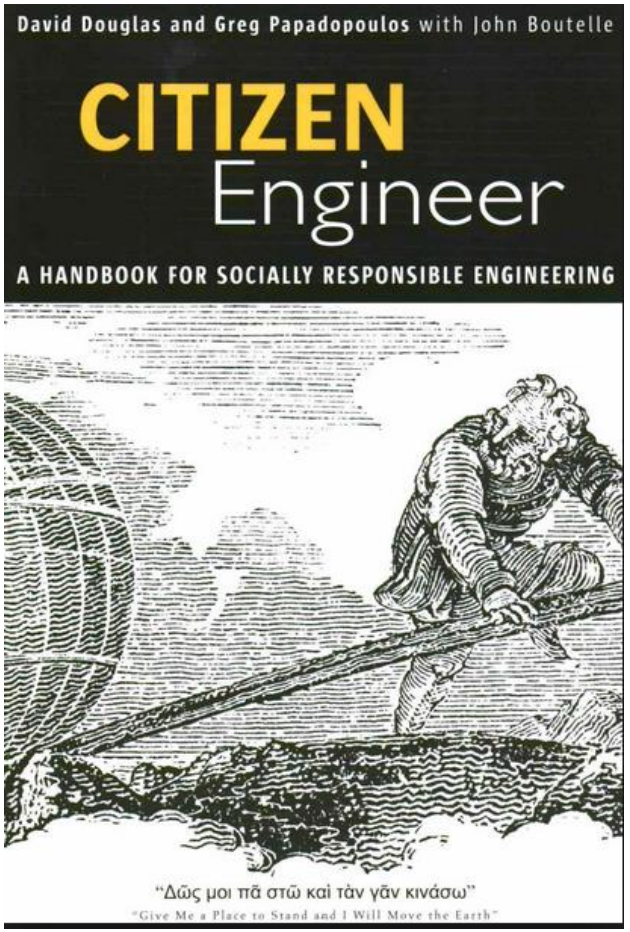
Citizen Engineer

Socially Rsponsible Engineering

EECE404 Senior Design II for Electrical and Computer Engineering

Howard University



- **Starter:**
  - Connection between engineering and society
  - Connection between product and its impact to society (and environment)
- **Main Focus**
  - Product's intended/desired/anticipated impact
  - Product's unintended/unanticipated impact
  - Anticipating the unintended impact
  - Design for mitigating the unintended impact

Engineer & Citizen

- Engineers (Constructive Artist and Pragmatists)
  - Design, create, invent, build and optimize things
  - Deal with **constraints** of technical limitations, technical & business **requirements**, budget **realities,** and **Time** constraints
- Citizen (Member of a **community)**
  - A **moral** element with **Rights** and **Responsibilities**
  - Good Practice of Citizenship
    - **Participation** in community
    - Working toward the **betterment** of the **public**

Citizen Engineer

- **Citizen Engineer**: Blend of (_____**)** and (_____**)**
- Basic Responsibilities of Engineers
  - Engineers have an (_____) obligation to make decisions that are (a) consistent with the safety, health, and welfare of the (_____), and to (b) disclose factors that might endanger the public or the (_____). → Code of Ethics
- New Demand and Awakening
  - We (engineers) are being asked to extend the sphere of responsibility (from basic responsibilities) to new responsibilities (_____ Responsibility)
  - **Why?**
    - The impact of the product we (engineers) produce is great, but may be unintended and undesired.

Challenges of Anticipating unintended Impacts

1. The number of possible social/environmental impacts is **large**, and each is **difficult to conceive before-hand**
2. Key impacts of our product may lie outside our company (or competency).

   (ex)Technology product → Biological Impact
3. Attempts to reduce impacts in one area result in impacts somewhere else.

   (ex) Carbon reducing wind-turbine → Animal Health.
4. Benefit trade-offs needs much deeper investigation and understanding (through product life-cycle).

   (Ex) Plastic bag → paper bag

Unanticipated Impact/Consequence of Engineering

- **Nuclear Power Plant**

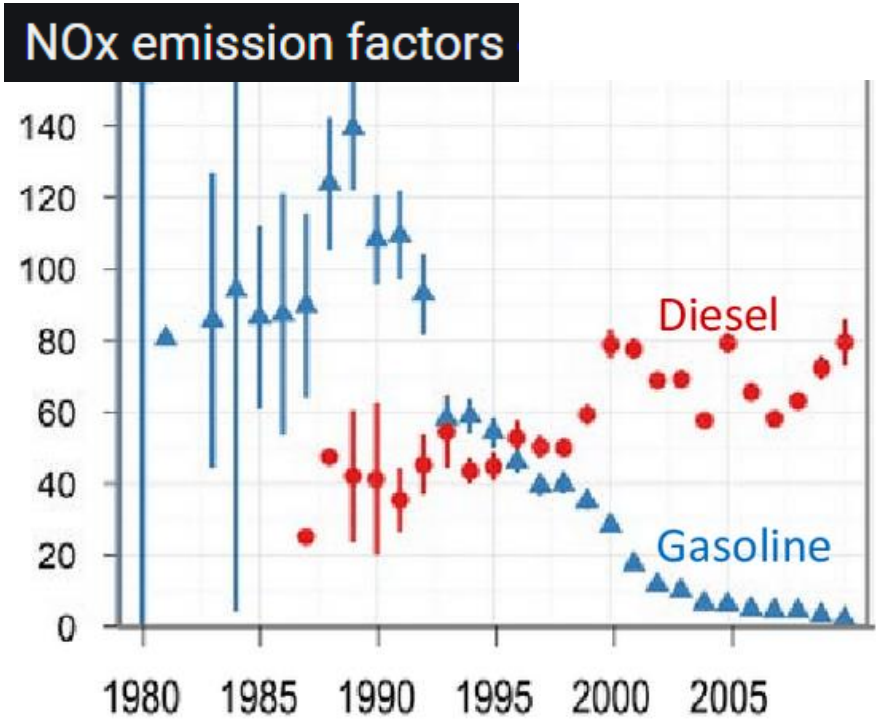
- Intended and Desired:

- Unintended and Undesirable:

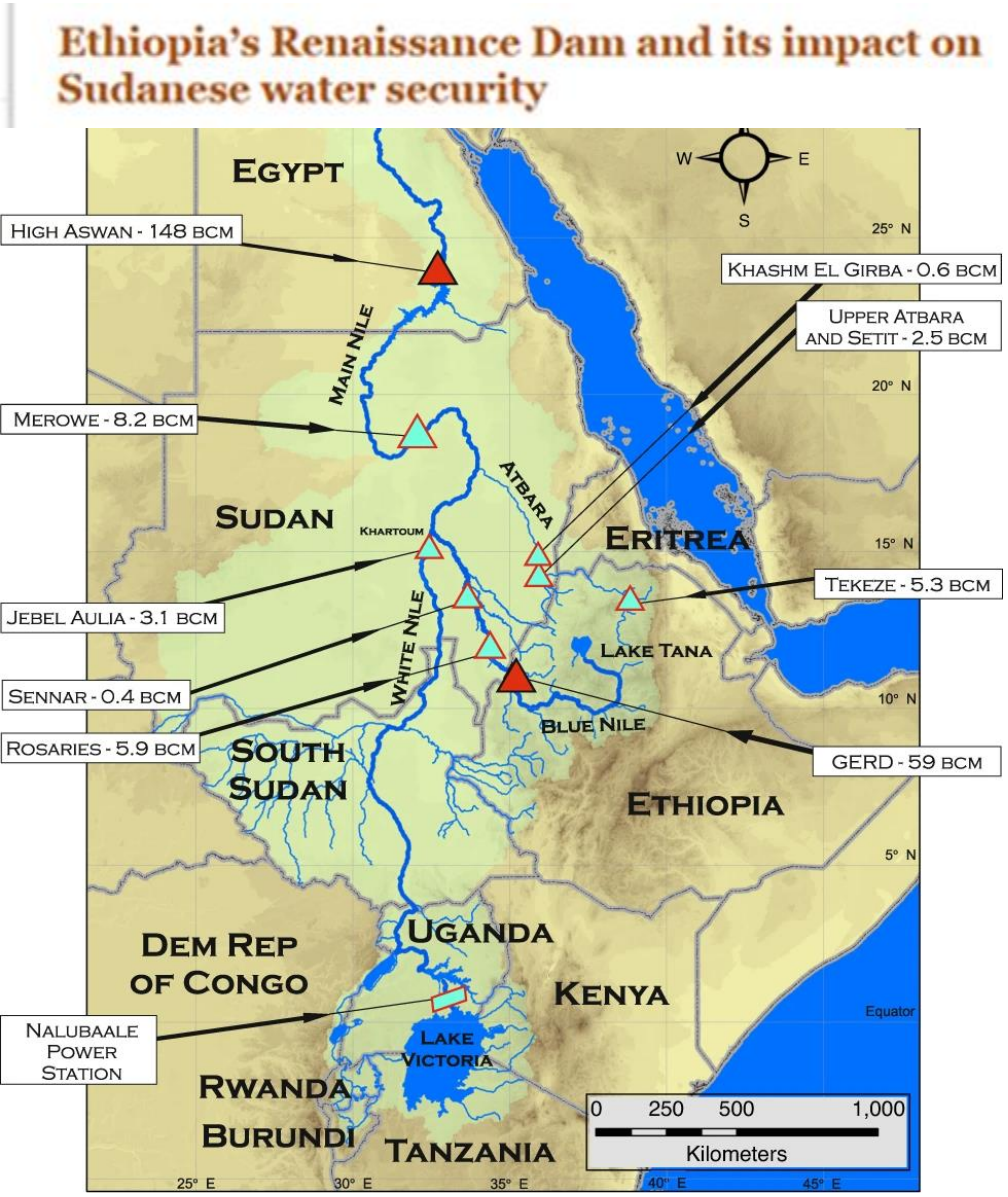
Unanticipated Impact/Consequence of Engineering

- **Diesel Cars**
- Intended and Desired:

- Unintended and Undesirable:



Unanticipated Impact/Consequence of Engineering



GERD (Grand Ethiopian Renaissance Dam)

- **Intended/desired**:
- **Unintended** :

How do we anticipate unintended/undesired impacts ?

- We engineers
  - (1) have to **ask** how our new products make **unintended undesirable consequences** on society and eco-systems
  - (2) Then **search and find** them
  - (3) From the findings, we may consider **changes and revisions** of our product design to **minimize** undesired consequences

How do we anticipate unintended/undesired impacts ?

- Any practical method to ?
  - (a) find the undesirable impact on society and eco-systems and
  - (b) find solutions to mitigate the possible undesired impact
- **Practical Approach**
  - 1. Search and list the potential unintended undesired impact on (a) society, (b) Human/animal health, and (c) environment
  - 2. Find and list the solutions for the potential unintended undesired impact
  - 3. Decide which solution to implement and the cost for the implementation
  - 4. Consider the eventual cost if the solutions are not implemented
  - 5. Conclusions

Practical Approach for Mitigating Unintended Undesired Impact (EXAMPLE)

- **Product Name**: EV
- **Intended and Desired Functions:**
  - Emission free vehicle
- **Potential unintended/undesired impact**
  - Society:
  - Human/Animal Health:
  - Environment:

Practical Approach for Mitigating Unintended Undesired Impact (EXAMPLE)

- **Solution to mitigate the unintended/undesired impact**
  - Society:
  - Human/Animal Health:
  - Environment:

Practical Approach for Mitigating Unintended Undesired Impact (EXAMPLE)

- **Cost for implementing the solutions**
  - Society:
  - Human/Animal Health:
  - Environment:

Practical Approach for Mitigating Unintended Undesired Impact (EXAMPLE)

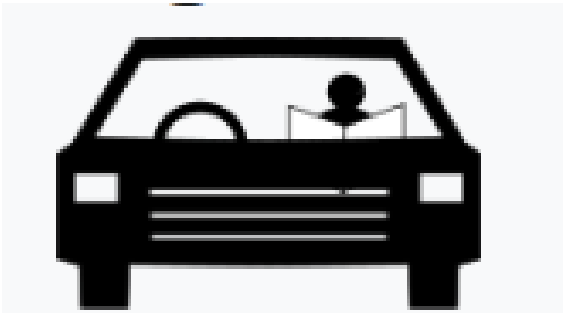
- **Eventual Cost for NOT implementing the solutions**
  - Society:
  - Human/Animal Health:
  - Environment:

Citizen Engineer Lab – Team Class Activity (or Assignment)

- Lab Report (a form provided):
  - Exercise the **Practical Approach** for socially responsible engineering
  - Specifically, think about the **unintended/undesired impacts** of the product
  - Find solution to mitigate the possible **unintended & undesired** impact of the product
  - Each team will be randomly assigned for a product from the list below
- Lab Report Submission due:
  - At the end of the class
  - If not done, it becomes a team assignment (with due the next day)

Citizen Engineer Lab – Team Class Activity (or Assignment)

- Example products
  - Smart phone
  - Synthetic Turf (for football or soccer field)
  - Sunscreen or skin cream with nanoparticle ingredients
  - Autonomous (self-driving) vehicle
  - Single serve K-cup pod coffee maker



Citizen Engineer – Lab Report

(Socially Responsible) Citizen Engineer - Lab Report

Date	
Name	

Section A:

Name of the product:

Section B:

Intended and Desired Functions of the product:

Section C:

(Potential) Unintended and Undesired Impacts

On society:

On Human/Animal Health:

On Environmental:

Section D:

Solutions to Mitigate the (potential) unintended & undesired Impacts

Solution 1:

Solution 2:

Solution 3:

Section E:

Additional Cost for Implementing one of the Solutions of Section D:

Section F:

Economic Trade-Off - Environmental/Societal Cost if the solution of Section E is not implemented:

Section G:

Concise conclusions: