Chapter 22: The Revolution in Energy and Industry

1. The Industrial Revolution in Great Britain
    a. Great Britain (England, Scotland, Wales) was the pioneer in industrialization--which was largely unplanned and with no precedent.
    b. The eighteenth-century origins of the Industrial Revolution
        i. A colonial empire, the expanding Atlantic trade, and a strong and tariff free home market created new foreign demands for English manufactured goods.
        ii. Cheap food also increased this demand domestically because people could now spend more on clothing, toys, and so on.
        iii. Available capital, stable government, economic freedom, and mobile labor in England encouraged growth.
            1. England had a strong central bank and well-developed credit markets.
            2. The constitutional monarchy ruled stably and allowed for a laissez-faire economy.
        iv. The Industrial Revolution began in Great Britain in the 1780s and on the Continent after 1815.
    c. The first factories
        i. Growing demand for textiles led to the creation of the world's first large factories.
            1. The putting out system could not keep up with demand.
            2. **Hargreaves's spinning jenny** and **Arkwright's water frame** speeded up the spinning process, allowing spinners to better spin the cotton textiles.
                a. The water frame required large specialized mills, factories that employed thousands from the start.
            3. Cotton spinning was gradually concentrated in factories.
        ii. Cotton goods became cheaper and more widely available.
            1. For example, the poor could now afford to wear underwear.
        iii. The wages of weavers rose rapidly, and many agricultural workers became handloom weavers.
            1. This was because they no longer had to scrounge around for yarn.
        iv. Working conditions in the early factories were worse than those for people spinning and weaving at home; factories were viewed as poorhouses.
        v. Abandoned children became a prime source of labor in the early factories.
            1. These "apprenticed" workers, better described as slaves, commonly worked 13-14 hours per day.
            2. This exploitation led to reform and humanitarian attitudes toward children.
        vi. By 1831, the cotton textile industry had grown to 22 percent of the country's entire industrial production.
    d. The problem of energy
        i. The search for a solution to the energy problem was a major cause of industrialization.
        ii. From prehistoric to medieval times the major energy sources were plants and animals, and human beings and animals did most of the work, keeping many in poverty.
        iii. Energy from the land was limited.
            1. By the eighteenth century, Britain's major source of fuel, wood, was nearly gone, allowing Russia to overtake Britain in the iron industry.
            2. Wood was crucial as a source of heat and as a source of charcoal for the production of iron.

3. A new source of power and energy was needed, so people turned to coal.

e. The steam engine breakthrough
    i. Before about 1700, coal was used for heat but not to produce mechanical energy or to run machinery.
        1. The coal that one miner extracted in one day could be converted into enough energy to create about 27 days' worth of similar energy for other production.
    ii. Early steam engines, such as those of Savery (1698) and Newcomen (1705), were inefficient but revolutionary converters of coal into energy.
        1. They were originally created to overcome the inefficiency of using animal power to pump out the water filling the coal mines.
    iii. In the 1760s, in Scotland, **James Watt** increased the efficiency of the **steam engine** and began to produce them.
    iv. Steam power was used in many industries, and it encouraged other breakthroughs.
        1. Steam power replaced waterpowered factories.
        2. It enabled the textile industry to expand.
        3. The iron industry was transformed as steam power made **coke** available.
        4. Cort's puddling furnace led to increased production of pig iron.
f. The coming of the railroads
    i. Automobiles were too loud and scared away the passing horses.
    ii. Rails were necessary for the transportation of heavier loads, so once they could support cars in 1816, good stuff happened C:
    iii. **Stephenson's** steampowered ***Rocket*** was Europe's first locomotive--running on the **Liverpool and Manchester Railway**, the first important railroad (1830).
    iv. The railroad boom (1830-1850) meant lower transportation costs, larger markets, and cheaper goods.
        1. In turn, this forced competition on most cottage workers and urban artisans.
    v. Railroad building took workers from their rural life and made them more inclined to become urban dwellers.
    vi. The railroad changed the outlook and values of the entire society.
g. Industry and population
    i. The **1851 Great Exposition**, held in the **Crystal Palace**, reflected the growth of industry and population in Britain and confirmed that Britain was the "workshop of the world."
        1. The Crystal Palace was made of glass and iron.
        2. Great Britain became known as the “workshop of the world,” producing two-thirds of the world’s coal and more than one-half of its iron and cotton cloth.
    ii. GNP grew by 400 percent and population boomed, but average consumption grew by only 75 percent.
        1. **Malthus (Essay on the Principle of Population)** argued that the population would always exceed the food supply.
            a. He argued that since population checks like war, famine and disease were dying off, population growth must be limited through abstinence.
        2. **Ricardo** said that wages would always be low.
        3. However, Malthus and Ricardo were proved wrong in the long run.

2. Industrialization in continental Europe
    a. Outside of Britain, industrialization proceeded gradually, with uneven jerks and national and regional variations.
    b. However, by the end of the 1800s, several European countries had become industrialized.
    c. National variations

i. Statistics show that between 1750 and 1830, Britain industrialized more rapidly than other countries--moving twice as fast, for example, as France in 1830.
ii. Belgium followed Britain's lead, with France showing gradual growth.
iii. By 1913, Germany and the United States were closing in on Britain; the rest of Europe (along with Japan) grew, while some Asian states (India, China) lost ground.

d. The challenge of industrialization
    i. Revolutions and wars on the Continent (the Napoleonic Wars) retarded economic growth after 1789.
    ii. Continental countries found it difficult to compete with Britain after 1815 because it was so economically and technologically advanced.
    iii. Continental countries industrialized slowly.
        1. Britain was already so industrialized for so long that British goods dominated the markets.
        2. British technology had become so advanced and complicated that few engineers outside of England understood it.
        3. Industrialization required expensive investments into the iron, coal and railroad industries for the technology of steam power to work.
        4. Landowners and government officials distrusted industrialization, so they did nothing to encourage it.
    iv. However, continental countries had three advantages.
        1. Most continental countries had a rich tradition of puttingout enterprise, merchantcapitalists, and urban artisans.
        2. Britain had done the developmental pathbreaking, so other countries could simply copy the British way of doing things.
        3. The power of strong central governments could be used to promote industry.

e. Agents of industrialization in continental Europe
    i. The British tried to keep their industrial secrets, making it illegal for artisans and skilled mechanics to leave Britain and making the export of textile machinery and other equipment illegal as well.
    ii. **Cockerill**, in Belgium, was one of many Englishmen who brought British industrial secrets to other parts of Europe.
        1. He had an industrial plant that illegally hired skilled British workers, who brought the latest British industrial breakthroughs.
    iii. In Germany, **Harkort's** failed attempt to industrialize Germany illustrates the difficulty of duplicating the British achievements.
        1. He wanted to build steam engines in Germany, but he ran into great debt from the heavy expenses.
    iv. Governments aided industrialists by erecting tariffs, building roads and canals, and financing railroads.
        1. After Napoleon’s wars ended in 1815, to protect from the flood of cheaper and better British goods, France laid high tariffs on British imports.
        2. Belgium’s railroads stimulated the development of heavy industry.
        3. The Prussian government agreed to pay the railroad investors for the money they spent on railroad bonds if closely monitored private companies were unable to do so, allowing capital to be quickly raised.
    v. Many thinkers and writers, such as **List** in Germany, believed that industrialization would advance the welfare of the nation. **(*National System of Political Economy)***
        1. He promoted **economic nationalism**, because an agricultural nation was poor and weak, unable to maintain political independence.

2. List supported the idea of a tariff-free zone in Germany, the **Zollverein** (1834).
    a. He attacked Britain's doctrine of free trade as an attempt "to make the rest of the world, like the Hindus, its serfs in all industrial and commercial relations."
3. Henceforth, goods could move among the German member states without tariffs, but goods from other nations were subject to a tariff.

vi. Banks played a more important role in industrialization on the Continent than in Britain.
1. British banks were private and conservative, dealing with a few wealthy clients and reluctant to take risks in industrial investment.
2. Belgian banks with **limited liability** were the first industrial banks, meaning a stockholder could only lose his original investment in the bank's common stock and could not be assessed for any additional losses.
    a. They attracted significant capital which they used to promote industrial development.
3. Industrial banks, such as the **Crédit Mobilier** founded by **Issac and Emile Pereire**, became important in France and Germany in the 1850s.
4. These industrial banks mobilized the savings of thousands of small investors and invested them in transportation and industry.
"It is not enough to outline gigantic progrms on paper. I must write my ideas on the earth." -- Emile Pereire

3. Capital and labor in the age of the Industrial Revolution
    a. The new class of factory owners
        i. Factory owners and industrial capitalists joined the merchants and professionals to create a larger middle class.
        ii. As the careers of Watt and Harkort illustrate, capitalist owners were locked into a highly competitive system.
            1. Much of their profits went to buying new and better machinery.
        iii. The early industrialists came from a variety of backgrounds.
            1. Some came from merchant families, while others came from artisan backgrounds.
            2. Quakers and Scots were important in Britain, while Protestants and Jews were important in France.
            3. They were self-made and newly rich, proud and self-satisfied.
        iv. As factories grew larger, opportunities declined.
            1. Formal education became more important as a means of success and advancement.
            2. Wives and daughters of successful businessmen were shut out of business activity and were expected to concentrate on feminine and domestic activities.
        v. Industrialists also became increasingly aware of the gap between themselves and their workers.
    b. The new factory workers
        i. Many observers claimed that the Industrial Revolution brought misery to the workers.
            1. The romantic poets **Blake** and **Wordsworth** protested the life of the workers and the pollution of the land and water.
            2. The **Luddites** smashed the new machines they believed were putting them out of work.

3. **Engels** wrote a blistering attack on the middle classes, *The Condition of the Working Class in England* (1844).
   "I charge the English middle classes with mass murder, wholesale robbery, and all the other crimes in the calendar."

ii. Others, such as **Ure** and **Chadwick**, claimed that life was improving for the working class.
   1. Ure 's study of the cotton industry found that conditions in most factories were not harsh and were even quite good.
   2. Chadwick believed that more people were able to buy more necessities and minor luxuries.

iii. The statistics with regard to purchasing power of the worker (real wages) show that there was little or no improvement between 1780 and 1820.
   1. Between 1792 and 1815, living conditions actually declined as food prices rose faster than wages.
   2. Only after 1840 did a substantial improvement in real wages occur. Even in this era of improving purchasing power, hours of labor increased and unemployment was present.
   3. In short, by 1850 there was considerable economic improvement for workers, but it was slow and hard won.
   4. However, higher wages were partially due to longer workweeks.

iv. Diet probably improved, as did the supply of clothing, but housing did not.

c. Conditions of work: were workers exploited?

i. Working in the factory meant more discipline and less personal freedom--the factory whistle replaced the more relaxed pace of cottage work.
   1. The factories resembled English poorhouses, which were like industrial prisons.

ii. As a result, cottage workers were reluctant to work in factories, leading to the need for child labor.
   1. Factory owners contracted with local officials to employ large numbers of children.
   2. At the time, child labor seemed necessary and was socially accepted.
   3. The use of pauper children was forbidden in 1802.
   4. Urban factories attracted whole families, as did coal mining, and tended to preserve kinship ties.
      a. The families were paid as a unit.
   5. Children and parents worked long hours (twelve hour shifts) to stay together during the day.

iii. Parliament acted to limit child labor.
   1. **Robert Owen**, a successful manufacturer in Scotland, proposed limiting the hours of labor and child labor.
      a. He believed that working at such a young age hurt the children and was not beneficial to the factories.
   2. The **Factory Act of 1833** limited child labor and the number of hours children could work in textile factories.
   3. Factory owners were required to establish elementary schools for the children of their employees.
   4. The Factory Act broke the pattern of whole factories working together in the factory because efficiency required standardized shifts for all workers.

iv. **Subcontracting** led to a close relationship between the subcontractor and his work

crew, many of whom were friends and relations.
    1. Manufacturers and builders hired workers through subcontractors, who were paid on the basis of what the subcontractors and their crews produced. In turn, subcontractors hired and fired their own workers.
    2. Subcontracting helped maintain kinship ties.

d. The sexual division of labor
    i. A new pattern of "separate spheres" emerged.
        1. The man emerged as the family's primary wage earner, while the woman found only limited job opportunities, because women were expected to concentrate on domestic issues.
        2. Married women were much less likely to work outside the house after the first child arrived.
        3. Women were confined to lowpaying, deadend jobs, forced into dependence.
    ii. The reasons for this reorganization of paid work along gender lines are debated.
        1. One argument centers on the idea of a deeply ingrained "patriarchal tradition," which grew out of the pre industrial craft unions.
        2. Others claim that factory discipline conflicted with strong incentives on the part of mothers to concentrate on child care.
        3. This theory centers on the claim that women saw division of labor as the best strategy for family survival in the industrializing society.
            a. The cost of working a “double shift” was not worth the meager wages, much of which was wasted on a caretaker for the children.
        4. Others argue that sexual division of labor was part of an effort to control the sexuality of working class youth.
            a. They believed that new, unsupervised factory jobs made courtship more likely.
        5. Conditions in the coal industry illustrated these points.
            a. Men and women alike wore very little clothing and were perceived to be having sex...despite working in family units.
            b. They also believed that mining would trigger sexual aggression in girls.
            c. **The Mines Act of 1842** prohibited underground work for all women as well as for boys under ten.

e. The early labor movement
    i. Many kinds of employment changed slowly; farm and domestic labor continued to be most common, and small scale handicraft production remained unchanged in many trades.
    ii. The Industrial Revolution had created a class clash between the hired hands and the managers/owners.
    “It is all the workers of England against a few masters of Bradford.”
    iii. Working-class solidarity and class consciousness developed--particularly in the north of England--and many employers adopted the feeling that unions were a form of restriction on industrial growth.
        1. **The Combination Act of 1799** outlawed unions and strikes.
        2. Unions sought to control the number of skilled workers, limit apprenticeship to members’ own children, and bargain with owners over wages and were not afraid to strike.
        3. An 1813-1814 law ended wage regulations and allowed the labor market to be flooded with women and children, causing wages to go down.

iv. Workers continued to organize and strike, and the **Combination Acts** were repealed in 1824.
v. Owen and others tried to create a national union of workers (the **G**rand **N**ational **C**onsolidated **T**rades **U**nion), and then after 1851 the craft unions (called "new model unions") won benefits for their members.
    1. It failed because it was an open union.
vi. **Chartism** was a workers' political movement that sought universal male suffrage, shorter work hours, and cheap bread.