacturer, or the quality and safety of consoles.

In addition, the reuse of consoles is supported through the commitment to provide information enabling data deletion.

In summary, the current SRI Recyclability Commitments are:

- To improve recycling at end-of-life console plastics parts >25g will be marked indicating their material composition, with the following exceptions:
  - The part has <1cm² level surface available for marking
  - The performance or function of a part is comprised e.g. buttons with tactile surface, plastic lenses, or display screens
  - External transparent parts
  - Marking is not technically possible due to the specific production method of the plastics used in the part e.g. extrusion moulding.

Signatories mark plastic parts indicating their material composition to ISO 11469 standard; however, ISO 11469 does not consider the difficulties marking actual product, hence the exceptions listed above.

Technical reports, standards and documents reviewed highlight several suggestions for improving the recyclability of electronic products. For example, the Voluntary Agreement of Complex Set Top Boxes, requires the marking of plastics with flame retardant information. The Signatories have to note however that information on flame retardants contained within plastics is only useful if products are manually disassembled. Therefore, for consoles marking would be of limited use as most plastics in WEEE are mechanically recycled. Marking could be complex and add little value to the recycling process. The Signatories aim to find the most cost-effective and least burdensome (both for the intended recipients and the Signatories) way to communicate useful information to recyclers. Nonetheless, as a step-forward, our new proposal is, to allow marking as an alternative to information provision to recyclers.

- From the 1st of January 2020: The following information shall be included within product disassembly instructions provided to repair and recycling operations to improve end-of-life recyclability:
  - Whether plastic casing contains brominated flame retardants
  - Whether LCD displays contain mercury

Although the SRI includes commitments to provide information on BFRs in consoles or regarding mercury possibly contained in the LCD displays on request to recyclers, to date no

WEEE systems have asked Signatories for such information, or information on the amount of critical metals in our products.

Current SRI Life Extension/ Durability commitments

- To support product life extension the following information shall be provided to consumers (either provided with the console itself, onscreen, in hardcopy, or online):
    - Explanation on how to keep the consoles in good working condition (examples could include, where applicable: how to keep the product dust free, how to install system updates, how to remove trapped disks, etc.)
    - How to delete personal data (e.g. if the consumer wishes to send the console for reuse)
    - Options available (if any) to consumers to upgrade the performance of their consoles (e.g. installing a bigger hard drive).

The Signatories already provide information on how to keep consoles in good working condition as well as how to delete personal data. Game encryption, for copyright protection, makes it challenging to provide information on upgrading hard drives and other components without disclosing proprietary information.

The Signatories design consoles to have a long life. The economic model is based on the sale of games more than consoles. There is an economic incentive to extend console life allowing the user to continue to purchase more games without having to spend money on replacement consoles or repairs. Although it is difficult to test electronics for a predicted life, the console manufacturers do extensive testing to improve the reliability of consoles. Testing is done during the design phase and on ongoing production.

Review of possible additional commitments

Beyond those discussed above, Signatories considered several other material efficiency criteria aspects for inclusion, listed and summarised below, along with our conclusions:

Hazardous Substance Restrictions

Possible commitments could include new restrictions on all halogenated flame retardants (HFRs), Short-Chain Chlorinated Paraffins (SCCPs), use of PVC, oxo-fragmentable plastics

Eco-design measures are not the appropriate legal instrument to restrict substances in products. Though Lot 5 (see appendix 1) have introduced a ban of all halogenated flame retardants in product enclosures, the industry strongly opposes the introduction, as does Digital Europe who believe that Eco-design measures should not restrict substances and substitute the role of RoHS[7]. Therefore, Signatories agree that the use of hazardous

[7] Directive 2011/65/EU (RoHS 2) came into force on the 21st July 2011.

substances, including flame retardants in EEE is governed by Directive 2011/65/EU of the European Parliament and of the Council (RoHS). No specific ecodesign requirements on flame retardant content should therefore be set in the SRI.

Information on Critical Metals to RecyclersWhen approached as part of the previous SRI review process, European Recycling Platform (ERP), a global compliance scheme confirmed that such detailed information is not required and cannot be used during recycling. This experience is shared by many companies who currently provide this information online for recyclers (according to IEC/TR 62635), and most of the time it goes un-accessed and therefore un-used. At present little is understood regarding loss of critical metals from raw materials production, from use in concentrations in products which are technically too low to recover and lost within the recycling process themselves ([8],[9]).Availability of spare parts

Under Article 9, 1(e) in the EU Waste Framework Directive[10] Member States are expected to: "encourage, as appropriate and without prejudice to intellectual property rights, the availability of spare parts, instruction manuals, technical information, or other instruments, equipment or software enabling the repair and re-use of products without compromising their quality and safety". As discussed in the previous section on the EC Consultant's report on the SRI, consoles include highly proprietary components which form a vital part of a specialised and locked encryption system to prevent software piracy, and for parts are only made available to authorised repair companies. This prevents serious and very real threats to the gaming industry, such as during the nineties when game software copying and piracy was commonplace.

As discussed in the 2017 SRI review, manufactures do not retain production for individual spare parts indefinitely. Stocks and spare parts may run out according to demand, and therefore a setting a timeline for available spare parts is problematic.

Nevertheless, Signatories provide an out of warranty repair service if their consoles are still available on sale. In practice Signatories continue to support out of warranty repair for years after products are first sold. This ensures that consumers are supported throughout the repair process.

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[8] Zimmermann, T. & S. Goesling-Reisemann. (2013) Critical metals and dissipative losses: A screening study. Science of the Total Environment. 461-462, pp 774-780.

[9] Zimmermann, T. & S. Goesling-Reisemann. (2014) Recycling potentials of critical metals – analysing secondary flows from selected applications. Resources. 3, pp291-318; doi:10.3390/resources3010291

[10] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

'Guaranteeing' battery life and removability

Battery lifetime varies dependent on consumer usage patterns. Batteries are designed to function for the duration of the product life (as discussed in the previous section reviewing the EC Consultant's report on the SRI), and at end-of-life the Signatories ensure, as required by the Battery Directive[11], that the batteries are readily removable by qualified professionals. Therefore, there is no need to alter consumer guarantees related to battery life.

Including greater percentages of recycled plastics

The WEEE Directive[12] states that "producers should be encouraged to integrate recycled material in new equipment", and eco labels such as The Japanese Eco mark, have defined a minimum share of post-consumer recycled plastic as an optional requirement for notebooks, as 10%. Though Signatories are aware that the use of recycled content in products forms and important step in closing the loop and creating a circular economy for plastics, the supply of polymers available do not meet the necessary quality and volume required for console production. Presently Signatories are not aware of any recycled PC-ABS that can comply with flame retardant grade V0 (1.5mm) required by safety standard IEC62368[13].

Providing access to system software 'service modes'

Making firmware available to third party repairers is not possible; doing so would infringe Signatories intellectual property rights (core operating systems) and would allow our copyright protection systems to be circumvented, opening the possibility for console games to be pirated.

Proposed Material Efficiency Changes

The following updates and modifications to the SRI are proposed:

Ensuring that external plastic parts >100g are removable using tools that are commercially available to recyclers

By ensuring that external plastic parts >100g are removable using tools that are commercially available to recyclers, Signatories are enabling the repair of consoles, whilst also increasing accessibility of high-value plastics to recyclers, and therefore supporting a shift towards a more

[11] Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC

[12] DIRECTIVE 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)

[13] IEC 62368-1 (2018) Audio/video, information and communication technology equipment - Part 1: Safety requirements

circular economy in the electronics sector. This follows-up on a commitment of Signatories to consider this issue made during the 2017 review process.

Allow marking as alternative method to provision of recycling information concerning brominated flame retardants contained in plastic casing used for external enclosures >25g

Signatories have agreed to a more flexible approach to providing information on brominated flame retardants contained in plastics used for external enclosures >25g, by allowing marking as an alternative method of information provision. Though yet unproven whether this brings any particular improvement to the recycling rate of plastics, this aligns with industry practice, such as the Complex Set top Box Voluntary Agreement, who require the marking of plastics with flame retardant information. By providing this information Signatories are supporting the waste management industry by enhancing the recyclability of plastic casing at end-of-life.

In alignment with CENELEC standard FprEN 45554:2019, Signatories will include the following clear and concise information regarding the repairability of consoles within the SRI, as well as making this available to consumers within product instructions

The statements will include the following topics:

- Whether repair is possible with tools commercially available to repairers or requires specialized proprietary tools
- If diagnostics for repair can be undertaken by any repairers or only authorised experts using a proprietary interface
- If spare parts are available to all repairers or only manufacturer-authorised repair service providers
- Stating that an out-of-warranty repair service is provided.

Provision of information listed above ensures that consumers are informed on the correct method/ entity required to review any faults or issues with consoles, and consequently aid accessibility to repair via the correct channels. As previously stated, Signatories take consumers 'right to repair' very seriously, hence the provision of out-of-warranty repair services.

[1] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

CONCLUSIONS AND SUMMARY OF PROPOSED CHANGES TO THE SRI

The Self-regulatory Initiative, also called Games Consoles Voluntary Agreement (GCVA) establishes a voluntary agreement for improved energy and material efficiency of games consoles. The SRI establish requirements on:

- Maximum power consumption
- Auto-power down
- Resource/material efficiency and end-of-life design
- Information in the user instructions
- Market coverage

The SRI covers games consoles placed on the EU market by the Signatories and represent 100% of the market coverage. The latest Annual Compliance Report (ACR) shows that the games consoles from all the 3 manufacturers (Microsoft, Nintendo and Sony) comply with the SRI requirements.

As part of their obligations under the SRI, the Signatories are required to review the SRI's every two years with a view to updating existing requirements and, if feasible, including new commitments. The objective of the Review Report is to provide a detailed description of the Signatories' review process underlying the latest proposed amendments to the SRI specification. The result of the thorough research and analysis carried out by the Signatories includes a number of improvements to existing commitments, as well the introduction of new ones.

The 2019 SRI Review Report is the product of nearly an entire year of work by the SRI Signatories, and took into account the suggestions made by the

Videogames Consoles Review Study[14]. Unlike the previous SRI review[15] carried out by the Signatories, the 2019 SRI Review had to run contemporaneously and in parallel with the Study, so the review timescales had to be adjusted accordingly.

The Signatories engaged cooperatively with the Consultants to address their questions, providing extensive data and other sources of information to support the Study. The Signatories were provided with the Study final report in September 2019. The Study's

[14] This study was carried out by independent consultants selected by European Commission, and spanned from December 2018 to September 2019. The aim of the Consultants' Review Study was to provide an independent review of the targets in the current SRI (version 2.6) and make proposals for possible changes.

[15] The 2017 SRI Review

conclusions and recommendations fed into the Signatories' SRI Review Report and influenced the development of the latest proposals.

The following tables summarises all proposed changes to the SRI, including those proposed by the Consultants' Review Study.

Energy Efficiency

The proposed changes stemming from the industry's *SRI 2019 Review* are:

Remove +20 W allowance for NUI
Define separate power caps for 2K & 4K navigation mode (as per media power consumption)
No additional requirements for HDR: signatories do not currently provide navigation function or media content in HDR
Set requirements against circumvention (proposed SRI text agreed already)
Explain current caps to account for power variation between models

The proposed changes stemming from the industry's *SRI 2019 Review* also proposed by the Consultants' *Review Study* are:

Clarify basis of navigation power caps after 30 minutes inactivity
Introduce 65 W cap for 2K navigation and 70 W cap for 4K navigation for 4K capable gaming consoles in 2020

The proposed changes stemming from the Consultants' *Review Study* are:

Consider definition and power cap for rest modes of next generation consoles in the next SRI review
Include a method to check stability of measurements and where necessary extend test time on a case by case basis
Consider reporting power consumption of any separately enabled ray tracing for the next generation in the next SRI review

Material Efficiency

The proposed changes stemming from the industry's *SRI 2019 Review* are:

Allow marking as alternative method to provision of recycling information concerning brominated flame retardants contained in plastic casing used for external enclosures >25g

The proposed changes stemming from the industry's *SRI 2019 Review* also proposed by the Consultants' *Review Study* are:

Plastic enclosure parts >100g removable using tools commercially available to recyclers
Draft statements describing the reparability of consoles

The proposed changes stemming from the Consultants' *Review Study* are:

Include home consoles consuming <20 W in scope of material efficiency requirements by 2021
Mark plastics >25 g and >100 mm2 in accordance with ISO 11469: re-insert ISO 11469 reference

Next Steps

As for next steps, the 2019 Review Report as well as the new version of the SRI is to be submitted to the Eco-design Consultation Forum[16] for discussion and approval. This meeting is scheduled to happen in December 2019. If approved the new SRI is going to be effective from January 2020.

Recently, in October 2019, two out the three Signatories (Microsoft and Sony) announced launch of their respective new generation of consoles to happen in 2020. As per the commitments within the SRI, a new Review will therefore be required to be undertaken to include these new models.

[16] The Consultation Forum is an European Commission initiative that consists of representatives of Member States, industry, civil society and other relevant stakeholders. They contribute to the definition and review of implementing measures, examine the effectiveness of established market surveillance mechanisms and assess voluntary agreements and other self-regulation measures within the context of the eco-design Directive.

ANNEX 1: ENERGY EFFICIENCY CRITERIA MATRIX

	Sub-topic	Description	Games Console VA Nov-1	CEN/CLC Durability	CEN/CLC Remanufacture	CEN/CLC RRU	CEN/CLC Recyclability	CEN/CLC reused comps	CEN/CLC Recycled	CEN/CLC CRMs	Printer VA (Mar-19)	CSTB VA - April-18	JRC 2019	Lot 5 - Latest Draft	Lot 9 - Latest Draft	Lot 3 - Preparatory Study	France Roadmap for CE	CE Action Plan Portugal	Waste & Resources Strategy
Design	Components and materials	Limit plastic polymer variation									X	X							
		Do not use coatings on plastics									X	X							
		Design for high quality plastics recycling									X								
		Do not prevent recycling of product parts									X								
		Allow use of non-OEM components									X								
		Ban intentional use of SCCPs										X							
		Ban intentional use of (specified) flame retardants in plastics										X		X					
		Ban intentional use of PVC										X							
		Ban use of oxo-fragmentable plastics															X		
		Limit Innovation Cycles											X						
	Dismantling	Allow manual separation of plastic parts with commonly available tools									X								
		Allow non-destructive disassembly of product or specified components	X								X	X	X			X			
		Avoid non-separable connections or joining/fastening techniques	X								X	X	X	X	X	X			
		Design for ease of access to key components/materials										X		X					
		Use Commonly Used Fasteners									X	X							
	Life span	Discourage premature disposal															X	X	
		Extend product working life														X		X	

		Disclose Expected Lifespan														X			X
	Markings	Mark or label parts containing substances to be removed at EoL					X								X		X			
		Mark plastics with polymer type	X								X	X			X		X			
		Mark plastics with flame retardant													X		X			
Documentation	End-of-Life Information for recyclers	Provide dismantling Instructions to recyclers to access specified components	X												X		X			
		Provide dismantling instructions to repairers and recyclers									X					X				
		Make hazardous material/substance information available to recyclers	X				X								X		X			
	Material Efficiency Information for End-users	Provide end-users with information regarding resource efficiency during use and EoL management	X								X						X			
	Make available documentation of Material Efficiency Product Aspects	Make information available to End-Users on product maintenance	X																	
		Make information available on results of reliability and durability assessments		X																
		Make information available on results of an assessment to measure the ability of a product to be re-manufactured			X															
		Make information available on results of an assessment to measure the ability of a product to be repaired, re-used and upgraded.				X														
		Make information available on options for upgrading a product	X																	
		Company reporting of efforts on reuse, repair and recycling																		X
		Make information available on results of an assessment to measure the ability of a product, and materials, to be recycled and recovered.					X													

		Verification of re-used components through documented evidence						X											
		Make information available on results of an assessment to determine the proportion of re-used components in a product						X											
		Verification of recycled material content through documentation							X										
		Make information available on results of an assessment to determine the proportion of recycled plastic content in a product									X	X							
		Make information available on results of an assessment to determine the proportion of recycled content in a product							X										
		Make information available on results of an assessment to determine the proportion of bio-based plastic content in a product										X							
	Material Declarations	A material declaration shall be provided for regulated CRMs.								X						X			
		A material declaration can be provided for non-regulated CRMs (Voluntary)								X									
		Manage and collate technical and supplier documentation as evidence of CRM declarations								X									
		Upload material information to a database																	X
Material efficiency Assessments	Product Scoring or assessment Systems	Creation of a scoring System for ability of a product to be re-manufactured			X														
		Creation of a scoring System for ability of a product to be repaired (and re-used and upgraded)				X							X				X		
		Product Repair Label														X			
		Battery Accessibility Label															X		
		Part Compatibility Label														X			
		Re-manufactured Product Assurance Label																	X
		Calculation of product recyclability and recovery scores					X												

	Product Calculations	Calculation to assess the proportion of reused components in a product						X												
		Calculation of the recycled material content in a product							X											
Service processes	Repair	Provision of repair information for safe repair to End-Users									X						X			
		Provision of repair information to professional/independent repairers											X	X		X				
		Provision of repair information to authorised repairers	X								X		X	X		X				
		Limit cost of Repair											X	X						
		Repair as part of business model	X										X							
		Design products for repair											X							
	Software / firmware	Provide upgrade options (via software) to extend functionality										X								
		Make diagnostics for repair more accessible											X							
		Enable Data Deletion											X		X	X				
		Enable Password reset											X							
		Provide latest version of firmware at a low cost, or free of charge and/or for a minimum period									X			X	X					
		Provide Information on availability of software/firmware inc. data deletion	X											X	X					
	Spare parts	Make Spare Parts available for a minimum time period									X			X						
		Make spare parts available to authorised repairers	X														X			
		Minimum delivery time of spare parts												X						
		Make spare parts available for purchase to consumers and professional repairers									X									
		Provide replacement instructions for spare parts									X									
		Do not provide public information on spare parts intended for professional repair									X									
		Limit price of spare parts											X							

		Provision of availability, price and ordering information on Spare Parts										X	X			X			
	Warranty	Provision of an additional commercial guarantee										X				X		X	
		Limit price of additional guarantees										X							
		Provision of guarantee for repaired products										X							
		Provision of guarantee for shipping of products										X							
		Warrantee labelling of product																X	
	EPR & Takeback	Eco-modulation of fees														X	X	X	
		Increase communication between producers and recyclers														X			
		Extension of EPR														X		X	

ANNEX 2 – DETAILED ANALYSIS OF THE CONSULTANTS' REVIEW STUDY PROPOSALS

Review Study	SRI Signatories comments	Proposed changes
Use adaptive auto power-down to learn user behaviour	Adaptive APD is used for home heating where otherwise the system remains on to sense the presence of residents within or in proximity to the home, and through which it learns their preferences over time. Residents do not have direct interaction with their home heating systems on a daily basis unless it is to set timers or temperatures. In the case of the games console, the system can automatically sense the presence of the players by their interactions with the controller, and power management is automatically enabled by default. Statistics already show that consoles are off or in low power mode for 21 hrs per day on average. Adaptive APD cannot improve on the APD system already used within consoles. Its use is highly likely to frustrate users, who have direct interaction with consoles at specific times, as the system wakes up and powers down according to its own judgment.	None

Extend SRI to “Games Consoles with a capability for both stationary and handheld gaming” [p. 135]	Response is elaborated in the section “Input from the Independent Review Study” of the SRI review report. The Signatories thank the consultants for their in-depth evaluation of the energy efficiency aspect of the consoles. As they have pointed out, “Games Consoles with a capability for both stationary and handheld gaming” are highly energy efficient. Consequently, they are less in need to be included in the scope of the energy requirements of the SRI.	Games Consoles consuming less than 20W in Active Gaming mode will be brought into the SRI scope. Due to their low power consumption, they will be subject only to the material efficiency requirements starting 1 January 2021.
Include arcade-style gaming devices in scope [p.136]	Arcade-style gaming devices are not ‘re-engineered consoles’ and do not have console dedicated operating systems.	Not applicable to SRI. Arcade-style gaming consoles will remain out of scope
Use current generation power consumption as the baseline to assess energy savings for next generation [p.136]	This would not be appropriate as next generation consoles have increased performance and functions.	An appropriate ‘business as usual case’ will be calculated for next generation in line with EC methods when needed.
Use 30 minutes measurement time window for testing [p.143]	The Signatories recognise longer testing window can improve the stability of measurements, but 30 minutes may not be necessary in every case.	Include a method to check stability of measurements and where necessary extend test time on a case by case basis.
Include one-step approach for powering down consoles [p.144]	Our customers have never complained that consoles are difficult to power off as power-down settings are easily changed.	None
Consider a cap of <5 W for rest mode of next generation consoles [p.144]	The features of next generation consoles are not yet publicly known, but this can be considered in the future.	Include commitment to consider the scope of functions included in an optional rest mode and a corresponding power cap for next generation consoles during the next SRI review. Note that rest mode is an optional feature for consumers.
Consider if 4K media play cap of 110 W is necessary or 90 W can be introduced [p.144]	As the consultant correctly notes, there can be high variability in the power consumption of different components.	Retain 110 W power cap for 4K media play and include

		explanatory rationale for this cap within the SRI agreement.
Introduce new separate caps for next generation, which should meet lower restrictions [p.144]	Next generation consoles will be higher performing and have new functions, and they may not meet current UHD console power caps at first.	A new category of consoles will be defined for next generation and, once complete specifications are announced, a new SRI review will be carried out to evaluate and determine new power caps.
Include a provision in the SRI to update existing consoles to comply with 2 W networked standby limits from EC regulation 1275/2008 [p.145]	Our consoles currently on the market already comply with the amended EC Commission Regulation 1275/2008 to the extent that the new 2W limit for network standby is applicable.	Not applicable. Consoles already comply with relevant regulation.
Schedule software updates for a time when national grids supply most renewable electricity [p.145]	Software updates account for only a fraction of console energy use, and the necessary smart grids infrastructure to implement this does not exist.	None.
Reduce energy consumption when consoles are inactive [p.145]	How navigation mode operates differs for each type of console on the market. The Signatories are considering adding alternative measurement methods for the navigation mode to cover all of these as much as possible.	Revise the SRI measurement method to test navigation inactive power consumption.
Ensure battery capacity remains at least 90% after 500 charges [p.145]	The consultants' Final Report provided no evidence to suggest that there is a shortfall in console battery performance requiring such a measure. Available studies provide evidence that consoles remain in use for many years.	None.
If ray tracing is a feature that users can enable and disable, consider measuring and reporting its power consumption [p.146]	Next generation set up and features are not public yet.	The Signatories will consider whether taking separate measurements of ray tracing is appropriate during the next SRI review.

Use a minimum of 10% post-consumer plastic [p.147]	The polymers available do not meet the necessary quality and volume of supply requirements for our production. Presently Signatories are not aware of any recycled high-quality PC+ABS that can comply with flame retardant grade V0 (1.5mm) required by IEC62368.	None.
Ensure batteries are easy to replace by end-users [p147]	This is already a requirement of the Batteries Directive except where needed for data integrity and safety reasons, which is the case for our consoles and peripherals. This is not in the scope of the ErP Directive. Console batteries are designed to function for the duration of the product life, and at the EOL of the product the Signatories ensure, as required by the Battery Directive, that the batteries are readily removable by qualified professionals.	None.
Improve ability to disassemble fasteners by the use of common tools or providing assistance to obtain more specialised tools [p.147]	This is already a requirement of the SRI as all tools used for removal of listed components must be commercially available. The tools referred to in the report (e.g. Y screwdrivers, etc.) are all commercially available.	None.
Use standardised interfaces for external power supplies [p.147]	This matter is being addressed by the Radio Equipment Directive's Common Charger initiative and therefore should not be added to the SRI.	Not applicable. Consoles already comply with relevant legislation.
Phase out hazardous substances [p.147]	Hazardous substance restrictions are not in the scope of the ErP Directive, but are covered under REACH, RoHS Directive, etc.	Not applicable. Consoles already comply with relevant legislation.
Guarantee cost free system update support at all times [p.147]	The Signatories already provide all system updates free of charge, available all the time. This is not relevant for the VA since it is entirely necessary and commonplace for consoles.	None.
Ensure availability of spare parts for any professional repair centres for at least 7	Recognising the strong push for a consumer's 'right to repair', the Signatories have included a commitment in	None.

years after last placing products on the EU market [p.147]	the SRI to providerefurbishment or out-of-warranty repair services enabling the possibility for consumers to repair their devices easily. However, because most parts of our consoles are proprietory and part of an encrypted system to protect the consoles against hacking and games piracy, the Signatories cannot directly provide spare parts to any independent repairer. All repair operators must therefore be authorised to ensure proper, safe, and secure console operation. The Waste Framework Directive already requires that Member States take sufficient steps to protect proprietary parts from being made freely available.	
Commit to free repair as the first remedy within the console guarantee time [p.147]	Depending on the level of repair/nature of the damage (e.g. water damage) there could be cases where the console cannot be repaired and must be “substituted” to assure consumer and product safety.	None.
Provide take-back schemes for the separate and non-destructive collection of the device [p.147]	This is a matter covered already by the WEEE Directive and not ErP. Our out-of-warranty service commitment means that the Signatories have established a separate collection system for reuse / repair of consoles. It is not cost or environmentally beneficial to collect consoles individually for recycling, and the Signatories will continue to work for improved recycling processes through EPR.	Not applicable. Consoles already comply with relevant legislation.
Provide information on the technical durability, upgradeability, and reparability of each device [p.147]	Signatories are not aware of any known reliable method or standard to measure or report the expected lifetime of an electronic circuit or product. The SRI already includes a requirement to report on the upgradability of consoles and how to maintain them in good condition.	Include a requirement to report statements on the repairability of consoles to consumers using criteria derived from relevant EC standards.

Provide technical information about disassembly steps to any professional repairer [p.147]	The consultants' Final Report does not take into account that console components are bespoke and proprietary and operate in conjunction with the console's firmware encryption. All repair operators must therefore be carefully controlled to ensure proper, safe, and secure console operation. The Signatories have already committed to providing out-of-warranty repair services.	None.
Mark plastics >25 g and >100 mm2 in accordance with ISO 11469 [p.147]	The SRI already includes this requirement but does not mention ISO 11469.	SRI to refer to ISO 11469 for plastics marking.
Provide information on the content of flame retardants in plastic parts [p.147]	The SRI already includes this requirement for brominated flame retardants.	None.
Provide a spare part inventory to any professional repair facility [p.147]	The Signatories can only provide spare parts to repairers under our control because console components are bespoke and proprietary and operate in conjunction the console's firmware encryption. All repair operators must therefore be carefully controlled to ensure proper, safe, and secure console operation. The Signatories have already committed to providing out-of-warranty repair services.	None.
Provide information on the timespan of spare parts availability for customers [p.147]	As noted above, disassembly of the console could provide access to protected intellectual property. The Signatories make repairs easily available through authorized facilities to ensure that the repaired consoles remain safe and protect the intellectual property.	None.
Provide information on the post-consumer recycled plastic content of consoles [p.148]	In the industry's experience, the polymers currently available do not meet the necessary quality and volume of supply requirements for our production. Presently, the Signatories are not aware of any recycled PC+ABS that can comply with flame retardant grade V0 (1.5mm) required by IEC62368. The Signatories will continue to monitor the development of polymers, and will consider	None.

	revisions to the SRI as new post-consumer recycled resins become available.	
Provide easily accessible information on the energy use of consoles [p.148]	Access to the information is already featured in user instructions provided with the product.	None.