The University of Queensland - IIT Delhi Academy of Research (UQIDAR) Joint PhD Project Proposal Template

1. Project details

Project title	**Recovery of Metals from Electronic Waste and Scale-up of the Developed Process**
Project ID	**UQIDAR-00163**

2. Supervision team

Please visit the IITD website www.iitd.ac.in and UQ website http://researchers.uq.edu.au/ to highlight potential collaborators that would be best suited for the proposed project. Complete where possible – advise if you'd like assistance establishing contacts.

	University of Queensland	IIT Delhi	External/Industry (if applicable)
Supervisor name and title	***Prof. Glen Corder***	***Prof. K.K. Pant***	
School or department	***Sustainable Minerals Institute***	***Chemical Engineering***	
Phone number	**+61 401 994 948**	***+91-11-2659 6172/26596177***	
Email-ID	**g.corder@uq.edu.au**	***kkpant@chemical.iitd.ac.in***	
URL for more info	***https://smi.uq.edu.au/profile/737/glen-corder***	***http://web.iitd.ac.in/~kkpant/***	

3. Other supervisors

Please provide information about other associate supervisors below.

Full name and title(s): Prof.
School/department/company details:
Phone:
Email:
URL:

2. Field Of Research (FOR) codes

Specify up to four four-digit FOR codes for your project – see **here** for more detail on FOR codes.

1. 0904	3. 0907
2. 0912	4. 0914

3. Keywords

Please choose up to 4 keywords for your project. E.g. Nanotechnology, data science, novel batteries, etc. Keywords will assist in classifying project and presenting projects to students on the applications portal.

1. Electronic Waste	3 Metal Recovery
2 Leaching	4. Economic Analysis

4. Discipline background of candidate

Please outline the preferred background of your student. E.g. Organic chemistry, physiology, topology, CFD, etc. This will assist in presenting projects to applicants on the apps portal.

1 Metallurgy	3 Chemistry

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2 chemical engineering	4. Electrochemistry

5. Project description

Electronic waste (e-waste) is the fastest growing waste stream with an annual growth rate of about 3–5%. E-waste generated in 2016 was 44.7 million tonnes and it is expected to grow to 52.2 million tonnes by 2021. Unregulated accumulation or dumping of e-waste can cause severe health and environment hazards as it contains toxic substances such as antimony, lead, cadmium, barium, arsenic etc. which have potential to leach into soil and water. These toxic substances can cause damage to the human nervous system, respiratory system, brain, kidney, heart, and liver. Consequently, it is inevitable to find a sustainable solution for the sound management of e-waste and to reduce the harmful effects on human health and the environment. Metals and plastic are the major components of e-waste with a share of 61% and 21% respectively. E-waste contains various heavy (Cu, Ni, Hg, Cd, Pb etc.) and precious metals (Ag, Au, Pd, Pt). Nevertheless, the presence of these metals may affect the ecosystem due to the lack of adequate management of e-waste. The metal content of e-waste makes it as an alternative resource of metal recovery and overcome the scarcity of metals. It is important to transform the e-waste into wealth by extracting the metal and conserving the resources. In this regard, the metal recovery process will be developed under the supervision of Prof. K. K. Pant at IIT Delhi while the economic analysis and the scale-up of the process will be done under the supervision of Prof. Glen Corder at the University of Queensland. The disposal of e-waste is the major challenge of modern society as the usual approach is to get rid of the e-waste via landfilling and incineration. However, these approaches are not environmentally friendly. It is expected that the successful completion and implementation of this project will help in sound management of e-waste along with the revenue generation by the recovery of metals.

6. Project deliverables/outcomes

The overall outcome would be a development of sustainable technology for the recovery of valuable metals from e-waste. Nevertheless, there would be several direct and indirect deliverables/outcomes of the proposed project. Some of the major outcomes are as follows:

1. Solving the e-waste problem
2. Standard protocol for e-waste characterization
3. Selection of process for recovery of valuable metals from e-waste
4. Optimization of process parameters for metal recovery
5. Technology development for metal recovery
6. Techno-economic feasibility study for a scale-up of the developed process
7. Design of pilot plant for metal recovery

7. Research impact themes

Highlight the research impact theme(s) this project will address. Feel free to nominate more than one. For more information, see http://www.uq.edu.au/research/impact

1. Healthy Ageing
2. Feeding the World
3. Resilient Environment
4. **Technology for Tomorrow** ✓
5. Transforming Societies

8. Type of student

This project is best suited for an:

i-student	✓
a-student	
i- or a-student	

Please note that:

- an i-student will be expected to spend year-1 at IIT-D, year-2 at UQ and the remaining time at IIT-D.

- an a-student will spend year-1 at UQ, year-2 at IIT-D and the remaining time at UQ.
- All students will be required to complete some amount of coursework in their first year.

9. Student capabilities and qualifications

Essential Capabilities: Sound knowledge in inorganic chemistry and electrochemistry

Desirable Capabilities: Experience in working on MP-AES, ICP, FT-IR, TGA, SEM, TEM

Expected qualifications (Courses/Degrees etc): Master degree in metallurgy, chemical engineering, material science, chemistry or equivalent