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# TODAY'S ANALYSIS

## (09 April 2024)

### TOPICS TO BE COVERED

- SEMICONDUCTOR CHIPS
- ZAPORIZHZHIA NUCLEAR POWER PLANT
- BUZZWORDS IN GLOBAL TRADE



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## SEMICONDUCTOR CHIPS

Semiconductor chip manufacturing capabilities are currently **limited to very few regions in the world**. With **supply chain disruptions** during the pandemic and recent geopolitical tensions, **many companies and countries**, including India, **have realised the importance of investing in chip manufacturing infrastructure**.

The **TATA group** has partnered with **Taiwan's Powerchip Semiconductor Manufacturing Corporation (PSMC)** to set-up a **300mm wafer fabrication plant** in Gujarat. It will roll out its first 28nm chip in 2026.

**Two assembly and test plants in Gujarat and Assam** have also been recently approved by the Government of India.

### WHAT IS A SEMICONDUCTOR CHIP?

A semiconductor **has properties between a conductor (which conducts electricity) and an insulator (which does not)**. In its purest form a semiconductor is a very weak conductor of electricity.

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## CAN ELECTRICAL PROPERTIES OF A SEMICONDUCTOR BE CHANGED?

Its electrical properties **can be changed by adding small amounts of certain substances called 'dopants'**. By taking a pure semiconductor and carefully injecting certain parts with specific dopants, complex circuits can be 'printed' on the semiconductor.

The **process is crudely analogous to creating an intricate work of art on a paper or a wall**, by using a bunch of stencils and spray paints of different colours. The stencils are called '**masks**' in the industry and the **paint is analogous to the dopant**.

## WHAT IS A TRANSISTOR?

The transistor, one of the earliest electronic components to be built using a semiconductor, is **an extremely versatile device**.

- In its most popular form it **can function as an electronic switch**. A typical semiconductor chip can have **millions/billions of these interconnected switches** that work together to perform various logical and computational operations.
- A transistor can also **function as an amplifier** (to amplify the weak signal received by your cell phone) and is an integral part of circuits that generate and process high frequency signals (such as those required in wireless communication technologies).

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Today **all these different avatars of the transistor are routinely packed into a single semiconductor chip** (such as the WiFi chip in your mobile).

## WHAT IS FABRICATION?

Technology has progressed at a relentless pace since the semiconductor chip was first conceptualised more than six decades ago. **Newer manufacturing technologies** have been introduced regularly.

- **The level of miniaturisation** of the semiconductor has increased.
- Sticking with the stencil analogy this is mainly due to the stencils being able to **etch smaller and more intricate patterns.**
- There have been **equally impressive gains in the switching capability** of the transistors. They are able to switch on-and-off faster (more computations per second) and with lesser power consumption (improved battery life)

## UPTO WHAT EXTENT HAS MINIATURISATION BEEN ACHIEVED?

The industry has used labels like **'45nm', '28nm' and '16nm'** to introduce each new manufacturing technology. These numbers convey the level of miniaturisation that is achievable using a particular technology (so smaller is better).

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## IS THIS THE DIMENSION OF A TRANSISTOR?

Though not always accurate, you can think of this number as representing the dimensions of single transistor.

## IS FABRICATION DONE IN 2D OR 3D?

While traditionally electronic circuits have been laid out flat on the semiconductor, researchers are increasingly looking to capitalise on the third dimension (height). As the length and breadth of a transistor switch decreases, increasing its height can help ensure reliable performance.

## WHAT IS A WAFER?

A semiconductor chip is **manufactured much like a postage stamp**. A sheet of stamps is printed on a piece of paper and then each **individual stamp is cut out**. Similarly, **an array (typically 300-400) of chips are printed on a circular piece** of semiconductor (called a wafer in industry parlance). This is then diced to create individual chips. A larger wafer size allows more chips to be printed on a single wafer which makes chip production faster and cheaper.

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## WHAT IS THE SIZE OF A SINGLE WAFER?

Wafer sizes used in the industry have constantly been increasing. The current state of art is **300mm** which is approximately 12 inches (this refers to the diameter of the wafer).

## STATUS OF SEMICONDUCTOR CHIP MANUFACTURING IN INDIA

India has had a **thriving chip design industry since the 1990s**. Due to the magic of **computer aided design** it is possible to design a semiconductor chip entirely in software. The process of **specifying the functionality** of a chip, translating this functionality to electronic circuits, **validating the circuits, optimising for speed, power consumption and size**, can be done by a team of skilled engineers sitting at their desktops.

The final design is abstracted into a file and sent to a fabrication plant for manufacturing.

India's foray into semiconductor manufacturing will benefit from the existing ecosystem for chip design which was fuelled by a steady supply of electronics and computer engineers.

## CHALLENGES IN SEMICONDUCTOR MANUFACTURING

- High Cost of setting up a plant.
- Dependency on other countries for raw materials for semiconductor manufacturing.  
(Fabs)
- Supply Chain disruptions.
- Poor Infrastructure & Logistics.
- Lack of skilled manpower.

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# ZAPORIZHZHIA NUCLEAR POWER PLANT

**A drone strike** at the Zaporizhzhia nuclear power plant on Sunday (April 7) triggered a new crisis at the facility that has been repeatedly brought to the brink of disaster by the war between Russia and Ukraine.



## WHO ATTACKED?

**Russia**, which has been in control of the facility, Europe's largest, for almost two years now, **accused Ukraine of launching the attacks.**

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The **International Atomic Energy Agency (IAEA)**, the global nuclear watchdog, confirmed there had been **“at least three direct hits”**, including on one of the six reactors at the plant, **but did not say who was responsible.**

### **WAS NUCLEAR SAFETY COMPROMISED?**

While **nuclear safety had not been compromised**, this is a serious incident with potential to undermine integrity of the reactor's containment system. But such reckless attacks **significantly increase the risk of a major nuclear accident** and must cease immediately.

### **ABOUT ZAPORIZHZHIA NUCLEAR POWER PLANT**

Zaporizhzhia is **one of five nuclear power stations in Ukraine**, which meets almost **half of its electricity demand** through nuclear energy. The six reactors at Zaporizhzhia have the **capacity to produce 5,700 MW** of electricity.

The drone attacks came **three days after the power station suffered its most recent loss of external power supply.** Nuclear power plants are connected to more than one external power source to run essential safety and security operations, including the crucial task of cooling the reactors.

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The power station has also faced **frequent shelling and mortar attacks** from both sides, making it the **most dangerous nuclear site in the world currently** — even though other nuclear power stations in Ukraine have also suffered shelling and lost external power at some point during the war.

## HOW RESILIENT ARE NUCLEAR POWER PLANTS?

Most nuclear reactors **are made of several layers of steel and concrete**, and are **designed to absorb shocks from earthquakes of magnitude 8 or even higher**.

## CAN SHELLING IMPACT THE POWER PLANTS?

**Ordinary shelling or gunfire can't impact them seriously**, and it is not surprising that the drone attack did not cause much physical damage to the Zaporizhzhia station.

It is, however, **not clear how a nuclear power plant would fare against a powerful bomb or missile attack**. Such an incident has **never happened**, and no country is expected to be so reckless as to bomb a nuclear reactor. However, the war around Zaporizhzhia seems to be testing that assumption.

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## **BUZZWORDS IN GLOBAL TRADE**

There are four buzzwords in global trade which are trending nowadays.

- (1) Offshoring
- (2) Reshoring
- (3) Nearshoring
- (4) Friendshoring

### **WHAT IS OFFSHORING?**

This is when a company moves business operations to another country.

### **REASONS FOR OFFSHORING:**

- This new country might have cheaper labour.
- Right kind of personnel are more available in that country.
- Many a times the developed countries offshore their operations to conserve their natural resources.

### **IS MANUFACTURING ONLY OFFSHORED?**

No. manufacturing is not the only candidate for offshoring. Departments like customer support, accounting, etc can also be offshored.

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## WHAT IS RESHORING?

This is the **opposite of reshoring**. It is also known as **inshoring** or **onshoring**.

This is when a **business transfers its processes back to its home country**.

## WHY COUNTRIES RESORT TO RESHORING?

It might be **responding to the fragility of global supply chains** or favourable tariffs.

## WHAT IS NEARSHORING?

It is when a **company locates a process in a nearby country where labour is cheaper and channels of shipping and communication are strong**.

The two countries **often share a border** with each other.

## WHAT IS FRIENDSHORING?

Friendshoring is the new buzzword in the global trade room. In practices, businesses can't always make or process everything domestically.

Friendshoring or Allyshoring **is when they rely on countries with shared values** when looking for raw materials or possible manufacturing bases.

That way, there are likely to be **fewer supply chain disruptions**.

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## MCQs

1. Consider the following statements and mark the correct one:
1. Semiconductor has properties between that of a conductor & insulator.
  2. In its purest form, semiconductor is a weak conductor of electricity.

- (A) Only 1  
(B) Only 2  
(C) Both 1 & 2  
(D) Neither 1 nor 2



**Ans. (C)**

2. What is the function of a Dopant in a semiconductor?
- (A) It can functions an electronic switch.  
(B) It can alter electrical properties of a semiconductor.  
(C) It can function as an amplifier.  
(D) None of the above

**Ans. (B)**

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3. Consider the following statements and mark the correct one:
1. Zaporizhia Nuclear power plant in Ukraine is the largest nuclear power plant in Europe.
  2. Zaporizhia Nuclear power plant is under Russia's control.

- (A) Only 1  
(B) Only 2  
(C) Both 1 & 2  
(D) Neither 1 nor 2



**Ans. (C)**

4. Zaporizhzhia Nuclear Power plant is located on the banks of which river?
- (A) Dnieper  
(B) Danube  
(C) Dniester  
(D) Pripet

**Ans. (A)**

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5. Consider the following Assertion & Reasoning and mark the correct statement:

**Assertion (A):** Offshoring is when a company moves business operations to another country.

**Reasoning (R):** Offshoring is done keeping in mind the availability of cheap labour in the country where operations are outsourced.

- (A) Both A & R are correct & R is the correct explanation of A.
- (B) Both A & R are correct & R is not the correct explanation of A.
- (C) A is true & R is false.
- (D) A is false & R is true.

**Ans. (A)**

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