

Institution: University of Leeds		
Unit of Assessment: 30 – Philosophy (cross-referred to History panel as History of Science)		
Title of case study: <i>Electrifying History: Enhancing public understanding of technological change in Britain</i>		
Period when the underpinning research was undertaken: 2008-2018		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period employed by the submitting HEI:
Graeme Gooday	Professor of History of Science & Technology	1994-present
Abigail Harrison Moore	Professor of Art History & Museum Studies	1996-present
Dr Michael Kay	PDRA, <i>Electrifying the Country House</i> Project	2015-18
Dr Elizabeth Bruton	PDRA, <i>Innovating in Combat</i> Project	2013-14
Dr Emily Rees	PDRA, <i>Electrifying Women</i> Project	2019-20
Period when the claimed impact occurred: 2016-present		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact (indicative maximum 100 words) Professor Graeme Gooday's research on the class- and gender-dependency of early UK domestic electrification, latterly with Professor Abigail Harrison Moore , furnished new stories used by national and local groups: i) For adult and school-age visitors, leading UK country houses – Cragside, Harewood House, Lotherton Hall and Standen – redeveloped their digital and onsite collections-based engagement to integrate stories of electrification into their social history. ii) Leading UK technology organizations, the Women's Engineering Society, the Institution of Engineering & Technology, as well as the Science Museum Group, transformed their narratives of women's long involvement in engineering to help normalize expectations of female future participation in this profession.		
2. Underpinning research (indicative maximum 500 words) The original research was undertaken by Professor Graeme Gooday in the Leverhulme- and AHRB-funded <i>Science in the Nineteenth Century Periodical</i> (1999-2002) project and the AHRC-funded Research Leave project <i>Electrifying History</i> (2006, I) with the main research product his 2008 monograph: <i>Domesticating Electricity: Technology, Uncertainty & Gender, 1880-1914</i> (1). Gooday's initial research (2000-2007), examined how responses to the innovation of electric lighting were documented in periodical literature across late nineteenth century Britain. He found extensive writing about electricity installations by both aristocratic men and engineering spouses (hitherto unacknowledged by historians or engineers), which addressed widespread doubts about the aesthetics, safety record, economy and reliability of electrical supply. From this evidence Gooday challenged both consumerist assumptions that domestic electricity was widely demanded as soon as it became available, and the technocratic assumption that electricity's adoption was inevitable simply on the grounds of its efficiency. He thus took on a broader investigation of the key factors in how far electrification actually occurred, and why it was sometimes rejected. By studying periodicals, newspapers and personal archives, two key factors emerged that hitherto had escaped historians' attention: a) The role of the wealthy aristocracy in country houses with both the resources and inclination to experiment with this expensive and hazardous new means of illumination in the early 1880s, and then (not necessarily successfully) to glamorise the electric light to broader audiences as the preferred illuminant (vs coal gas or candles) of social elites. Two such country houses explored were Cragside in Northumbria and Hatfield House in Hertfordshire. b) the significant role of electrical engineers' spouses in promoting the merits of electrification to home-makers. In part, decisions to electrify the home were taken by women whose concerns about electricity's aesthetic and safety problems were most effectively met by writings from the authoritative women who had collaborated with engineering spouses in electric lighting projects. One particularly important figure was Alice Brandreth Gordon, who wrote the best-selling <i>Decorative Electricity</i> (1890/91) as "Mrs J. E. H. Gordon," spouse of consulting engineer James Edward Henry Gordon. Building upon <i>Domesticating Electricity</i> , Gooday collaborated with historian of art & design, Professor Abigail Harrison Moore in 2011-16 to further understanding of electrification's		

material culture (2, 3). With **Harrison Moore**, **Goody** secured AHRC follow-on funding in 2015-16 for *Electrifying the Country House* (ECH; II), with **Dr Michael Kay** as PDRA (4). The final phase of impact relates to **Goody's** research since 2016 with **Dr Elizabeth Bruton** (formerly employed at Leeds, now Curator of Engineering, Science Museum, London) (5). Launched to support the centenary of the Women's Engineering Society (WES) in 2019, the recent AHRC follow-on project *Electrifying Women* (EW; III) publicized how women's expert technical roles pre-dated WES's foundation, with **Dr Emily Rees** as Research and Engagement Assistant (6).

3. References to the research (indicative maximum of six references)

- 1) G. **Goody** (2008/2018) *Domesticating Electricity: Technology, Uncertainty & Gender, 1880-1914*. London: Pickering & Chatto/University of Pittsburgh Press. Available at UoL.
- 2) A. **Harrison Moore** and G. **Goody** (2013) 'Decorative Electricity: Standen and the Aesthetics of New Lighting Technologies in the Nineteenth Century Home,' *Nineteenth-Century Contexts*, 35:4, pp. 363-83. <https://doi.org/10.1080/08905495.2013.822687>
- 3) A. **Harrison Moore** and G. **Goody** (2016) 'True ornament? The art and industry of electric lighting in the home, 1889-1902,' in K. Nichols, R. Wade & G. Williams (eds.), *Art versus Industry? New Perspectives on Visual and Industrial Cultures in Nineteenth-Century Britain*. Manchester: MUP, pp.158-78. <http://eprints.whiterose.ac.uk/95199/5/Goody%20Harrison-Moore%20Chapter%20July%202014%5B1%5D.pdf>
- 4) M. **Kay**, A. **Harrison Moore** and G. **Goody** (2019) 'Electrifying the Country House: Taking Stories of Innovation to New Audiences,' *Museum and Society*, 17:1, pp.1-18. <https://doi.org/10.29311/mas.v17i1.2690>
- 5) E. **Bruton** and G. **Goody** (2018) 'Towards a Longer History of British Women in Engineering,' *Viewpoint: Magazine of the British Society for the History of Science*, no. 117: pp.12-13. https://www.bshs.org.uk/wp-content/uploads/Viewpoint_117_WEB.pdf
- 6) G. **Goody** and E. **Rees** (2019) 'Where are the Women in Engineering? A century-old story'. *Newcomen Links*, 252, pp. 12-14. <https://electrifyingwomen.org/wp-content/uploads/sites/56/2020/03/NLinks-Women-in-Engineering-252-Dec-194030.pdf>

Grants

- I) AHRC Research Grant, *Electrifying History: expertise, risk and gender in late Victorian culture*, G. **Goody** (March 2006 – June 2006, **£14,013**).
- II) AHRC Follow-on Funding for Impact and Engagement, *Electrifying the Country House: Educational resources on the history of domestic electricity*, G. **Goody** and A. **Harrison Moore** (May 2015 – July 2016, **£79,307**).
- III) AHRC Follow-on Funding for Impact and Engagement, *Electrifying Women: Understanding the Long History of Women in Engineering*, G. **Goody** and E. **Bruton** (June 2019 – February 2020, **£76,394**).
- IV) In 2017 ECH project PRDA **Kay** secured Arts Council *Culture Capital Exchange* funding to extend ECH work to Harewood House near Leeds (April – May 2016, **£5,000**).

4. Details of the impact (indicative maximum 750 words)

Impact I: Inspiring country houses, enabling volunteers, and engaging publics with stories of technological innovation

In the ECH project **Goody**, **Harrison Moore** and **Kay** collaborated with National Trust properties Craggside and Standen, and Leeds City Council's Lotherton Hall to embed their stories as pioneers in electricity supply with new site-specific visitor resources and a collaborative digital interactive tailored for the UK primary curriculum Key Stage 2 (KS2).

New visitor trails and digital resources enabled the properties to integrate their innovative stories of electrical science into more familiar cultural and social narratives. Standen can now communicate its status as one of the first British houses to be built with electrical fittings to its 151,401 visitors in 2018-19 (417 per day): "For too long this important aspect of the property's history had been underplayed and as a result of this project we will be able to share it with people and give it the status it deserves" (A). For Craggside's c.250,000 visitors p.a. (2018-19 figure), ECH's digital resources "enhanced several segments of visitors from the 'curious minds' who crave some information through to 'out and abouts' who like just a brief overview – making their visits more enjoyable; [...] the portability made it a tool for a core visit and visiting parties, making it accessible to a larger audience" (B). **Kay's** funding (IV) enabled Harewood House to become the fourth heritage partner: archival research on its electrification fed into a temporary exhibit on the State Floor (Summer 2017) and a permanent exhibit, *The Below Stairs Lighting*

Cabinet. Both of these integrated narratives from *Domesticating Electricity* (1) and linked to 'Below Stairs' activities, drawing visitors' attention to servants' use of electricity in life and work. Harewood recorded 210,694 annual visitors (Association of Leading Visitor Attractions 2019).

The project team trained Cragside volunteers to give them the confidence and ability to deliver ECH's new technological stories to visitors. Three educational animations, produced by ECH interns, and other bespoke online resources were made freely available and loaded on tablets *in situ* to enable the c.80 volunteers to react to visitor enquiries and "give a visual representation of the systems involved in the magic that is hydroelectricity at Cragside". It also furnished all volunteers with a "simple visual aide memoire to immediately display to visitors" and the most experienced volunteers "the opportunity to delve deeper in the story through the very same medium" (B). At Lotherton Hall, where **Kay** co-produced an educational visitor trail and the film, *Lotherton Electrified* (2016) for its c.480,000 visitors (April 2018 – April 2019), ECH "enhanced [volunteers'] delivery and interest in the subject," encouraged them to undertake their own research, and boosted "their confidence" in discussing technical topics (A). Standen's 40 volunteers responded enthusiastically to **Kay** and **Harrison Moore's** lecture to staff, which introduced the house's story of innovation. Volunteers noted that it enabled them to give more complete accounts of early electricity, helping room guides to give more detailed answers to visitors' questions (A). Indeed, "To many it [the research] was revelatory and developed a consistent story to tell, through the many staff and volunteers involved, across the property" (B).

ECH facilitated an unprecedented collaboration among the three original country houses, to enhance their traditional heritage roles and integrate those into online resources to support the national curriculum's science element. For example, the ECH interactive, *Exploring the First Electrical Houses*, tells the stories of Cragside, Lotherton Hall and Standen, blending local stories with themes of aesthetics and reliability in stories of electrification drawn directly from **Gooday's Domesticating Electricity** (1). Tested by pupils from two West Yorkshire-based schools, this interactive has contributed to primary teaching in science, history, art, and design & technology areas of the KS2 curriculum. The interactive resource proved effective for children's learning: one teacher noted that pupils "really loved" the character card exercise (A). Cragside's House Manager observed how the interactive enhanced interpretation both "on the property and online", providing thereby "valuable material prior to school visits and on the visits too" (B).

The project reached a broad, diversely-situated set of audiences through a range of avenues and public events, including Light Night 2015 (110 attendees, 90% of whom rated it a 'quite good' or 'very good' event), six public lectures, media coverage (including *BBC Radio Leeds*, *Modern History Review* (April 2018) and *The Conversation* (22.07.2019; 3,073 views at 31.12.2020)) and participation in public heritage events, such as Old Science Week (2015) at Lotherton Hall and Heritage Open Days at the University of Leeds (A, C). **Gooday** and **Kay** also supported 24 University of Leeds drama students in a musical theatrical adaptation *Electrified* (2015) of related stories from Hatfield House featured in *Domesticating Electricity* (1). This material was re-worked as Harewood-focused workshops in summer 2016 for c.30 students attending *IntoUniversity*, which provides holiday learning centres across the UK to inspire achievement in young people from socio-economically deprived areas.

Since ECH finished, Standen's curatorial team has exploited collaborations further, bringing **Gooday** and **Harrison Moore's** research to new audiences in the House, on television and online. In BBC4's *Victorian Sensations: Electric Dreams* (22.05.2019; c.500,000 viewers), **Harrison Moore** drew attention to Philip Webb's bespoke sunflower lamp (an object highlighted in the KS2 interactive) while popular science presenter Hannah Fry's voiceover emphasises the crucial role played by women in the eventual acceptance of electricity in affluent homes: "planning the interior with Webb is family matriarch, Margaret Beale. It's women like her that are driving the take-up of electric power" (5.50-9.40mins, C). **Harrison Moore** also discusses the significance of Standen's electrical innovations for the arts and crafts movement in the short film *William Morris: Useful Beauty in the Home* (2018, the second most-watched HENI Talk (a non-commercial initiative to provide accessible art history films for 14-16 year olds created as a result of declining access to Art History in schools) with 210k+ views at 08.12.2020, C). Embedded in Standen's website, an edited version of the film also runs permanently in the House as part of the National Trust's interpretation for its c.151,000 visitors p.a., and has been used as a teaching resource by schools in the pandemic period: 'Great quality in small compass' (home-schooling parent, UK, 03.06.2020, C).

ECH research (3, 4) provided the central thrust to Standen's 2020 exhibition, *A Dangerous Novelty? The Age of Electricity* (18.01-31.03.2020), with **Gooday** and **Harrison Moore** advising on descriptive panels and object selection. Visitors to Standen remarked that they had not previously considered its relation to the history of domestic electricity: "*the exhibition has made me reflect on how much electricity matters to us*"; "*[I] hadn't realised the importance of Standen House in the introduction of electricity to our lives*"; and, "*the exhibition has reminded me that new things are frightening and we have to help people move forward [in relation to sustainable technologies]*" (C). These are all headlines from **Gooday** and **Harrison Moore's** research (2); and, like *Electric Dreams*, the exhibition also included original *Punch* cartoons which had been deployed to reflect the public reception of electricity in **Gooday's** *Domesticating Electricity* (1). As Standen's House Manager emphasised, the ECH research "*has provided us with a new way of interpreting the House and engaging a diversity of audiences and their interests*" (C).

Impact II: Changing perceptions about the long history of women in engineering

In the *Electrifying Women* (EW) project **Gooday**, **Bruton** and **Rees** (the **EW team**) collaborated with the Women's Engineering Society (WES), Science Museum Group (SMG) and Institution of Engineering & Technology (IET) to promote wider cross-sector knowledge of WES's centenary in 2019-20. This was a key opportunity to enhance public awareness of women's long under-recognised participation in engineering, as documented in *Domesticating Electricity* (1).

EW engaged new audiences with locally-specific histories of women's engineering roles since the nineteenth century, showing the many precedents for women's work in the field. The programme delivered 32 integrated events across England, Scotland and Wales, comprising free public lectures, Wikithons, student workshops, archive taster events, creative writing workshops, volunteer training sessions and a student-led musical theatre production, *SHE*. The project introduced 1,647 members of the public to established female engineering figures, such as Hertha Ayrton, and to those newly re-surfaced, like Henrietta Vansittart. Online audiences comprising 30,000+ people from 60+ countries were reached through blogposts, short films, online events (including presentations at the first *British Society for the History of Science Global Digital Festival* (6-10.07.2020; 53 attendees from 8 countries)), free resources, Facebook and Twitter accounts and newspaper articles (*Yorkshire Evening Post* (15.07.2019); *The Guardian/The Observer* (16.06.2020; 24,471 views at 22.09.2020)) (C, D).

By engaging HE and non-STEM groups, the project helped WES engage with "*audiences that would not otherwise have been reached*", bringing "*about a significant step-change in how the WES centenary was celebrated and shared*" (E). The **EW team** took "*archival stories of WES's founding to engineering undergraduates at Nottingham and Loughborough*," who "*will now be more able to contribute to the writing of WES's history*" (F). *SHE* (21-23.11.2019) introduced c.800 audience members to histories of women in engineering, with 92% finding the production *Extremely relevant and educational* (*SHE* Survey, n=43). Students from the production later collaborated with WES to create three dramatic videos for its YouTube Channel (C). Creative writing workshops attracted 30 participants and led to two co-produced anthologies, which drew upon themes and characters from **Gooday's** *Domesticating Electricity* (1): *Electrifying Women: From Fact to Fantasy* (Hannah Stone ed.; UoL: Feb. 2020) and *Even More Electrifying Women: The Can't Lockdown Creativity Edition* (Stone ed., UoL: Oct. 2020), including contributions from Spain and Germany. These events "*offered an innovative way of taking the story of women engineers*" to new regional, national and international publics (E). The **EW team** also provided research training to self-selecting participants, building capacity for on-going discovery and public documentation of early female engineers. For example, over three Wikithons, **EW team** trained 46 new Wikipedia editors, improved 101 articles and created 21 new pages (D). The Pageviews Analysis tool shows they have since been read 315,500 times (G). Although Wikipedia is the 13th-most visited website in the world, only 18% of its pages are dedicated to women: Wikimedia UK confirmed that the EW project had helped fulfil its "*strategic goal to increase the engagement and representation of marginalised people and subjects*" and applauded the **EW team** "*for identifying a need and taking positive steps to address it*" (G).

A thirst for information about women's past work in engineering was apparent at all EW events. At the Leeds launch, attendees highlighted the pressing need to enhance the historical visibility of female engineers: "*you can't be what you can't see, right?*" and "*Visibility helps! Dismantle idea that women haven't got the right skills*" (D). At later events, attendees commented: "*Information I've never come across before*"; "*Surprised at extent and earliness of*

participation”; *“It’s made me realise how long a hidden history of women there is in engineering, and made me more aware of the ways in which they became hidden, and how their stories might be uncovered”* (D). WES’s CEO confirmed that *“through EW’s work, national awareness of WES’ existence and origins has been significantly boosted”* (E). Workshop feedback from female engineering students confirmed that learning about antecedents helped contextualise their experience; one said that *“it was very motivating and inspirational. Helps me want to continue to pursue my engineering degree”* (D).

The **EW team** forged an *“invaluable expert network”* (H) of curators, archivists and researchers, who worked together to expose more stories of women in engineering in heritage collections. For the IET, EW has *“opened new opportunities for research into the history of women in engineering that goes beyond the WES collections”* by examining stories of non-professional women engineers. The IET Library and Archives Manager testified that the EW project *“has increased the public profile of our collections on women in engineering,”* with staff *“now know[ing] more about the individuals in our collections”* (F).

The project’s events and online resources have contributed to SMG delivering its *Inspiring Futures Vision 2030* and *“helped the Science Museum to build a society literate in engineering,”* *“grow engineering capital”* and *“show[n] that engineering is open to all”* (I). A key facet of this was the Science Museum’s launch of a dedicated *Women in Engineering* webpage in June 2020, bringing EW case studies, such as Henrietta Vansittart and Katherine Parsons, to the global online readership of a flagship heritage organisation (5,204 views at 22.12.2020, I). Parsons’ inclusion as a spousal collaborator epitomizes **Gooday’s** focus on familial co-working as a core feature of women’s early participation in engineering. The **EW team** also brokered the collaboration between WES and the Science and Industry Museum, Manchester (SIM) informing the £6 million, Department for Digital, Culture, Media & Sport-funded redevelopment of its oldest and one of its most popular galleries, the Power Hall, due to reopen in 2021. Again delivering on SMG’s *Inspiring Futures Vision 2030* and seeking to *“inspir[e] reflection on women in engineering careers today,”* the Power Hall reinterpretation draws upon EW to help include *“diverse examples of people who have worked closely with engines”*. SIM Curator of Engineering emphasised the challenge the museum faced in finding women who worked locally as engineers and how its collaboration with the EW project led to the identification of *“specific figures,”* including Dorothy Smith, apprenticed with Metropolitan Vickers in 1916 and who spent her career developing electric motors (H). Smith features in the redesigned Power Hall. As WES’ CEO observed: *“This conjoint participation will ensure, for the first time, that stories of women engineers (including WES members) will feature in all areas of that large-scale exhibition”* (E).

A successful international session at the BSHS Global Digital Festival in July 2020 enabled the **EW team** to introduce UK partners to a recently-formed alliance based in North America: the Society of Women Engineers (USA), the Canadian Institute of Women Engineers & Scientists, and the International Network of Women Engineers and Scientists (INWES). An EW-hosted video meeting on 10 December 2020 facilitated a collaborative plan to deliver more inclusive transnational stories. By brokering these connections EW has thus facilitated an important initiative in enabling a properly global understanding of women’s long history in engineering, which *“will enable a significant step-change in the nature of INWES’s activity”* (J).

5. Sources to corroborate the impact (indicative maximum of 10 references)

- A) M. Kay, A. Harrison Moore and G. Gooday (2019). Composite evidence, comprising feedback from House Managers, volunteers and Yorkshire-based teachers (in (4) above).
- B) *Craggs House Manager, email correspondence (26.11.2019-24.06.2020).
- C) *‘Media and Events Reach Report: **Professor Graeme Gooday**, 2016-20,’ including ‘A Dangerous Novelty: Visitor and curator feedback, Standen’ (UoL & Standen, 2020). Composite evidence.
- D) ‘Electrifying Women: Project Statistics & Evaluation of Participant Feedback’ (UoL, 2020). Composite evidence.
- E) *WES CEO, Letter of Support (02.10.2020).
- F) *IET Library and Archives Manager, Letter of Support (23.12.2020).
- G) *Wikimedia UK Programme Coordinator, Letter of Support (18.12.2020).
- H) SIM Curator of Engineering, Letter of Support (17.12.2020).
- I) SMG Head of Research & Public History, Letter of Support (22.12.2020).
- J) INWES President, Letter of Support (22.1.2021).