A GUIDE TO A CATTLE SLAUGHTERHOUSE

1 - PRESENTATION

1-1 Nature of the Activity

The slaughterhouse transforms live cattle into meat carcasses (and/or quarters) and by-products (blood, fat, meat scraps and bones, "white" offals - head, bowels, feet..., "red" offals - livers, hearts, lungs - and leather). The by-products can be processed on the site.

The slaughterhouse assures sanitary control of the cattle that is to be consumed and guarantees excellent hygienic conditions at the time of slaughter and during the preparation of the carcasses.

The slaughterhouse can be set up close to stock farms, areas of consumption (near large cities) or shipping areas in the case of export (near a port, railroad junction...).

1-2 Alternatives

* Raw Materials :

The following slaughterhouse was designed especially for the slaughter of large cattle, but one can consider from the start the possibility of slaughtering calves on the same line. To slaughter sheep and hogs, one must install specific complementary lines.

* Finished Products :

- Refrigerated or frozen products : the products (and by-products) can be marketed either refrigerated or frozen. The advantage of freezing or a freezing tunnel (+ store-room for frozen stock) must be determined case by case.

- Degree of valorization of the products :

  . carving : the slaughterhouse can market full carcasses, half carcasses and quarters. One can easily plan a meat carving unit adjacent to the slaughterhouse which can prepare bags of 1 to 3 kg (see "a Guide to a Meat Carving Unit")

  . treatment of offals : one can foresee the de-fatting of the bowels, the treatment of the skin (salting, trimming, cutting up), the treatment of the fat...
*Technology:*
The technological alternatives depend essentially on the engineering and construction of the slaughterhouse and the equipment.

- **Construction:** the following chart shows the possible options for the principal sections of the slaughterhouse (cattle sheds, slaughtering hall, offal unit, refrigeration units).

<table>
<thead>
<tr>
<th></th>
<th>Cattle sheds</th>
<th>Slaughtering hall</th>
<th>Offal unit</th>
<th>Refrigeration units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Framework</strong></td>
<td>unimportant</td>
<td>preferably metal</td>
<td>metal</td>
<td>metal</td>
</tr>
<tr>
<td><strong>Posts</strong></td>
<td>unimportant</td>
<td>concrete or metal</td>
<td>concrete or metal</td>
<td>metal</td>
</tr>
<tr>
<td><strong>Secondary framework</strong></td>
<td>none</td>
<td>yes, galvanized metal</td>
<td>none</td>
<td>yes, galvanized metal</td>
</tr>
<tr>
<td><strong>Wall finishes</strong></td>
<td>Brick walls with smooth plaster, ventilation at the top</td>
<td>enamelled sandstone walls-min. 3 m high</td>
<td>enamelled sandstone or smooth partitions in panels</td>
<td>Preferably insulated panels</td>
</tr>
<tr>
<td><strong>Floors</strong></td>
<td>scored cement</td>
<td>smooth, easy to clean, exemple : resin or tile floor</td>
<td>dust-resistant cement</td>
<td>dust-resistant cement</td>
</tr>
<tr>
<td><strong>Roofing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Equipment:**
  - for slaughterhouses of a certain size, handling on the line is done with the use of aerial rails (animal suspended). The system can be mechanized or simply on a slope (transfer by gravity).
  - One can also foresee a conveyor belt for the circulation of "red" offals and the aerial rail system in the cold rooms (mechanized or not).
  - The work platforms can be elevatory, which allows one to process animals of different sizes conveniently (eventually calves and large cattle).
  - For very large units, one can consider a conveyor belt for the transfer of skins.
No matter what options are chosen, one must perform the same order of operations:

- fell, haul, hang animal on the rail
- bleed, collect the blood
- cut off the horns, work on the head
- cut first leg, then second
- work on udders, chump end

- work on flanks, neck, cut off fore legs
- remove skin from top to bottom
- split the sternum
- eviscerate the abdomen
- eviscerate the thorax
- split the vertebrae, cut off the head
- inspection
- final trimming.

1-3 Types of Possible Units

Three classes of size and corresponding levels of mechanization will be described:

Unit A: 10 - 15 animals per hour - handled with gravity

Unit B: 20 - 25 animals per hour - handled with gravity

Unit C: 30 - 35 animals per hour - mechanized network
2.1 Description of the Unit

2.1.1 Finished Products

<table>
<thead>
<tr>
<th>UNIT</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products made</td>
<td>Carcasses, quarters</td>
<td>Same as A</td>
<td>Same as A</td>
</tr>
<tr>
<td></td>
<td>and by-products</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>unprocessed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of preservation</td>
<td>Refrigerated</td>
<td>Same as A</td>
<td>Same as A</td>
</tr>
<tr>
<td>Production (in carcass weight)</td>
<td>25 t</td>
<td>55 t</td>
<td>75 t</td>
</tr>
<tr>
<td>- daily</td>
<td>6000 t</td>
<td>11 000 t</td>
<td>15 000 t</td>
</tr>
<tr>
<td>- annual (35 hours per week and 280 kg per carcass)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Technological Choices

<table>
<thead>
<tr>
<th>OPERATIONS</th>
<th>TECHNOLOGICAL OPTIONS</th>
<th>SOLUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stabling of animals</td>
<td>Barnyard or cubicles</td>
<td>cubicles</td>
</tr>
<tr>
<td>Handling slaughtering</td>
<td>aerial or ground gravity or mechanized</td>
<td>aerial gravity</td>
</tr>
<tr>
<td>Conveyance of &quot;red&quot; offals</td>
<td>by cart or conveyor</td>
<td>cart</td>
</tr>
<tr>
<td>Transfer of skins</td>
<td>by belt or cart</td>
<td>belt</td>
</tr>
<tr>
<td>Removal of skins</td>
<td></td>
<td>top to bottom</td>
</tr>
<tr>
<td>Sweating of carcasses</td>
<td>manual conveyance or by conveyor</td>
<td>manual</td>
</tr>
<tr>
<td>Work platform</td>
<td>Static or elevatory</td>
<td>static</td>
</tr>
<tr>
<td>Refrigerated rooms</td>
<td>Sweating or Storing</td>
<td>Same as A</td>
</tr>
</tbody>
</table>

**UNIT A** 6000 t/year  
**UNIT B** 11 000 t/year  
**UNIT C** 15 000 t/year
### 2-2 Economic Analysis

#### 2-2-1 Investments

<table>
<thead>
<tr>
<th>UNITS</th>
<th>A 6000 t/year</th>
<th>B 11 000 t/year</th>
<th>C 15 000 t/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>Estimated price FOB US $</td>
<td>Estimated price FOB US $</td>
<td>Estimated price FOB US $</td>
</tr>
<tr>
<td>Slaughtering line</td>
<td>$500 000</td>
<td>$700 000</td>
<td>$900 000</td>
</tr>
<tr>
<td>Offal equipment</td>
<td>$180 000</td>
<td>$250 000</td>
<td>$440 000</td>
</tr>
<tr>
<td>Cool room equipment</td>
<td>$600 000</td>
<td>$1 000 000</td>
<td>$1,300 000</td>
</tr>
<tr>
<td>Secondary framework</td>
<td>$80 000</td>
<td>$120 000</td>
<td>$150 000</td>
</tr>
<tr>
<td>&quot;Cool rooms + slaughtering&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL EQUIPMENT</td>
<td>$1.4 million</td>
<td>$2.1 million</td>
<td>$2.9 million</td>
</tr>
</tbody>
</table>

**Buildings**
- Surface area of buildings
  - Stabling area: 450 m², 900 m², 1200 m²
  - Loading yards: 100 m², 130 m², 150 m²
  - Slaughtering hall: 310 m², 380 m², 420 m²
  - Sweating area: 130 m², 250 m², 350 m²
  - Cold room for storage: 400 m², 820 m², 1090 m²
  - Offal unit: 570 m², 800 m², 950 m²
  - Offices, machine shop: 480 m², 660 m², 900 m²

**Minimum surface area of land**
- 7500 m², 12 000 m², 15 000 m²

**Other investment costs**
- Electrical power: 400 Kw, 500 Kw, 700 Kw
- Cold (negative calories): 120 000 nc/hr, 200 000 nc/hr, 350 000 nc/hr
- Water (maximum use): 90 m³/hr, 120 m³/hr, 150 m³/hr

**Total investment cost**
- $2 to $3 M, $4 to $5 M, $5 to $6 M

#### 2-2-2 Functioning

<table>
<thead>
<tr>
<th>UNIT A 6000 t/year</th>
<th>UNIT B 11 000 t/year</th>
<th>UNIT C 15 000 t/year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total personnel</strong></td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>(maintenance included)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Annual consumption</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Animals (units cattle)</td>
<td>21 000</td>
<td>40 000</td>
</tr>
<tr>
<td>- Water</td>
<td>70 000 m³</td>
<td>100 000 m³</td>
</tr>
<tr>
<td>- Electricity</td>
<td>150 kwh/t or 900 Mwh</td>
<td>150 kwh/t or 1650 Mwh</td>
</tr>
</tbody>
</table>
3 - KEY FACTORS TO THE PROJECT'S SUCCESS

3-1 Supply

One must foresee regular supplying of in the slaughterhouse in order to limit the duration of stabling. Depending on the case, the animals will be led to the slaughterhouse (with weight loss if distance is long) or transported by truck or train (taking into consideration the logistical infrastructure in the choice of a building site).

In the second case, foresee a period of stabling to reduce the consequences of stress.

3-2 Technology and Equipment

The conception is a matter for specialists familiar with the problems of construction, the choice of techniques for production of fluid, process and work methods for slaughtering lines, regulations etc.

The choice of the building site for the slaughterhouse must take into account local criteria (land, geographic location, drainage) and sanitary standards.

These standards aim to separate the "unclean" system (evacuation of scraps, delivery of live animals...) from the "clean" system (carcasses, cleaned and refrigerated offals...).

As for construction, one must underline the importance of the extra cost linked to the exploitation of the slaughterhouse and the equipment suspended from the secondary framework. This secondary framework is closely linked to the equipment and rests either on the principal framework of the building (90% of the cases) or on independent posts attached to the floor (in cold rooms).

Required fluids: cold water, sterilized hot water 45°, hot water 90°, compressed air, cooling fluid (water with glycol or ammonia for above 0° cold).

Vapour: not necessary, except if one plans a secondary treatment of casings (cooking). The majority of the calorific needs will be produced by recovery of heat from the cold system.

Negative cold: the advantage of freezing must take into account the program and standards of hygiene. To avoid overly complex installations, plan on an installation for direct expansion with R22 or R502.
From the first conception of the slaughterhouse, one must foresee the range of animals to be processed in order to eventually install an additional pig or sheep line. A sanitary slaughterhouse is obligatory if it is conceived according to EEC standards. It comprises one room for the manual slaughter of sick animals, another for sanitary carving, a refrigerator for barreled meat and another for seized meat.

3-3 Personnel

A training session in hygienic regulations is essential for all personnel (ensure in particular that the meat is not exposed to in the outside air while the trucks are being loaded and that all the equipment and tiling are washed frequently). Personnel must observe strict standards of personal hygiene.

3-4 Quality Control

- The quality of the meat depends on the quality of the livestock
- Veterinary control of livestock and carcasses
- General hygienic plan (including hygiene training for personnel)
- Adequate pre-refrigeration of the carcasses (cooling is a key factor for the quality and good preservation of meat in storage).

3-5 Distribution and Commercialization

Carefully monitor the cold chain and the duration of the forwarding of products to the consumers.
The slaughterhouse will supply meat carving units and distributors.

3-6 Financing

The slaughterhouse is generally locked upon as a public service, open to diverse users. The profit of the slaughterhouse is calculated per head of slaughtered cattle. In this case, there is no stock to foresee and the required working capital need only take into account users' terms of payment.
3-7 Other Specific Problems

Processing Scraps:

The waste from a slaughterhouse is composed of:
- solid waste removed from the waste water
- stercoraceous material
- horns, hooves
- dung from the stables if straw is used and cattle trailers
- sewage

Their storage necessitates at least the construction of a covered manure yard and a slurry manure pit.

The difficulty of evacuation and recycling of these wastes can influence the choice of the site.

Water Needs and Treatment:

The unit which consumes large quantities of water (300 - 500 m3/day) and produces large amounts of waste needs either a purification plant, or to work in conjunction with a collective plant after treatment.

4 - INDUCED ACTIVITIES

- A slaughterhouse can be conceived as a tool for both economic development and sanitary control of a line of breeding - slaughtering - marketing of meat.
- The processing of by-products permits the development of various induced activities: working of leather, processing of casings, carcass disposal (tallow, gelatin), blood meal
- A meat carving unit can associate itself with a slaughterhouse if the market demands elaborate and semi-elaborate products.