The International Dimension of Engineering Programme Accreditation

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ENAEE – International Workshop on New developments and Quality Assurance for Engineering Education

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Outline

- International engineering programme recognition systems:
  - ENAEE and the EUR-ACE Labels described in first session
  - Washington, Sydney and Dublin Accords in the IEA
- The International Engineering Alliance (IEA):
  - What it is?
  - What is its scope?
  - How does it operate?
- The IEA-ENAEE co-operation project:
  - Product: Best Practice in Accreditation
  - Current Project: Competence for independent practice (CIP)
    - What bodies define CIP?
    - How does it relate to graduate level outcomes?
    - What are the elements of CIP?

IEA-ENAEE Co-operation Project

- Product: Joint document: *Best Practice in Engineering Programme Accreditation: An exemplar*, (Nov 2015)
- Comparing different systems:
  - IEA Accord accreditation recognises the educational foundation as part of development to registration or licencing
  - ENAEE Authorised Agencies to award EUR-ACE Label(s)
- Current project: Developing a common point of reference between the two systems:
  - A key milestone when developing the full competence in an engineering role is the ***competency for independent practice*** (CIP)
  - CIP is assessed formally in IEA systems

Best Practice in Engineering Programme Accreditation

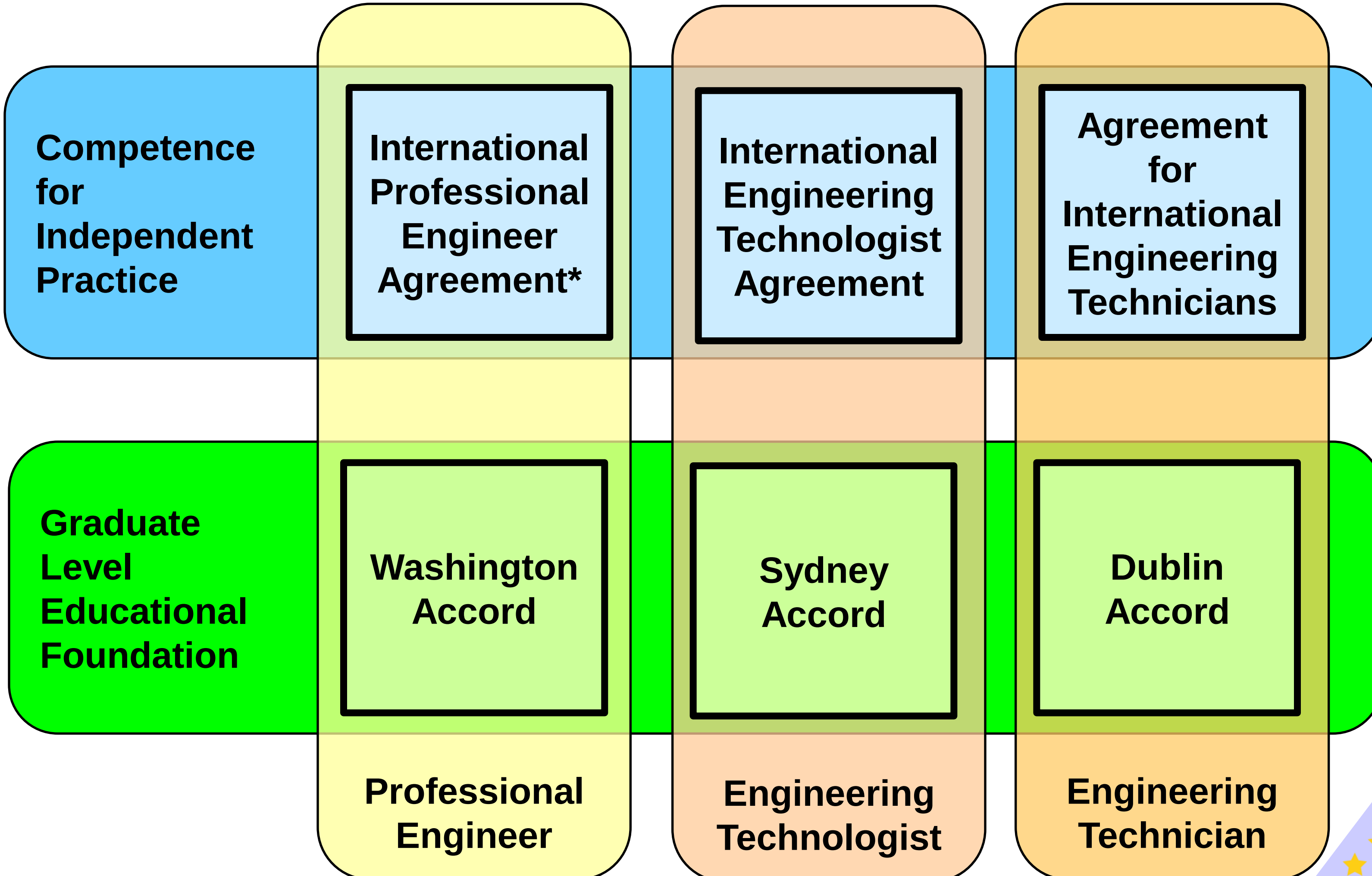
- Contains elements of best practice for accreditation of engineering programmes and in general
- Elements of best practice are consistent with
  - INQAAHE Guidelines* (2007)
  - European Standards and Guidelines* (ENQA 2009)
  - IEA Accord Rules and Procedures (IEA 2013)
  - EUR-ACE® Framework Standards and Guidelines (2015)
- Intended to guide bodies setting up, operating or improving accreditation systems
- Available at: **www.ieagreements.org** and **www.enaee.eu**

*as applicable to programme accreditation

The International Engineering Alliance (IEA)

- IEA Founded in 2007, initially to provide a common Secretariat for its constituent bodies
- IEA has become an authority on education and professional competence with objective:
  - to improve engineering education and competence globally through widening the recognition and uptake of its constituent Accords and Competency Agreements
- The IEA is governed by its Accords and Agreements, which operate independently in their own areas

IEA Scope: Levels, Occupations & Agreements



* APEC Engineer Agreement has largely overlapping membership

Operation of the IEA Accords/Agreements

- Standards for each occupation:
  - ***Graduate Attributes***: (= Programme Outcomes)
  - ***Professional Competencies***: benchmark competency for independent practice
- IEA Rules follow Best Practice in Accreditation systems
- Two-stage assessment for admission to an Accord:
  - ***Provisional Status***: organisation and its system have acceptable characteristics
  - ***Signatory Status***: outcomes applied and accreditation system are substantially equivalent to Accord norms
- Periodic review to maintain signatory status

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The Engineering Technologist

- About half of the IEA countries formally recognise the ***engineering technologist*** as key member of the engineering team
- The ***engineering technologist*** emerged from splitting the broad engineer role into two partly overlapping roles, for example

<u>Professional Engineer</u>

- Broad-based engineering knowledge
- Develops and evaluates technology
- Assess and mitigate significant risk & uncertainty
- ...

Both roles (overlap)

- Manage engineering operations

<u>Engineering Technologist</u>

- Deep knowledge of specific technologies
- Applies new and emerging technology
- Manage risk while applying technology
- ...

- Dedicated education provision, accreditation and professional recognition exists for engineering technologists

Differences in Educational Standard

Washington Accord (Professional Engineer)

WK3: Systematic, theory-based **engineering fundamentals** in an engineering discipline

WA2: …. analyse *complex engineering problems …* using first principles of mathematics, natural sciences and engineering sciences.

A programme that builds knowledge and develops the attributes is typically achieved in 4 to 5 years of study

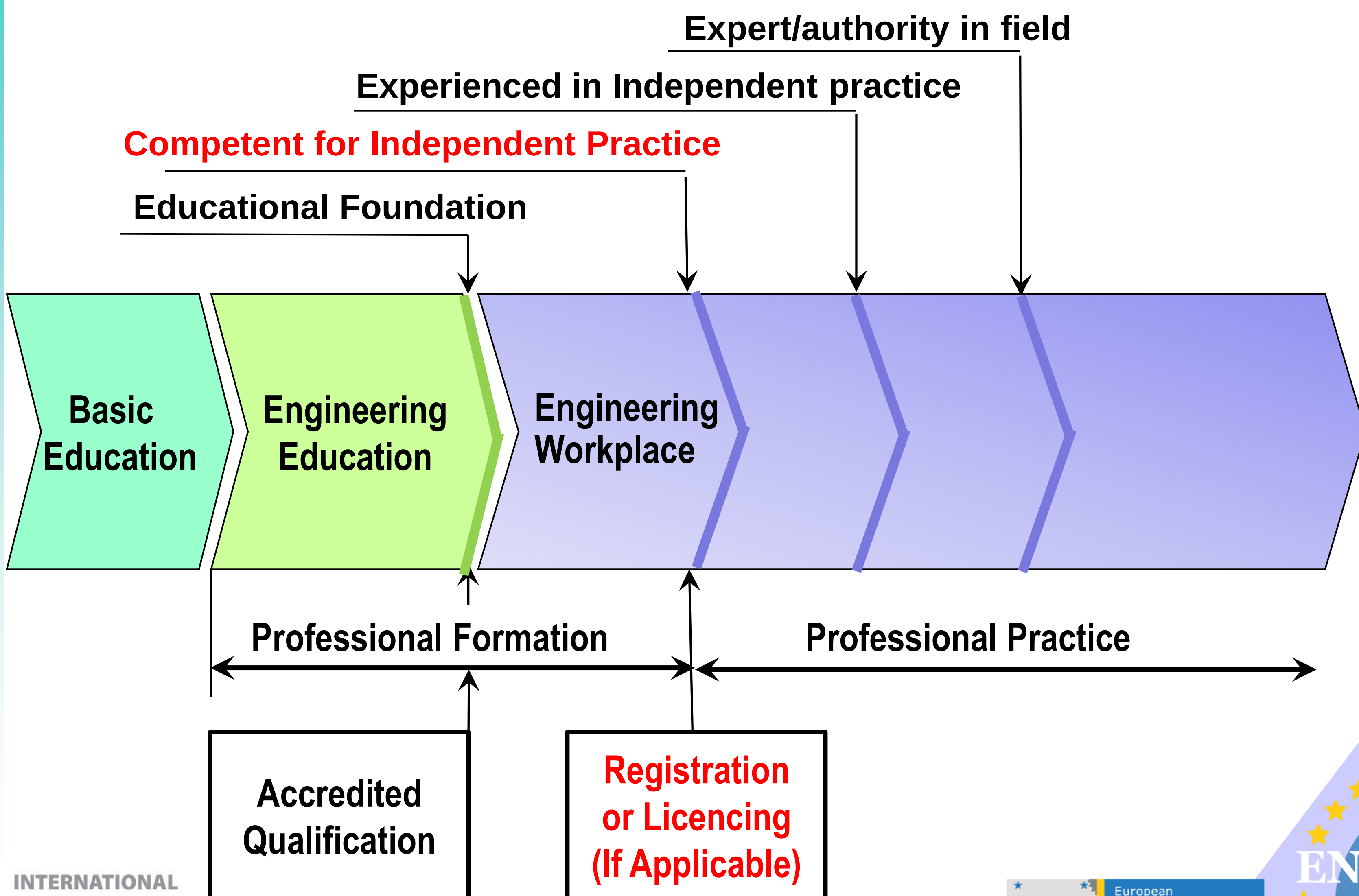
Sydney Accord Engineering Technologist

SK3: Systematic , theory-based **engineering fundamentals** in an accepted sub-discipline

SA2: … analyse *broadly-defined* engineering problems … using analytical tools appropriate to the discipline or area of specialisation.

A programme that builds knowledge and develops the attributes is typically achieved in 3 to 4 years of study,

Engineering Practitioner Lifecycle



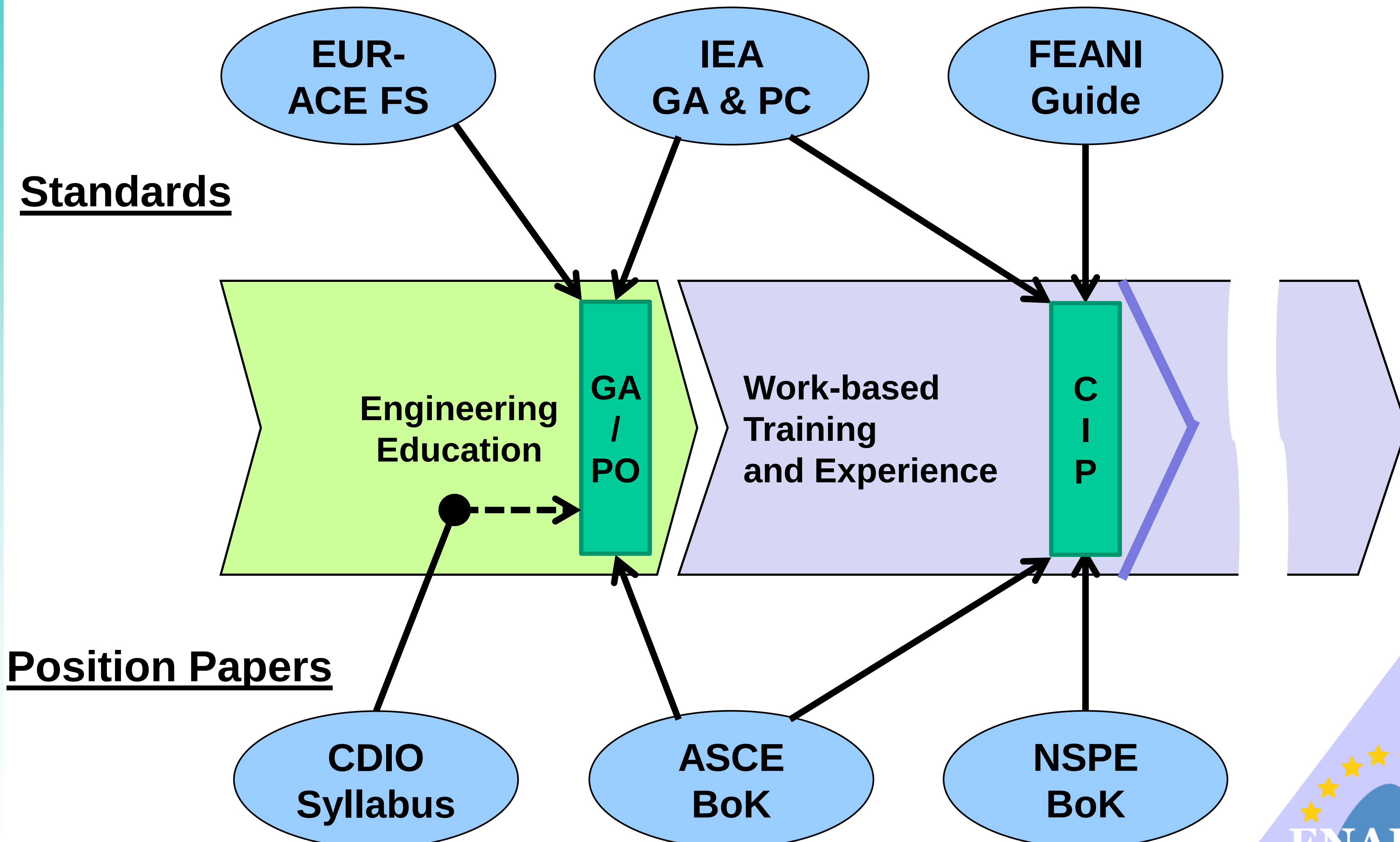
* Engineers and Technologists only

Division of Responsibility for Engineering Formation

- Education providers are not expected to produce ready-to-use engineers: in early employment, “junior engineers” complete their training particularly in
  - the soft skills.
  - training in industrial, economic and professional issues;
  - working in an international context*.
- The division of responsibility between engineering education and the junior engineer period in industry in the company is an open question*
  - FEANI Minimum of 7 years: University 3-5: Experience 2-4
  - Typically in IEA jurisdiction: University = 4, Experience = 4+ yr

* *B. Remaud,* European perspectives on the competences of engineering graduates, Engineering Education, pp 11-17, December 2013

CIP Sources: Standards & Position Papers



Progression from Graduate to CIP Examples

Graduate Attribute/ Programme outcome	**Professional Engineer Competence for Independent Practice (CIP)**
Solve complex engineering problems in a simulated context	Solve complex engineering problems in real-life context
Apply knowledge of math, natural science, engineering fundamentals and an engineering specialization	Apply advanced knowledge in engineering practice area(s), supported by fundamentals
Apply economic principles to analyse engineering proposals	Analyse the costs, benefits, risks of engineering proposals & solutions
Apply ethical principles and reasoning	Act ethically and professionally
Know and understand the responsibilities of engineering practice	Take responsibility for engineering decisions

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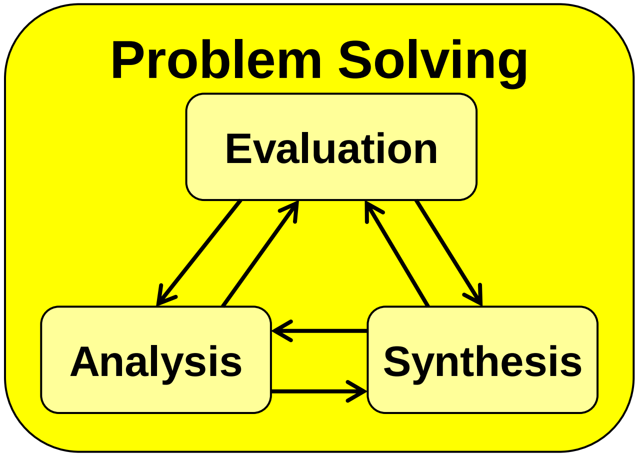
Components of Engineering Competency

1. The core competence is **problem solving** via systematic application of
   - Analysis
   - Synthesis and
   - Evaluation

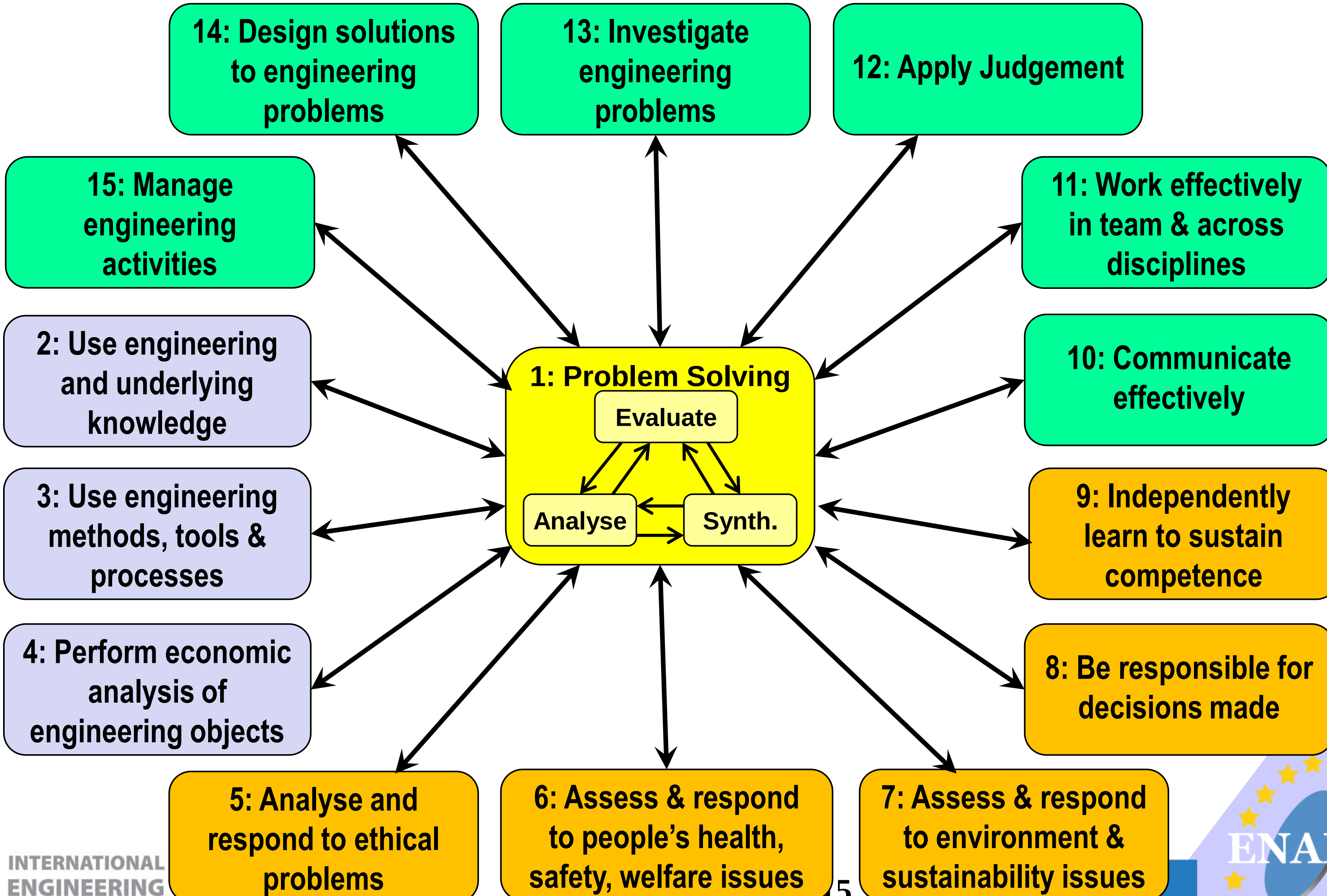


2. **Engineering enabling functions**: use knowledge, handle information, use tools, economic analysis

3. Discharging the **responsibilities of engineering practice**: managing issues and impacts: ethical, people-related, environmental

4. **Engineering practice competencies**: Investigation, Design, Managing supported by communication, teamwork, leadership

Competencies for Independent Practice



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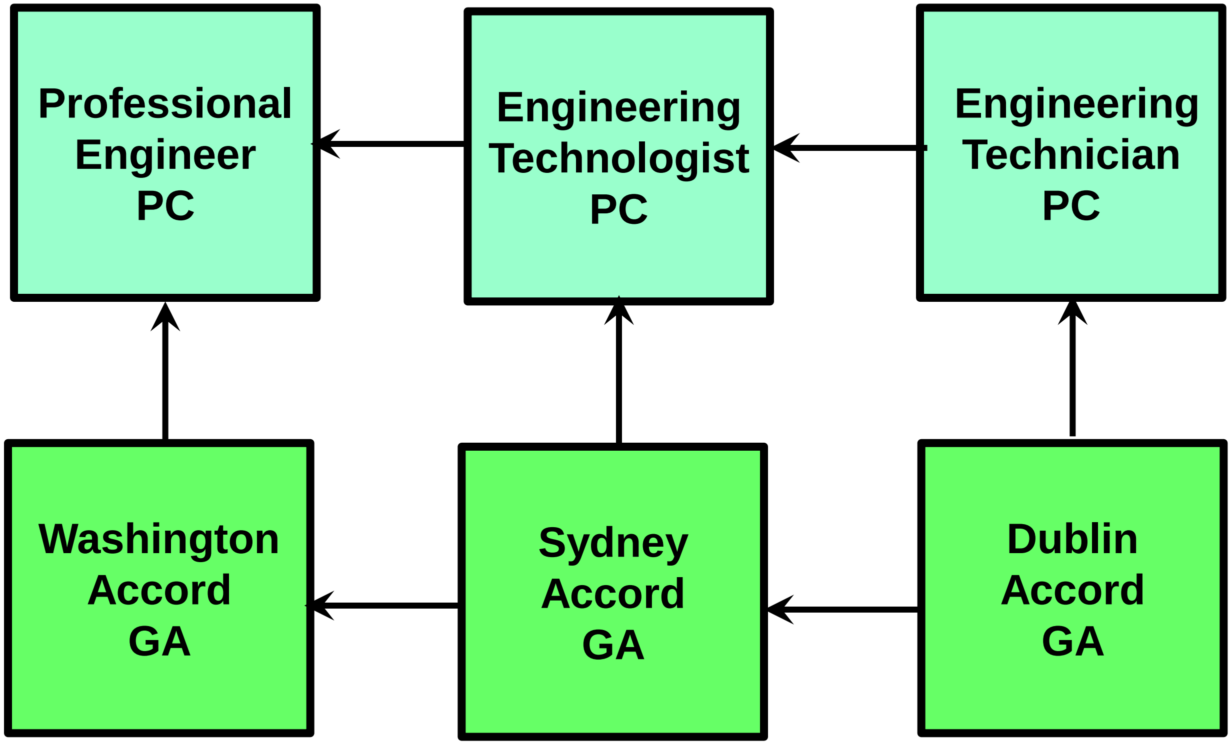
Conclusions

- IEA-ENAEE Co-operation Project has delivered a consensus Best Practice in Accreditation
- Purpose of engineering education programmes is comparable in:
  - National systems with regulation of engineering practice
  - National systems without regulation
- The Competence for Independent Practice of a professional engineer is a Working Group document at present
- With refinement, we believe that CIP will provide a
  - consensus on the competence of a professional engineer when embarking on independent practice
  - a reference for evaluating educational outcomes for professional engineer education

Differentiating Outcomes and Competencies



Vertically:
- Responsibility
- Context
- Judgement

Horizontally:
- Knowledge profile: type, mode of usage
- Demands of problem solving
- Autonomy

GA: Graduate Attributes
PC: Professional Competency

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